

## References

- Ablain, M. et al., 2019: Uncertainty in satellite estimates of global mean sea-level changes, trend and acceleration. *Earth System Science Data*, **11**(3), 1189–1202, doi:[10.5194/essd-11-1189-2019](https://doi.org/10.5194/essd-11-1189-2019).
- Abram, N.J. et al., 2010: Ice core evidence for a 20th century decline of sea ice in the Bellingshausen Sea, Antarctica. *Journal of Geophysical Research Atmospheres*, **115**, D23101, doi:[10.1029/2010jd014644](https://doi.org/10.1029/2010jd014644).
- Abram, N.J. et al., 2014: Evolution of the Southern Annular Mode during the past millennium. *Nature Climate Change*, **4**(7), 564–569, doi:[10.1038/nclimate2235](https://doi.org/10.1038/nclimate2235).
- Abram, N.J. et al., 2020a: Palaeoclimate perspectives on the Indian Ocean Dipole (2020b). *Quaternary Science Reviews*, **237**, 106302, doi:[10.1016/j.quascirev.2020.106302](https://doi.org/10.1016/j.quascirev.2020.106302).
- Abram, N.J. et al., 2020b: Coupling of Indo-Pacific climate variability over the last millennium (2020a). *Nature*, **579**(7799), 385–392, doi:[10.1038/s41586-020-2084-4](https://doi.org/10.1038/s41586-020-2084-4).
- Ackley, S., P. Wadhams, J.C. Comiso, and A.P. Worby, 2003: Decadal decrease of Antarctic sea ice extent inferred from whaling records revisited on the basis of historical and modern sea ice records. *Polar Research*, **22**, 19–25, doi:[10.1111/j.1751-8369.2003.tb00091.x](https://doi.org/10.1111/j.1751-8369.2003.tb00091.x).
- Adler, R.F., G. Gu, M. Sapiano, J.J. Wang, and G.J. Huffman, 2017: Global Precipitation: Means, Variations and Trends During the Satellite Era (1979–2014). *Surveys in Geophysics*, **38**(4), 679–699, doi:[10.1007/s10712-017-9416-4](https://doi.org/10.1007/s10712-017-9416-4).
- Adler, R.F. et al., 2018: The Global Precipitation Climatology Project (GPCP) monthly analysis (New Version 2.3) and a review of 2017 global precipitation. *Atmosphere*, **9**(4), doi:[10.3390/atmos9040138](https://doi.org/10.3390/atmos9040138).
- Ahn, J. and E.J. Brook, 2014: Siple Dome ice reveals two modes of millennial CO<sub>2</sub> change during the last ice age. *Nature Communications*, **5**(3723), doi:[10.1038/ncomms4723](https://doi.org/10.1038/ncomms4723).
- Ahn, J., S. Marcott, and E. Brook, 2019: Atmospheric CO<sub>2</sub> during the late Holocene. *in prep.*
- Ahn, J., E.J. Brook, A. Schmittner, and K. Kreutz, 2012: Abrupt change in atmospheric CO<sub>2</sub> during the last ice age. *Geophysical Research Letters*, **39**, L18711, doi:[10.1029/2012gl053018](https://doi.org/10.1029/2012gl053018).
- Aiken, J. et al., 2017: A synthesis of the environmental response of the North and South Atlantic Sub-Tropical Gyres during two decades of AMT. *Progress in Oceanography*, **158**, 236–254, doi:[10.1016/j.pocean.2016.08.004](https://doi.org/10.1016/j.pocean.2016.08.004).
- Ait Brahim, Y. et al., 2019: North Atlantic Ice-Rafting, Ocean and Atmospheric Circulation During the Holocene: Insights From Western Mediterranean Speleothems. *Geophysical Research Letters*, **46**(13), 7614–7623, doi:[10.1029/2019gl082405](https://doi.org/10.1029/2019gl082405).
- Albani, S. et al., 2015: Twelve thousand years of dust: the Holocene global dust cycle constrained by natural archives. *Climate of the Past*, **11**(6), 869–903, doi:[10.5194/cp-11-869-2015](https://doi.org/10.5194/cp-11-869-2015).
- Albani, S. et al., 2016: Paleodust variability since the Last Glacial Maximum and implications for iron inputs to the ocean. *Geophysical Research Letters*, **43**(8), 3944–3954, doi:[10.1002/2016gl067911](https://doi.org/10.1002/2016gl067911).
- Alfaro-Sánchez, R. et al., 2018: Climatic and volcanic forcing of tropical belt northern boundary over the past 800 years. *Nature Geoscience*, doi:[10.1038/s41561-018-0242-1](https://doi.org/10.1038/s41561-018-0242-1).
- Alkama, R., B. Decharme, H. Douville, and A. Ribes, 2011: Trends in Global and Basin-Scale Runoff over the Late Twentieth Century: Methodological Issues and Sources of Uncertainty. *Journal of Climate*, **24**(12), 3000–3014, doi:[10.1175/2010jcli3921.1](https://doi.org/10.1175/2010jcli3921.1).
- Alkama, R., L. Marchand, A. Ribes, and B. Decharme, 2013: Detection of global runoff changes: results from observations and CMIP5 experiments. *Hydrology and Earth System Sciences*, **17**, 2967–2979, doi:[10.5194/hess-17-2967-2013](https://doi.org/10.5194/hess-17-2967-2013).
- Allan, R.P. et al., 2014: Physically Consistent Responses of the Global Atmospheric Hydrological Cycle in Models and Observations. *Surveys in Geophysics*, **35**, 533–552, doi:[10.1007/s10712-012-9213-z](https://doi.org/10.1007/s10712-012-9213-z).
- Allen, R.J. and M. Kovilakam, 2017: The Role of Natural Climate Variability in Recent Tropical Expansion. *Journal of Climate*, **30**, 6329–6350, doi:[10.1175/jcli-d-16-0735.1](https://doi.org/10.1175/jcli-d-16-0735.1).
- Allen, R.J., S.C. Sherwood, J.R. Norris, and C.S. Zender, 2012: Recent Northern Hemisphere tropical expansion primarily driven by black carbon and tropospheric ozone. *Nature*, **485**, 350–354.
- Allison, L.C. et al., 2019: Towards quantifying uncertainty in ocean heat content changes using synthetic profiles. *Environmental Research Letters*, **14**(8), 84037, doi:[10.1088/1748-9326/ab2b0b](https://doi.org/10.1088/1748-9326/ab2b0b).
- Alonso-Garcia, M. et al., 2017: Freshening of the Labrador Sea as a trigger for Little Ice Age development. *Clim. Past*, **13**(4), 317–331, doi:[10.5194/cp-13-317-2017](https://doi.org/10.5194/cp-13-317-2017).
- AMAP, 2017: *Snow, Water, Ice and Permafrost in the Arctic (SWIPA)*. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway, 269 pp.
- Ammann, C.M., G.A. Meehl, W.M. Washington, and C.S. Zender, 2003: A monthly and latitudinally varying volcanic forcing dataset in simulations of 20th century climate. *Geophysical Research Letters*, **30**(12), doi:[10.1029/2003gl016875](https://doi.org/10.1029/2003gl016875).
- An, Z. et al., 2015: Global Monsoon Dynamics and Climate Change. *Annual Review of Earth and Planetary Sciences*, **43**(1), 29–77, doi:[10.1146/annurev-earth-060313-054623](https://doi.org/10.1146/annurev-earth-060313-054623).
- Anagnostou, E. et al., 2016: Changing atmospheric CO<sub>2</sub> concentration was the primary driver of early Cenozoic climate. *Nature*, **533**, 380–384, doi:[10.1038/nature17423](https://doi.org/10.1038/nature17423).

- 1 Anagnostou, E. et al., 2020a: Proxy evidence for state-dependence of climate sensitivity in the Eocene greenhouse.  
2 *Nature Communications*, **11**(1), 4436, doi:[10.1038/s41467-020-17887-x](https://doi.org/10.1038/s41467-020-17887-x).
- 3 Anagnostou, E. et al., 2020b: Proxy evidence for state-dependence of climate sensitivity in the Eocene greenhouse.  
4 *Nature Communications*, **11**(1), 4436, doi:[10.1038/s41467-020-17887-x](https://doi.org/10.1038/s41467-020-17887-x).
- 5 Anchukaitis, K.J. et al., 2017: Last millennium Northern Hemisphere summer temperatures from tree rings: Part II,  
6 spatially resolved reconstructions. *Quaternary Science Reviews*, **163**, 1–22,  
7 doi:[10.1016/j.quascirev.2017.02.020](https://doi.org/10.1016/j.quascirev.2017.02.020).
- 8 Anderson, H.J. et al., 2018: Southern Hemisphere westerly wind influence on southern New Zealand hydrology during  
9 the Lateglacial and Holocene. *Journal of Quaternary Science*, **33**(6), 689–701, doi:[10.1002/jqs.3045](https://doi.org/10.1002/jqs.3045).
- 10 Anderson, J.G. et al., 2017: Stratospheric ozone over the United States in summer linked to observations of convection  
11 and temperature via chlorine and bromine catalysis. *Proceedings of the National Academy of Sciences*,  
12 doi:[10.1073/pnas.1619318114](https://doi.org/10.1073/pnas.1619318114).
- 13 Anderson, R.F. et al., 2019: Deep-Sea Oxygen Depletion and Ocean Carbon Sequestration During the Last Ice Age.  
14 *Global Biogeochemical Cycles*, **33**(3), 301–317, doi:[10.1029/2018gb006049](https://doi.org/10.1029/2018gb006049).
- 15 Andersson, A. et al., 2011: Evaluation of HOAPS-3 Ocean Surface Freshwater Flux Components. *Journal of Applied  
16 Meteorology and Climatology*, **50**, 379–398, doi:[10.1175/2010jamc2341.1](https://doi.org/10.1175/2010jamc2341.1).
- 17 Andersson, S.M. et al., 2015: Significant radiative impact of volcanic aerosol in the lowermost stratosphere. *Nature  
18 Communications*, **6**, 7692, doi:[10.1038/ncomms8692](https://doi.org/10.1038/ncomms8692).
- 19 Andres, M., K.A. Donohue, and J.M. Too, 2020: The Gulf Stream's path and time-averaged velocity structure and  
20 transport at 68.5°W and 70.3°W. *Deep Sea Research Part I: Oceanographic Research Papers*, **156**, 103179,  
21 doi:[10.1016/j.dsr.2019.103179](https://doi.org/10.1016/j.dsr.2019.103179).
- 22 Andrews, T., R.A. Betts, B.B.B. Booth, C.D. Jones, and G.S. Jones, 2017: Effective radiative forcing from historical  
23 land use change. *Climate Dynamics*, doi:[10.1007/s00382-016-3280-7](https://doi.org/10.1007/s00382-016-3280-7).
- 24 Artxabaleta, A.L., K.W. Smith, and T.S. Kalra, 2017: Regime Changes in Global Sea Surface Salinity Trend. *Journal  
25 of Marine Science and Engineering*, **5**(4), doi:[10.3390/jmse5040057](https://doi.org/10.3390/jmse5040057).
- 26 Armand, L., A. Ferry, and A. Leventer, 2017: Advances in palaeo sea ice estimation. In: *Sea Ice (Third Edition)*  
27 [Thomas, D.N. (ed.)]. John Wiley & Sons, Ltd, Chichester, UK and Hoboken, NJ, USA, pp. 600–629,  
28 doi:[10.1002/9781118778371.ch26](https://doi.org/10.1002/9781118778371.ch26).
- 29 Ashcroft, L., J. Gergis, and D.J. Karoly, 2016: Long-term stationarity of El Niño–Southern Oscillation teleconnections  
30 in southeastern Australia. *Climate Dynamics*, **46**(9), 2991–3006, doi:[10.1007/s00382-015-2746-3](https://doi.org/10.1007/s00382-015-2746-3).
- 31 Ashok, K., S.K. Behera, S.A. Rao, H. Weng, and T. Yamagata, 2007: El Niño Modoki and its possible teleconnection.  
32 *Journal of Geophysical Research: Oceans*, **112**(C11), doi:[10.1029/2006jc003798](https://doi.org/10.1029/2006jc003798).
- 33 Ashouri, H. et al., 2015: PERSIANN-CDR: Daily Precipitation Climate Data Record from Multisatellite Observations  
34 for Hydrological and Climate Studies. *Bull. Amer. Meteor. Soc.*, 69–84, doi:[10.1175/bams-d-13-00068.1](https://doi.org/10.1175/bams-d-13-00068.1).
- 35 Atkinson, A. et al., 2019: Krill (*Euphausia superba*) distribution contracts southward during rapid regional warming.  
36 *Nature Climate Change*, **9**(2), 142–147, doi:[10.1038/s41558-018-0370-z](https://doi.org/10.1038/s41558-018-0370-z).
- 37 Aumann, H.H., S. Broberg, E. Manning, and T. Pagano, 2019: Radiometric Stability Validation of 17 Years of AIRS  
38 Data Using Sea Surface Temperatures. *Geophysical Research Letters*, **46**(21), 12504–12510,  
39 doi:[10.1029/2019gl085098](https://doi.org/10.1029/2019gl085098).
- 40 Austermann, J., J.X. Mitrovica, P. Huybers, and A. Rovere, 2017: Detection of a dynamic topography signal in last  
41 interglacial sea-level records. *Science Advances*, **3**(7), doi:[10.1126/sciadv.1700457](https://doi.org/10.1126/sciadv.1700457).
- 42 Avery, M.A., S.M. Davis, K.H. Rosenlof, H. Ye, and A.E. Dessler, 2017: Large anomalies in lower stratospheric water  
43 vapour and ice during the 2015–2016 El Niño. *Nature Geoscience*, **10**(6), 405–409, doi:[10.1038/ngeo2961](https://doi.org/10.1038/ngeo2961).
- 44 Ayache, M., D. Swingedouw, Y. Mary, F. Eynaud, and C. Colin, 2018: Multi-centennial variability of the AMOC over  
45 the Holocene: A new reconstruction based on multiple proxy-derived SST records. *Global and Planetary  
46 Change*, **170**, 172–189, doi:[10.1016/j.gloplacha.2018.08.016](https://doi.org/10.1016/j.gloplacha.2018.08.016).
- 47 Azorin-Molina, C., J.H. Dunn, C.A. Mears, P. Berrisford, and T.R. McVicar, 2017: Surface winds: Land surface wind  
48 speed [in “State of the Climate in 2016”]. *Bulletin of the American Meteorological Society*, **98**(8), S37–S39,  
49 doi:[10.1175/2017bamsstateoftheclimate.1](https://doi.org/10.1175/2017bamsstateoftheclimate.1).
- 50 Azorin-Molina, C. et al., 2019: Surface winds [in “State of the Climate in 2018”]. *Bulletin of the American  
51 Meteorological Society*, **100**(9), S43–S45, doi:[10.1175/2019bamsstateoftheclimate.1](https://doi.org/10.1175/2019bamsstateoftheclimate.1).
- 52 Azorin-Molina, C. et al., 2020: Land and ocean surface winds. *State of the Climate in 2019. Bulletin of the American  
53 Meteorological Society*, **101**(8), S63–S65, doi:[10.1175/2020bamsstateoftheclimate.1](https://doi.org/10.1175/2020bamsstateoftheclimate.1).
- 54 Babila, T.L. et al., 2018: Capturing the global signature of surface ocean acidification during the Palaeocene–Eocene  
55 Thermal Maximum. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and  
56 Engineering Sciences*, **376**(2130), doi:[10.1098/rsta.2017.0072](https://doi.org/10.1098/rsta.2017.0072).
- 57 Bachem, P.E., B. Risebrobakken, and E.L. McClymont, 2016: Sea surface temperature variability in the Norwegian Sea  
58 during the late Pliocene linked to subpolar gyre strength and radiative forcing. *Earth and Planetary Science  
59 Letters*, **446**, 113–122, doi:[10.1016/j.epsl.2016.04.024](https://doi.org/10.1016/j.epsl.2016.04.024).
- 60 Bachem, P.E., B. Risebrobakken, S. De Schepper, and E.L. McClymont, 2017: Highly variable Pliocene sea surface  
61 conditions in the Norwegian Sea. *Climate of the Past*, **13**(9), doi:[10.5194/cp-13-1153-2017](https://doi.org/10.5194/cp-13-1153-2017).

- 1 Badger, M.P.S. et al., 2019: Insensitivity of alkenone carbon isotopes to atmospheric CO<sub>2</sub> at low to moderate CO<sub>2</sub>  
2 levels. *Climate of the Past*, **15**(2), 539–554, doi:[10.5194/cp-15-539-2019](https://doi.org/10.5194/cp-15-539-2019).
- 3 Baggenstos, D. et al., 2019: Earth’s radiative imbalance from the Last Glacial Maximum to the  
4 present. *Proceedings of the National Academy of Sciences*, **116**(30), 14881–14886,  
5 doi:[10.1073/pnas.1905447116](https://doi.org/10.1073/pnas.1905447116).
- 6 Bagnell, A. and T. DeVries, 2020: Correcting Biases in Historical Bathymeterograph Data Using Artificial Neural  
7 Networks. *Journal of Atmospheric and Oceanic Technology*, **37**(10), 1781–1800, doi:[10.1175/jtech-d-19-0103.1](https://doi.org/10.1175/jtech-d-19-0103.1).
- 8 Bailey, H.L. et al., 2018: Holocene atmospheric circulation in the central North Pacific : A new terrestrial diatom and d  
9 18 O dataset from the Aleutian Islands. *Quaternary Science Reviews*, **194**, 27–38,  
10 doi:[10.1016/j.quascirev.2018.06.027](https://doi.org/10.1016/j.quascirev.2018.06.027).
- 11 Baker, A., J. C. Hellstrom, B.F.J. Kelly, G. Mariethoz, and V. Trouet, 2015: A composite annual-resolution stalagmite  
12 record of North Atlantic climate over the last three millennia. *Scientific Reports*, **5**(1), 10307,  
13 doi:[10.1038/srep10307](https://doi.org/10.1038/srep10307).
- 14 Bakker, D.C.E. et al., 2016: A multi-decade record of high-quality fCO<sub>2</sub> data in version 3 of the Surface Ocean CO<sub>2</sub>  
15 Atlas (SOCAT). *Earth Syst. Sci. Data*, **8**(2), 383–413, doi:[10.5194/essd-8-383-2016](https://doi.org/10.5194/essd-8-383-2016).
- 16 Ball, W.T. et al., 2018: Evidence for a continuous decline in lower stratospheric ozone offsetting ozone layer recovery.  
17 *Atmos. Chem. Phys.*, **18**(2), 1379–1394, doi:[10.5194/acp-18-1379-2018](https://doi.org/10.5194/acp-18-1379-2018).
- 18 Ball, W.T. et al., 2019: Stratospheric ozone trends for 1985–2018: sensitivity to recent large variability. *Atmospheric  
19 Chemistry and Physics*, **19**(19), 12731–12748, doi:[10.5194/acp-19-12731-2019](https://doi.org/10.5194/acp-19-12731-2019).
- 20 Ballalai, J.M. et al., 2019: Tracking Spread of the Agulhas Leakage Into the Western South Atlantic and Its Northward  
21 Transmission During the Last Interglacial. *Paleoceanography and Paleoceanography*, **34**(11), 1744–1760,  
22 doi:[10.1029/2019pa003653](https://doi.org/10.1029/2019pa003653).
- 23 Balmaseda, M.A., K.E. Trenberth, and E. Källén, 2013: Distinctive climate signals in reanalysis of global ocean heat  
24 content. *Geophysical Research Letters*, **40**(9), 1754–1759, doi:[10.1002/grl.50382](https://doi.org/10.1002/grl.50382).
- 25 Bamber, J.L., R.M. Westaway, B. Marzeion, and B. Wouters, 2018: The land ice contribution to sea level during the  
26 satellite era. *Environmental Research Letters*, **13**(6), 63008, doi:[10.1088/1748-9326/aac2f0](https://doi.org/10.1088/1748-9326/aac2f0).
- 27 Banerjee, A., F. J C, L.M. Polvani, D. Waugh, and K.-L. Chang, 2020: A pause in southern hemisphere circulation  
28 trends due to the Montreal Protocol. *Nature*, **579**, 544–548, doi:[10.1038/s41586-020-2120-4](https://doi.org/10.1038/s41586-020-2120-4).
- 29 Barbarossa, V. et al., 2018: Data Descriptor: FLO1K, global maps of mean, maximum and minimum annual streamflow  
30 at 1 km resolution from 1960 through 2015. *Scientific Data*, **5**, 1–11, doi:[10.1038/sdata.2018.52](https://doi.org/10.1038/sdata.2018.52).
- 31 Bard, E. and R.E.M. Rickaby, 2009: Migration of the subtropical front as a modulator of glacial climate. *Nature*,  
32 **460**(7253), 380–383, doi:[10.1038/nature08189](https://doi.org/10.1038/nature08189).
- 33 Barichivich, J. et al., 2013: Large-scale variations in the vegetation growing season and annual cycle of atmospheric  
34 CO<sub>2</sub> at high northern latitudes from 1950 to 2011. *Global Change Biology*, doi:[10.1111/gcb.12283](https://doi.org/10.1111/gcb.12283).
- 35 Baringer, M.O. et al., 2018: Meridional overturning and oceanic heat transport circulation observations in the North  
36 Atlantic Ocean [in “State of the Climate in 2017”]. *Bulletin of the American Meteorological Society*, **99**(8),  
37 S91–S94, doi:[10.1175/2018bamsstateoftheclimate.1](https://doi.org/10.1175/2018bamsstateoftheclimate.1).
- 38 Barlow, N.L.M. et al., 2018: Lack of evidence for a substantial sea-level fluctuation within the Last Interglacial. *Nature  
39 Geoscience*, **11**(9), 627–634, doi:[10.1038/s41561-018-0195-4](https://doi.org/10.1038/s41561-018-0195-4).
- 40 Barnes, E.A., E. Dunn-Sigouin, G. Masato, and T. Woollings, 2014: Exploring recent trends in Northern Hemisphere  
41 blocking. *Geophysical Research Letters*, **41**(2), 638–644, doi:[10.1002/2013gl058745](https://doi.org/10.1002/2013gl058745).
- 42 Barr, C. et al., 2014: Climate variability in south-eastern Australia over the last 1500 years inferred from the high-  
43 resolution diatom records of two crater lakes. *Quaternary Science Reviews*, **95**, 115–131,  
44 doi:[10.1016/j.quascirev.2014.05.001](https://doi.org/10.1016/j.quascirev.2014.05.001).
- 45 Barr, C. et al., 2019: Holocene El Niño–Southern Oscillation variability reflected in subtropical Australian  
46 precipitation. *Scientific Reports*, **9**(1), 1627, doi:[10.1038/s41598-019-38626-3](https://doi.org/10.1038/s41598-019-38626-3).
- 47 Barrett, H.G., J.M. Jones, and G.R. Bigg, 2018: Reconstructing El Niño Southern Oscillation using data from ships’  
48 logbooks, 1815–1854. Part II: Comparisons with existing ENSO reconstructions and implications for  
49 reconstructing ENSO diversity. *Climate Dynamics*, **50**(9), 3131–3152, doi:[10.1007/s00382-017-3797-4](https://doi.org/10.1007/s00382-017-3797-4).
- 50 Barrucand, M.G., M.E. Zitto, R. Piotrkowski, P. Canziani, and A. O’Neill, 2018: Historical SAM index time series:  
51 linear and nonlinear analysis. *International Journal of Climatology*, **38**, e1091–e1106, doi:[10.1002/joc.5435](https://doi.org/10.1002/joc.5435).
- 52 Bartoli, G., B. Höönsch, and R.E. Zeebe, 2011: Atmospheric CO<sub>2</sub> decline during the Pliocene intensification of  
53 Northern Hemisphere glaciations. *Paleoceanography*, **26**(4), doi:[10.1029/2010pa002055](https://doi.org/10.1029/2010pa002055).
- 54 Bastos, A., S.W. Running, C. Gouveia, and R.M. Trigo, 2013: The global NPP dependence on ENSO: La Niña and the  
55 extraordinary year of 2011. *Journal of Geophysical Research: Biogeosciences*, **118**, 1247–1255,  
56 doi:[10.1002/jgrg.20100](https://doi.org/10.1002/jgrg.20100).
- 57 Batchelor, C.L. et al., 2019: The configuration of Northern Hemisphere ice sheets through the Quaternary. *Nature  
58 Communications*, **10**(1), 3713, doi:[10.1038/s41467-019-11601-2](https://doi.org/10.1038/s41467-019-11601-2).
- 59 Bauer, S.E. et al., 2020: Historical (1850–2014) Aerosol Evolution and Role on Climate Forcing Using the GISS  
60 ModelE2.1 Contribution to CMIP6. *Journal of Advances in Modeling Earth Systems*, **12**(8), e2019MS001978,

- doi:[10.1029/2019ms001978](https://doi.org/10.1029/2019ms001978).

Bauska, T.K. et al., 2015: Links between atmospheric carbon dioxide, the land carbon reservoir and climate over the past millennium. *Nature Geoscience*, **8**, 383–387, doi:[10.1038/ngeo2422](https://doi.org/10.1038/ngeo2422).

Bayr, T., D. Dommegård, T. Martin, and S.B. Power, 2014: The eastward shift of the Walker Circulation in response to global warming and its relationship to ENSO variability. *Climate Dynamics*, **43(9–10)**, 2747–2763, doi:[10.1007/s00382-014-2091-y](https://doi.org/10.1007/s00382-014-2091-y).

Beal, L.M. and S. Eliot, 2016: Broadening not strengthening of the Agulhas Current since the early 1990s. *Nature*, **540**, 570–573, doi:[10.1038/nature19853](https://doi.org/10.1038/nature19853).

Beaufort, L. and M. Grelaud, 2017: A 2700-year record of ENSO and PDO variability from the Californian margin based on coccolithophore assemblages and calcification. *Progress in Earth and Planetary Science*, **4(1)**, 5, doi:[10.1186/s40645-017-0123-z](https://doi.org/10.1186/s40645-017-0123-z).

Beckley, B.D., P.S. Callahan, D.W. Hancock III, G.T. Mitchum, and R.D. Ray, 2017: On the “Cal-Mode” Correction to TOPEX Satellite Altimetry and Its Effect on the Global Mean Sea Level Time Series. *Journal of Geophysical Research: Oceans*, **122(11)**, 8371–8384, doi:[10.1002/2017jc013090](https://doi.org/10.1002/2017jc013090).

Befort, D.J., S. Wild, T. Kruschke, U. Ulbrich, and G.C. Leckebusch, 2016: Different long-term trends of extra-tropical cyclones and windstorms in ERA-20C and NOAA-20CR reanalyses. *Atmospheric Science Letters*, **17**, 586–595, doi:[10.1002/asl.694](https://doi.org/10.1002/asl.694).

Bellomo, K. and A.C. Clement, 2015: Evidence for weakening of the Walker circulation from cloud observations. *Geophysical Research Letters*, **42(18)**, 7758–7766, doi:[10.1002/2015gl065463](https://doi.org/10.1002/2015gl065463).

Bellomo, K., L.N. Murphy, M.A. Cane, A.C. Clement, and L.M. Polvani, 2018: Historical forcings as main drivers of the Atlantic multidecadal variability in the CESM large ensemble. *Climate Dynamics*, **50(9)**, 3687–3698, doi:[10.1007/s00382-017-3834-3](https://doi.org/10.1007/s00382-017-3834-3).

Bellouin, N. et al., 2020: Radiative forcing of climate change from the Copernicus reanalysis of atmospheric composition. *Earth System Science Data*, **12(3)**, 1649–1677, doi:[10.5194/essd-12-1649-2020](https://doi.org/10.5194/essd-12-1649-2020).

Belt, S.T., 2018: Source-specific biomarkers as proxies for Arctic and Antarctic sea ice. *Organic Geochemistry*, doi:[10.1016/j.orggeochem.2018.10.002](https://doi.org/10.1016/j.orggeochem.2018.10.002).

Belt, S.T. et al., 2015: Identification of paleo Arctic winter sea ice limits and the marginal ice zone: Optimised biomarker-based reconstructions of late Quaternary Arctic sea ice. *Earth and Planetary Science Letters*, **431**, 127–139, doi:[10.1016/j.epsl.2015.09.020](https://doi.org/10.1016/j.epsl.2015.09.020).

Benestad, R.E., H.B. Erlandsen, A. Mezghani, and K.M. Parding, 2019: Geographical Distribution of Thermometers Gives the Appearance of Lower Historical Global Warming. *Geophysical Research Letters*, **46(13)**, 7654–7662, doi:[10.1029/2019gl083474](https://doi.org/10.1029/2019gl083474).

Bentley, M.J. et al., 2014: A community-based geological reconstruction of Antarctic Ice Sheet deglaciation since the Last Glacial Maximum. *Quaternary Science Reviews*, **100**, 1–9, doi:[10.1016/j.quascirev.2014.06.025](https://doi.org/10.1016/j.quascirev.2014.06.025).

Bereiter, B. et al., 2018: Mean global ocean temperatures during the last glacial transition. *Nature*, **553(39)**, 39, doi:[10.1038/nature25152](https://doi.org/10.1038/nature25152).

Berends, C.J., B. de Boer, A.M. Dolan, D.J. Hill, and R.S.W. van de Wal, 2019: Modelling ice sheet evolution and atmospheric CO<sub>2</sub> during the Late Pliocene. *Climate of the Past*, **15(4)**, 1603–1619, doi:[10.5194/cp-15-1603-2019](https://doi.org/10.5194/cp-15-1603-2019).

Berger, A. and M.F. Loutre, 1991: Insolation values for the climate of the last 10 million years. *Quaternary Science Reviews*, **10(4)**, 297–317, doi:[10.1016/0277-3791\(91\)90033-q](https://doi.org/10.1016/0277-3791(91)90033-q).

Berry, D.I. and E.C. Kent, 2011a: Air-Sea fluxes from ICOADS : the construction of a new gridded dataset with uncertainty estimates. *International Journal of Climatology*, **31**, 987–1001, doi:[10.1002/joc.2059](https://doi.org/10.1002/joc.2059).

Berry, D.I. and E.C. Kent, 2011b: Air-Sea fluxes from ICOADS : the construction of a new gridded dataset with uncertainty estimates. *International Journal of Climatology*, **31**, 987–1001, doi:[10.1002/joc.2059](https://doi.org/10.1002/joc.2059).

Berry, D.I., E.C. Kent, and P.K. Taylor, 2004: An Analytical Model of Heating Errors in Marine Air Temperatures from Ships. *Journal of Atmospheric and Oceanic Technology*, **21(8)**, 1198–1215, doi:[10.1175/1520-0426\(2004\)021<1198:aamohe>2.0.co;2](https://doi.org/10.1175/1520-0426(2004)021<1198:aamohe>2.0.co;2).

Berry, D.I., G.K. Corlett, O. Embury, and C.J. Merchant, 2018: Stability Assessment of the (A)ATSR Sea Surface Temperature Climate Dataset from the European Space Agency Climate Change Initiative. *Remote Sensing*, **10(1)**, doi:[10.3390/rs10010126](https://doi.org/10.3390/rs10010126).

Bertram, R.A. et al., 2018: Pliocene deglacial event timelines and the biogeochemical response offshore Wilkes Subglacial Basin, East Antarctica. *Earth and Planetary Science Letters*, **494**, 109–116, doi:[10.1016/j.epsl.2018.04.054](https://doi.org/10.1016/j.epsl.2018.04.054).

Berx, B. et al., 2013: Combining in situ measurements and altimetry to estimate volume, heat and salt transport variability through the Faroe–Shetland Channel. *Ocean Sci.*, **9(4)**, 639–654, doi:[10.5194/os-9-639-2013](https://doi.org/10.5194/os-9-639-2013).

Betts, R.A., C.D. Jones, J.R. Knight, R.F. Keeling, and J.J. Kennedy, 2016: El Niño and a record CO<sub>2</sub> rise. *Nature Climate Change*, **6**, 806–810, doi:[10.1038/nclimate3063](https://doi.org/10.1038/nclimate3063).

Betts, R.A. et al., 2018: Changes in climate extremes, fresh water availability and vulnerability to food insecurity projected at 1.5°C and 2°C global warming with a higher-resolution global climate model. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, **376(2119)**, 20160452,

1 doi:[10.1098/rsta.2016.0452](https://doi.org/10.1098/rsta.2016.0452).

2 Beusch, L., L. Gudmundsson, and S.I. Seneviratne, 2020: Crossbreeding CMIP6 Earth System Models With an  
3 Emulator for Regionally Optimized Land Temperature Projections. *Geophysical Research Letters*, **47**(15),  
4 e2019GL086812, doi:[10.1029/2019gl086812](https://doi.org/10.1029/2019gl086812).

5 Bianchi, G.G. and I.N. McCave, 1999: Holocene periodicity in North Atlantic climate and deep-ocean flow south of  
6 Iceland. *Nature*, **397**(6719), 515–517, doi:[10.1038/17362](https://doi.org/10.1038/17362).

7 Biasutti, M. et al., 2018: Global energetics and local physics as drivers of past, present and future monsoons. *Nature  
8 Geoscience*, **11**(6), 392–400, doi:[10.1038/s41561-018-0137-1](https://doi.org/10.1038/s41561-018-0137-1).

9 Bierman, P.R., J.D. Shakun, L.B. Corbett, S.R. Zimmerman, and D.H. Rood, 2016: A persistent and dynamic East  
10 Greenland Ice Sheet over the past 7.5 million years. *Nature*, **540**(7632), 256–260, doi:[10.1038/nature20147](https://doi.org/10.1038/nature20147).

11 Bindoff, N.L. et al., 2019: Changing Ocean, Marine Ecosystems, and Dependent Communities. In: *IPCC Special  
12 Report on the Ocean and Cryosphere in a Changing Climate* [Pörtner, H.-O., D.C. Roberts, V. Masson-  
13 Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, and A. Okem (eds.)]. In  
14 Press, pp. 447–587.

15 Binney, H. et al., 2017: Vegetation of Eurasia from the last glacial maximum to present: Key biogeographic patterns.  
16 *Quaternary Science Reviews*, **157**, 80–97, doi:[10.1016/j.quascirev.2016.11.022](https://doi.org/10.1016/j.quascirev.2016.11.022).

17 Binney, H.A. et al., 2009: The distribution of late-Quaternary woody taxa in northern Eurasia: evidence from a new  
18 macrofossil database. *Quaternary Science Reviews*, doi:[10.1016/j.quascirev.2009.04.016](https://doi.org/10.1016/j.quascirev.2009.04.016).

19 Biondi, F., A. Gershunov, and D.R. Cayan, 2001: North Pacific Decadal Climate Variability since 1661. *Journal of  
20 Climate*, **14**(1), 5–10, doi:[10.1175/1520-0442\(2001\)014<0005:npdcvs>2.0.co;2](https://doi.org/10.1175/1520-0442(2001)014<0005:npdcvs>2.0.co;2).

21 Bisagni, J.J., A. Gangopadhyay, and A. Sanchez-Franks, 2017: Secular change and inter-annual variability of the Gulf  
22 Stream position, 1993–2013, 70°–55°W. *Deep-Sea Research Part I: Oceanographic Research Papers*, **25**, 1–  
23 10, doi:[10.1016/j.dsr.2017.04.001](https://doi.org/10.1016/j.dsr.2017.04.001).

24 Biskaborn, B.K. et al., 2019a: Permafrost is warming at a global scale. *Nature Communications*, **10**(1), 264,  
25 doi:[10.1038/s41467-018-08240-4](https://doi.org/10.1038/s41467-018-08240-4).

26 Biskaborn, B.K. et al., 2019b: Permafrost is warming at a global scale. *Nature Communications*, **10**(1), 264,  
27 doi:[10.1038/s41467-018-08240-4](https://doi.org/10.1038/s41467-018-08240-4).

28 Blake-Mizen, K. et al., 2019: Southern Greenland glaciation and Western Boundary Undercurrent evolution recorded  
29 on Eirik Drift during the late Pliocene intensification of Northern Hemisphere glaciation. *Quaternary Science  
30 Reviews*, **209**, 40–51, doi:[10.1016/j.quascirev.2019.01.015](https://doi.org/10.1016/j.quascirev.2019.01.015).

31 Blanchon, P., A. Eisenhauer, J. Fietzke, and V. Liebetrau, 2009: Rapid sea-level rise and reef back-stepping at the close  
32 of the last interglacial highstand. *Nature*, **458**(7240), 881–884, doi:[10.1038/nature07933](https://doi.org/10.1038/nature07933).

33 Bliss, A.C., J.A. Miller, and W.N. Meier, 2017: Comparison of passive microwave-derived early melt onset records on  
34 Arctic sea ice. *Remote Sensing*, doi:[10.3390/rs9030199](https://doi.org/10.3390/rs9030199).

35 Blowes, S.A. and Blowes, S., Supp., S., Antao, L., Bates, A., Bruelheide, Chase, J., Moyes, F., Magurran, A., McGill,  
36 B., Myers-Smith, I., Winter, M., Bjorkman, A., Bowler, D., Byrnes, J., Bonzalez, A., hines, J., Isbell, F., Jones,  
37 H., Navarro, L., Thompson, P., 2019: The geography of biodiversity change in marine and terrestrial  
38 assemblages. *Science*, **366**(6463), 339–345, doi:[10.1126/science.aaw1620](https://doi.org/10.1126/science.aaw1620).

39 Blunden, J. and D.S. Arndt, 2019: State of the Climate in 2018. *Bulletin of the American Meteorological Society*,  
40 **100**(9), Si–S306, doi:[10.1175/2019bamsstateoftheclimate.1](https://doi.org/10.1175/2019bamsstateoftheclimate.1).

41 Bohlinger, P., B.M. Sinnhuber, R. Ruhnke, and O. Kirner, 2014: Radiative and dynamical contributions to past and  
42 future Arctic stratospheric temperature trends. *Atmospheric Chemistry and Physics*, **14**(3), 1679–1688,  
43 doi:[10.5194/acp-14-1679-2014](https://doi.org/10.5194/acp-14-1679-2014).

44 Böhm, E. et al., 2015: Strong and deep Atlantic meridional overturning circulation during the last glacial cycle. *Nature*,  
45 **517**(7532), 73–76, doi:[10.1038/nature14059](https://doi.org/10.1038/nature14059).

46 Bojinski, S. et al., 2014: The Concept of Essential Climate Variables in Support of Climate Research, Applications, and  
47 Policy. *Bulletin of the American Meteorological Society*, **95**(9), 1431–1443, doi:[10.1175/bams-d-13-00047.1](https://doi.org/10.1175/bams-d-13-00047.1).

48 Bokhorst, S. et al., 2016: Changing Arctic snow cover: A review of recent developments and assessment of future needs  
49 for observations, modelling, and impacts. *Ambio*, **45**, 516–537, doi:[10.1007/s13280-016-0770-0](https://doi.org/10.1007/s13280-016-0770-0).

50 Booth, B.B.B., N.J. Dunstone, P.R. Halloran, T. Andrews, and N. Bellouin, 2012: Aerosols implicated as a prime driver  
51 of twentieth-century North Atlantic climate variability. *Nature*, **484**(7393), 228–232, doi:[10.1038/nature10946](https://doi.org/10.1038/nature10946).

52 Bordbar, M.H., T. Martin, M. Latif, and W. Park, 2017: Role of internal variability in recent decadal to multidecadal  
53 tropical Pacific climate changes. *Geophysical Research Letters*, **44**(9), 4246–4255, doi:[10.1002/2016gl072355](https://doi.org/10.1002/2016gl072355).

54 Bordi, I., R. Bonis, K. Fraedrich, and A. Sutera, 2015: Interannual variability patterns of the world's total column water  
55 content: Amazon River basin. *Theoretical and Applied Climatology*, **122**, 441–455, doi:[10.1007/s00704-014-1304-y](https://doi.org/10.1007/s00704-014-1304-y).

57 Borge, A.F., S. Westermann, I. Solheim, and B. Etzelmüller, 2017: Strong degradation of palsas and peat plateaus in  
58 northern Norway during the last 60 years. *Cryosphere*, **11**(1), 1–16, doi:[10.5194/cr-11-1-2017](https://doi.org/10.5194/cr-11-1-2017).

59 Born, A. and A. Levermann, 2010: The 8.2 ka event: Abrupt transition of the subpolar gyre toward a modern North  
60 Atlantic circulation. *Geochemistry, Geophysics, Geosystems*, **11**(6), doi:[10.1029/2009gc003024](https://doi.org/10.1029/2009gc003024).

61 Borstad, G., W. Crawford, J.M. Hipfner, R. Thomson, and K. Hyatt, 2011: Environmental control of the breeding

- success of rhinoceros auklets at Triangle Island, British Columbia. *Marine Ecology Progress Series*, **424**, 285–302, doi:[10.3354/meps08950](https://doi.org/10.3354/meps08950).
- Bosilovich, M.G., F.R. Robertson, L. Takacs, A. Molod, and D. Mocko, 2017: Atmospheric Water Balance and Variability in the MERRA-2 Reanalysis. *Journal of Climate*, **30**, 1177–1196, doi:[10.1175/jcli-d-16-0338.1](https://doi.org/10.1175/jcli-d-16-0338.1).
- Bourassa, A.E., C.A. McLinden, A.F. Bathgate, B.J. Elash, and D.A. Degenstein, 2012: Precision estimate for Odin-OSIRIS limb scatter retrievals. *Journal of Geophysical Research*, **117(D4)**, D04303, doi:[10.1029/2011jd016976](https://doi.org/10.1029/2011jd016976).
- Bova, S., Y. Rosenthal, Z. Liu, S.P. Godad, and M. Yan, 2021: Seasonal origin of the thermal maxima at the Holocene and the last interglacial. *Nature*, **589(7843)**, 548–553, doi:[10.1038/s41586-020-03155-x](https://doi.org/10.1038/s41586-020-03155-x).
- Bowen, G.J. et al., 2015: Two massive, rapid releases of carbon during the onset of the Palaeocene–Eocene thermal maximum. *Nature Geoscience*, **8(1)**, 44–47, doi:[10.1038/ngeo2316](https://doi.org/10.1038/ngeo2316).
- Bradley, S.L., G.A. Milne, B.P. Horton, and Y. Zong, 2016: Modelling sea level data from China and Malay-Thailand to estimate Holocene ice-volume equivalent sea level change. *Quaternary Science Reviews*, **137**, 54–68, doi:[10.1016/j.quascirev.2016.02.002](https://doi.org/10.1016/j.quascirev.2016.02.002).
- Bradley, S.L., R.C.A. Hindmarsh, P.L. Whitehouse, M.J. Bentley, and M.A. King, 2015: Low post-glacial rebound rates in the Weddell Sea due to Late Holocene ice-sheet readvance. *Earth and Planetary Science Letters*, **413**, 79–89, doi:[10.1016/j.epsl.2014.12.039](https://doi.org/10.1016/j.epsl.2014.12.039).
- Braesicke, A.P. et al., 2018: Update on Global Ozone: Past, Present and Future. In: *Scientific Assessment of Ozone Depletion: 2018*. Global Ozone Research and Monitoring Project – Report No. 58, World Meteorological Organization (WMO), Geneva, Switzerland, pp. 3.1–3.74.
- Braganza, K., J.L. Gergis, S.B. Power, J.S. Risbey, and A.M. Fowler, 2009: A multiproxy index of the El Niño–Southern Oscillation, A.D. 1525–1982. *Journal of Geophysical Research: Atmospheres*, **114(D5)**, doi:[10.1029/2008jd010896](https://doi.org/10.1029/2008jd010896).
- Braithwaite, C.J.R. et al., 2000: Origins and development of Holocene coral reefs: a revisited model based on reef boreholes in the Seychelles, Indian Ocean. *International Journal of Earth Sciences*, **89(2)**, 431–445, doi:[10.1007/s005310000078](https://doi.org/10.1007/s005310000078).
- Brennan, M.K., G.J. Hakim, and E. Blanchard-Wrigglesworth, 2020: Arctic Sea-Ice Variability During the Instrumental Era. *Geophysical Research Letters*, **47(7)**, e2019GL086843, doi:[10.1029/2019gl086843](https://doi.org/10.1029/2019gl086843).
- Brewin, R.J.W. et al., 2012: The influence of the Indian Ocean Dipole on interannual variations in phytoplankton size structure as revealed by Earth Observation. *Deep Sea Research Part II: Topical Studies in Oceanography*, **77–80**, 117–127, doi:[10.1016/j.dsr2.2012.04.009](https://doi.org/10.1016/j.dsr2.2012.04.009).
- Brierley, C.M., 2015: Interannual climate variability seen in the Pliocene Model Intercomparison Project. *Climate of the Past*, **11(3)**, 605–618, doi:[10.5194/cp-11-605-2015](https://doi.org/10.5194/cp-11-605-2015).
- Brierley, C.M. et al., 2020: Large-scale features and evaluation of the PMIP4-CMIP6 midHolocene simulations. *Climate of the Past*, **16(5)**, 1847–1872, doi:[10.5194/cp-16-1847-2020](https://doi.org/10.5194/cp-16-1847-2020).
- Brigham-Grette, J. et al., 2013: Pliocene Warmth, Polar Amplification, and Stepped Pleistocene Cooling Recorded in NE Arctic Russia. *Science*, **340(6139)**, doi:[10.1126/science.1233137](https://doi.org/10.1126/science.1233137).
- Briner, J.P. et al., 2016: Holocene climate change in Arctic Canada and Greenland. *Quaternary Science Reviews*, **147**, 340–364, doi:[10.1016/j.quascirev.2016.02.010](https://doi.org/10.1016/j.quascirev.2016.02.010).
- Briner, J.P. et al., 2020: Rate of mass loss from the Greenland Ice Sheet will exceed Holocene values this century. *Nature*, **586(7827)**, 70–74, doi:[10.1038/s41586-020-2742-6](https://doi.org/10.1038/s41586-020-2742-6).
- Bristow, L.A. et al., 2017: N2 production rates limited by nitrite availability in the Bay of Bengal oxygen minimum zone. *Nature Geoscience*, **10(1)**, 24–29, doi:[10.1038/ngeo2847](https://doi.org/10.1038/ngeo2847).
- Broecker, W.S., 1989: The salinity contrast between the Atlantic and Pacific oceans during glacial time. *Paleoceanography*, **4(2)**, 207–212, doi:[10.1029/pa004i002p00207](https://doi.org/10.1029/pa004i002p00207).
- Bronnimann, S. et al., 2015: Southward shift of the northern tropical belt from 1945 to 1980. *Nature Geoscience*, **8(12)**, 969–974, doi:[10.1038/ngeo2568](https://doi.org/10.1038/ngeo2568).
- Bronsemaer, B. et al., 2020: Importance of wind and meltwater for observed chemical and physical changes in the Southern Ocean. *Nature Geoscience*, **13(1)**, 35–42, doi:[10.1038/s41561-019-0502-8](https://doi.org/10.1038/s41561-019-0502-8).
- Brook, E.J. and C. Buizert, 2018: Antarctic and global climate history viewed from ice cores. *Nature*, **558**, 200–208, doi:[10.1038/s41586-018-0172-5](https://doi.org/10.1038/s41586-018-0172-5).
- Brown, R.D., 2002: Reconstructed North American, Eurasian, and Northern Hemisphere Snow Cover Extent, 1915–1997, Version 1. National Snow and Ice Center, Boulder, Colorado, USA. , doi:[10.7265/n5v985z6](https://doi.org/10.7265/n5v985z6).
- Brown, R., Shuler, D. V., Bulygina, O., Derksen, C., Luoju, K., Mudryk, L., 2017: Arctic terrestrial snow cover. In: *Snow, Water, Ice and Permafrost in the Arctic (SWIPA) 2017*. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway, pp. 25–64.
- Brühl, C., 2018: Volcanic SO<sub>2</sub> data derived from limb viewing satellites for the lower stratosphere from 1998 to 2012, and from nadir viewing satellites for the troposphere. World Data Center for Climate (WDCC) at DKRZ.
- Buckley, B.M. et al., 2019: Interdecadal Pacific Oscillation reconstructed from trans-Pacific tree rings : 1350 – 2004 CE. *Climate Dynamics*, **53**, 3181–3196, doi:[10.1007/s00382-019-04694-4](https://doi.org/10.1007/s00382-019-04694-4).
- Buizert, C. et al., 2015: Precise interpolar phasing of abrupt climate change during the last ice age. *Nature*, **520**, 661,

- doi:[10.1038/nature14401](https://doi.org/10.1038/nature14401).

Buizert, C. et al., 2018: Greenland-Wide Seasonal Temperatures During the Last Deglaciation. *Geophysical Research Letters*, **45**(4), 1905–1914, doi:[10.1002/2017gl075601](https://doi.org/10.1002/2017gl075601).

Burke, K.D. et al., 2019: Differing climatic mechanisms control transient and accumulated vegetation novelty in Europe and eastern North America. *Philosophical transactions of the Royal Society of London. Series B, Biological sciences*, **374**, 20190218, doi:[10.1098/rstb.2019.0218](https://doi.org/10.1098/rstb.2019.0218).

Burls, N.J. and A. Fedorov, 2017: Wetter subtropics in a warmer world : Contrasting past and future hydrological cycles. *Proceedings of the National Academy of Sciences of the United States of America*, **114**(49), 12888–12893, doi:[10.1073/pnas.1703421114](https://doi.org/10.1073/pnas.1703421114).

Burmeister, K., P. Brandt, and J.F. Lübbeke, 2016: Revisiting the cause of the eastern equatorial Atlantic cold event in 2009. *Journal of Geophysical Research: Oceans*, **121**(7), 4777–4789, doi:[10.1002/2016jc011719](https://doi.org/10.1002/2016jc011719).

Burn, M.J. and S.E. Palmer, 2014: Solar forcing of Caribbean drought events during the last millennium. *Journal of Quaternary Science*, **29**(8), 827–836, doi:[10.1002/jqs.2660](https://doi.org/10.1002/jqs.2660).

Burrows, M.T. et al., 2019: Ocean community warming responses explained by thermal affinities and temperature gradients. *Nature Climate Change*, **9**(12), 959–963, doi:[10.1038/s41558-019-0631-5](https://doi.org/10.1038/s41558-019-0631-5).

Businger, J.A., J.C. Wyngaard, Y. Izumi, and E.F. Bradley, 1971: Flux-Profile Relationships in the Atmospheric Surface Layer. *Journal of the Atmospheric Sciences*, **28**(2), 181–189, doi:[10.1175/1520-0469\(1971\)028<018:fprita>2.0.co;2](https://doi.org/10.1175/1520-0469(1971)028<018:fprita>2.0.co;2).

Butler, A.H. and E.P. Gerber, 2018: Optimizing the definition of a sudden stratospheric warming. *Journal of Climate*, **31**(6), 2337–2344, doi:[10.1175/jcli-d-17-0648.1](https://doi.org/10.1175/jcli-d-17-0648.1).

Butler, A.H., J.P. Sjoberg, D.J. Seidel, and K.H. Rosenlof, 2017: A sudden stratospheric warming compendium. , 63–76, doi:[10.7289/v5ns0rwp](https://doi.org/10.7289/v5ns0rwp).

Butler, A.H. et al., 2015: Defining sudden stratospheric warmings. *Bulletin of the American Meteorological Society*, **96**(11), 1913–1928, doi:[10.1175/bams-d-13-00173.1](https://doi.org/10.1175/bams-d-13-00173.1).

Byrne, M.P. and P.A. O’Gorman, 2018: Trends in continental temperature and humidity directly linked to ocean warming. *Proceedings of the National Academy of Sciences*, **115**(19), 4863–4868, doi:[10.1073/pnas.1722312115](https://doi.org/10.1073/pnas.1722312115).

Byrne, M.P., A.G. Pendergrass, A.D. Rapp, and K.R. Wodzicki, 2018: Response of the Intertropical Convergence Zone to Climate Change : Location, Width, and Strength. *Current Climate Change Reports*, **4**(4), 355–370, doi:[10.1007/s40641-018-0110-5](https://doi.org/10.1007/s40641-018-0110-5).

Caballero, R. and M. Huber, 2013: State-dependent climate sensitivity in past warm climates and its implications for future climate projections.. *Proceedings of the National Academy of Sciences of the United States of America*, **110**(35), 14162–7, doi:[10.1073/pnas.1303365110](https://doi.org/10.1073/pnas.1303365110).

Caesar, L., S. Rahmstorf, A. Robinson, G. Feulner, and V. Saba, 2018: Observed fingerprint of a weakening Atlantic Ocean overturning circulation. *Nature*, **556**(7700), 191, doi:[10.1038/s41586-018-0006-5](https://doi.org/10.1038/s41586-018-0006-5).

Caesar, L., G.D. McCarthy, D.J.R. Thornalley, N. Cahill, and S. Rahmstorf, 2021: Current Atlantic Meridional Overturning Circulation weakest in last millennium. *Nature Geoscience*, doi:[10.1038/s41561-021-00699-z](https://doi.org/10.1038/s41561-021-00699-z).

Caley, T. et al., 2014: Quantitative estimate of the paleo-Agulhas leakage. *Geophysical Research Letters*, **41**(4), 1238–1246, doi:[10.1002/2014gl059278](https://doi.org/10.1002/2014gl059278).

Camoin, G.F. et al., 1997: Holocene sea level changes and reef development in the southwestern Indian Ocean. *Coral Reefs*, **16**(4), 247–259, doi:[10.1007/s003380050080](https://doi.org/10.1007/s003380050080).

Campos, J.L.P.S. et al., 2019: Coherent South American Monsoon Variability During the Last Millennium Revealed Through High-Resolution Proxy Records. *Geophysical Research Letters*, **46**(14), 8261–8270, doi:[10.1029/2019gl082513](https://doi.org/10.1029/2019gl082513).

Cao, B. et al., 2018: Thermal Characteristics and Recent Changes of Permafrost in the Upper Reaches of the Heihe River Basin, Western China. *Journal of Geophysical Research: Atmospheres*, **123**, 7935–7949, doi:[10.1029/2018jd028442](https://doi.org/10.1029/2018jd028442).

Cao, J., B. Wang, and J. Liu, 2019: Attribution of the Last Glacial Maximum climate formation. *Climate Dynamics*, **53**(3), 1661–1679, doi:[10.1007/s00382-019-04711-6](https://doi.org/10.1007/s00382-019-04711-6).

Capotondi, A. et al., 2015: Understanding ENSO Diversity. *Bulletin of the American Meteorological Society*, **96**(6), 921–938, doi:[10.1175/bams-d-13-00117.1](https://doi.org/10.1175/bams-d-13-00117.1).

Capron, E., A. Govin, R. Feng, B.L. Otto-Bliesner, and E.W. Wolff, 2017: Critical evaluation of climate syntheses to benchmark CMIP6/PMIP4 127 ka Last Interglacial simulations in the high-latitude regions. *Quaternary Science Reviews*, **168**, 137–150, doi:[10.1016/j.quascirev.2017.04.019](https://doi.org/10.1016/j.quascirev.2017.04.019).

Capron, E. et al., 2019: Challenges and research priorities to understand interactions between climate, ice sheets and global mean sea level during past interglacials. *Quaternary Science Reviews*, **219**, 308–311, doi:[10.1016/j.quascirev.2019.06.030](https://doi.org/10.1016/j.quascirev.2019.06.030).

Carilli, J.E. et al., 2015: Reply to comment by Karnauskas et al. on “Equatorial Pacific coral geochemical records show recent weakening of the Walker circulation”. *Paleoceanography*, **30**, 575–582, doi:[10.1002/2014pa002683.received](https://doi.org/10.1002/2014pa002683.received).

Carlson, A.E. et al., 2014: Earliest Holocene south Greenland ice sheet retreat within its late Holocene extent.

- 1      *Geophysical Research Letters*, **41(15)**, 5514–5521, doi:[10.1002/2014gl060800](https://doi.org/10.1002/2014gl060800).
- 2 Carmichael, M.J. et al., 2016: A model–model and data–model comparison for the early Eocene hydrological cycle. *Climate of the Past*, **12(2)**, 455–481, doi:[10.5194/cp-12-455-2016](https://doi.org/10.5194/cp-12-455-2016).
- 3 Carmichael, M.J. et al., 2017: Hydrological and associated biogeochemical consequences of rapid global warming  
4 during the Paleocene-Eocene Thermal Maximum. *Global and Planetary Change*, **157**, 114–138,  
5 doi:[10.1016/j.gloplacha.2017.07.014](https://doi.org/10.1016/j.gloplacha.2017.07.014).
- 6 Carn, S.A., L. Clarisse, and A.J. Prata, 2016: Multi-decadal satellite measurements of global volcanic degassing.  
7 *Journal of Volcanology and Geothermal Research*, **311**, 99–134, doi:[10.1016/j.jvolgeores.2016.01.002](https://doi.org/10.1016/j.jvolgeores.2016.01.002).
- 8 Carré, M. et al., 2014: Holocene history of ENSO variance and asymmetry in the eastern tropical Pacific. *Science*,  
9 **345(6200)**, 1045–1048, doi:[10.1126/science.1252220](https://doi.org/10.1126/science.1252220).
- 10 Carter, B.R. et al., 2019: Pacific Anthropogenic Carbon Between 1991 and 2017. *Global Biogeochemical Cycles*, **33(5)**,  
11 597–617, doi:[10.1029/2018gb006154](https://doi.org/10.1029/2018gb006154).
- 12 Casanova-Masjoan, M. et al., 2020: Along-Stream, Seasonal, and Interannual Variability of the North Icelandic  
13 Irminger Current and East Icelandic Current Around Iceland. *Journal of Geophysical Research: Oceans*,  
14 **125(9)**, e2020JC016283, doi:[10.1029/2020jc016283](https://doi.org/10.1029/2020jc016283).
- 15 Cattiaux, J., Y. Peings, D. Saint-Martin, N. Trou-Kechout, and S.J. Vavrus, 2016: Sinuosity of midlatitude atmospheric  
16 flow in a warming world. *Geophysical Research Letters*, **43(15)**, doi.org/10.1002/2016GL070309.
- 17 Ceglar, A., M. Zampieri, A. Toreti, and F. Dentener, 2019: Observed Northward Migration of Agro-Climate Zones in  
18 Europe Will Further Accelerate Under Climate Change. *Earth's Future*, doi:[10.1029/2019ef001178](https://doi.org/10.1029/2019ef001178).
- 19 Centurioni, L.R. et al., 2019: Global in situ Observations of Essential Climate and Ocean Variables at the Air-Sea  
20 Interface. *Frontiers in Marine Science*, **6**, 419, doi:[10.3389/fmars.2019.00419](https://doi.org/10.3389/fmars.2019.00419).
- 21 Chai, Y. et al., 2020: Homogenization and polarization of the seasonal water discharge of global rivers in response to  
22 climatic and anthropogenic effects. *Science of the Total Environment*, **709**, 136062,  
23 doi:[10.1016/j.scitotenv.2019.136062](https://doi.org/10.1016/j.scitotenv.2019.136062).
- 24 Chakraborty, S., Y.K. Tiwari, P.K.D. Burman, S.B. Roy, and V. Valsala, 2020: Observations and Modeling of GHG  
25 Concentrations and Fluxes Over India. In: *Assessment of Climate Change over the Indian Region: A Report of  
the Ministry of Earth Sciences (MoES), Government of India* [Krishnan, R., J. Sanjay, C. Gnanaseelan, M.  
26 Mujumdar, A. Kulkarni, and S. Chakraborty (eds.)]. Springer, Singapore, pp. 73–92, doi:[10.1007/978-981-15-4327-2\\_4](https://doi.org/10.1007/978-981-15-4327-2_4).
- 27 Chalk, T.B. et al., 2017: Causes of ice age intensification across the Mid-Pleistocene Transition. *Proceedings of the  
National Academy of Sciences*, doi:[10.1073/pnas.1702143114](https://doi.org/10.1073/pnas.1702143114).
- 28 Chan, D. and Q. Wu, 2015: Significant anthropogenic-induced changes of climate classes since 1950. *Scientific  
Reports*, **5(13487)**, doi:[10.1038/srep13487](https://doi.org/10.1038/srep13487).
- 29 Chan, D., E.C. Kent, D.I. Berry, and P. Huybers, 2019: Correcting datasets leads to more homogeneous early-twentieth-  
30 century sea surface warming. *Nature*, **571(7765)**, 393–397, doi:[10.1038/s41586-019-1349-2](https://doi.org/10.1038/s41586-019-1349-2).
- 31 Chandanpurkar, H.A., J.T. Reager, J.S. Famiglietti, and T.H. Syed, 2017: Satellite- and reanalysis-based mass balance  
32 estimates of global continental discharge (1993–2015). *Journal of Climate*, **30(21)**, 8481–8495,  
33 doi:[10.1175/jcli-d-16-0708.1](https://doi.org/10.1175/jcli-d-16-0708.1).
- 34 Chang, C.-Y., J.C.H. Chiang, M.F. Wehner, A.R. Friedman, and R. Ruedy, 2011: Sulfate Aerosol Control of Tropical  
35 Atlantic Climate over the Twentieth Century. *Journal of Climate*, **24(10)**, 2540–2555,  
36 doi:[10.1175/2010jcli4065.1](https://doi.org/10.1175/2010jcli4065.1).
- 37 Chang, E.K.M. and A.M.W. Yau, 2016: Northern Hemisphere winter storm track trends since 1959 derived from  
38 multiple reanalysis datasets. *Climate Dynamics*, **47(5–6)**, 1435–1454, doi:[10.1007/s00382-015-2911-8](https://doi.org/10.1007/s00382-015-2911-8).
- 39 Charlton, A.J. et al., 2007: A New Look at Stratospheric Sudden Warmings. Part II: Evaluation of Numerical Model  
40 Simulations. *J. Climate*, **20**, 470–488, doi:[10.1175/jcli3994.1](https://doi.org/10.1175/jcli3994.1).
- 41 Chatzistergos, Theodosios, Usoskin, Ilya G., Kovaltsov, Gennady A., Krivova, Natalie A., and Solanki, Sami K., 2017:  
42 New reconstruction of the sunspot group numbers since 1739 using direct calibration and "backbone"  
43 methods. *A&A*, **602**, A69, doi:[10.1051/0004-6361/201630045](https://doi.org/10.1051/0004-6361/201630045).
- 44 Chemke, R. and L.M. Polvani, 2019: Opposite tropical circulation trends in climate models and in reanalyses. *Nature  
Geoscience*, **12(7)**, 528–532, doi:[10.1038/s41561-019-0383-x](https://doi.org/10.1038/s41561-019-0383-x).
- 45 Chen, 2016: Decoupling between Plant Productivity and Growing Season Length under a Warming Climate in  
46 Canada's Arctic. *American Journal of Climate Change*, **5**, 344–359, doi:[10.4236/ajcc.2016.53026](https://doi.org/10.4236/ajcc.2016.53026).
- 47 Chen, B. and Z. Liu, 2016: Global water vapor variability and trend from the latest 36 year (1979 to 2014) data of  
48 ECMWF and NCEP reanalyses, radiosonde, GPS, and microwave satellite. *Journal of Geophysical Research:  
Atmospheres*, **121**, 11442–11462, doi:[10.1002/2016jd024917](https://doi.org/10.1002/2016jd024917).
- 49 Chen, C. et al., 2019: China and India lead in greening of the world through land-use management. *Nature  
Sustainability*, **2**, 122–129, doi:[10.1038/s41893-019-0220-7](https://doi.org/10.1038/s41893-019-0220-7).
- 50 Chen, C.-T.A. et al., 2017: Deep oceans may acidify faster than anticipated due to global warming. *Nature Climate  
Change*, **7(12)**, 890–894, doi:[10.1038/s41558-017-0003-y](https://doi.org/10.1038/s41558-017-0003-y).
- 51 Chen, I.C., J.K. Hill, R. Ohlemüller, D.B. Roy, and C.D. Thomas, 2011: Rapid range shifts of species associated with  
52 high levels of climate warming. *Science*, **333(6045)**, 1024–1026, doi:[10.1126/science.1206432](https://doi.org/10.1126/science.1206432).

- 1 Chen, S., K. Wei, W. Chen, and L. Song, 2014: Regional changes in the annual mean Hadley circulation in recent  
2 decades. *Journal of Geophysical Research: Atmospheres*, **119**(13), 7815–7832, doi:[10.1002/2014jd021540](https://doi.org/10.1002/2014jd021540).
- 3 Chen, S. et al., 2016: A high-resolution speleothem record of western equatorial Pacific rainfall: Implications for  
4 Holocene ENSO evolution. *Earth and Planetary Science Letters*, **442**, 61–71, doi:[10.1016/j.epsl.2016.02.050](https://doi.org/10.1016/j.epsl.2016.02.050).
- 5 Chen, X. and X. Zou, 2014: Postlaunch calibration and bias characterization of AMSU-A upper air sounding channels  
6 using GPS RO Data. *Journal of Geophysical Research: Atmospheres*, **119**(7), 3924–3941,  
7 doi:[10.1002/2013jd021037](https://doi.org/10.1002/2013jd021037).
- 8 Chen, X. and J.M. Wallace, 2015: ENSO-Like Variability: 1900–2013. *Journal of Climate*, **28**(24), 9623–9641,  
9 doi:[10.1175/jcli-d-15-0322.1](https://doi.org/10.1175/jcli-d-15-0322.1).
- 10 Chen, X., S. Liang, Y. Cao, T. He, and D. Wang, 2015: Observed contrast changes in snow cover phenology in northern  
11 middle and high latitudes from 2001–2014. *Scientific Reports*, **5**(1), 16820, doi:[10.1038/srep16820](https://doi.org/10.1038/srep16820).
- 12 Chen, X. et al., 2017: The increasing rate of global mean sea-level rise during 1993–2014. *Nature Climate Change*,  
13 **7**(7), 492–495, doi:[10.1038/nclimate3325](https://doi.org/10.1038/nclimate3325).
- 14 Chen, X. et al., 2019a: Tropopause trend across China from 1979 to 2016: A revisit with updated radiosonde  
15 measurements. *International Journal of Climatology*, **39**(2), 1117–1127, doi:[10.1002/joc.5866](https://doi.org/10.1002/joc.5866).
- 16 Chen, X. et al., 2019b: Tropopause trend across China from 1979 to 2016: A revisit with updated radiosonde  
17 measurements. *International Journal of Climatology*, **39**(2), 1117–1127, doi:[10.1002/joc.5866](https://doi.org/10.1002/joc.5866).
- 18 Cheng, L. et al., 2017a: Improved estimates of ocean heat content from 1960 to 2015. *Science Advances*, **3**(3),  
19 doi:[10.1126/sciadv.1601545](https://doi.org/10.1126/sciadv.1601545).
- 20 Cheng, L. et al., 2017b: Improved estimates of ocean heat content from 1960 to 2015. *Science Advances*, **3**(3),  
21 doi:[10.1126/sciadv.1601545](https://doi.org/10.1126/sciadv.1601545).
- 22 Cheng, L. et al., 2018: How Well Can We Correct Systematic Errors in Historical XBT Data? *Journal of Atmospheric  
23 and Oceanic Technology*, **35**(5), 1103–1125, doi:[10.1175/jtech-d-17-0122.1](https://doi.org/10.1175/jtech-d-17-0122.1).
- 24 Cheng, L. et al., 2020: Improved estimates of changes in upper ocean salinity and the hydrological cycle. *Journal of  
25 Climate*, **33**(23), 10357–10381, doi:[10.1175/jcli-d-20-0366.1](https://doi.org/10.1175/jcli-d-20-0366.1).
- 26 Cherian, R. and J. Quaas, 2020: Trends in AOD, Clouds, and Cloud Radiative Effects in Satellite Data and CMIP5 and  
27 CMIP6 Model Simulations Over Aerosol Source Regions. *Geophysical Research Letters*, **47**(9),  
28 e2020GL087132, doi:[10.1029/2020gl087132](https://doi.org/10.1029/2020gl087132).
- 29 Cherian, R., J. Quaas, M. Salzmann, and M. Wild, 2014: Pollution trends over Europe constrain global aerosol forcing  
30 as simulated by climate models. *Geophysical Research Letters*, **41**(6), 2176–2181, doi:[10.1002/2013gl058715](https://doi.org/10.1002/2013gl058715).
- 31 Cheung, H.N., W. Zhou, H.Y. Mok, M.C. Wu, and Y. Shao, 2013: Revisiting the Climatology of Atmospheric Blocking  
32 in the Northern Hemisphere. *Advances in Atmospheric Sciences*, **30**, 397–410.
- 33 Chevalier, M. and B.M. Chase, 2015: Southeast African records reveal a coherent shift from high- to low-latitude  
34 forcing mechanisms along the east African margin across last glacial-interglacial transition. *Quaternary  
35 Science Reviews*, **125**, 117–130, doi:[10.1016/j.quascirev.2015.07.009](https://doi.org/10.1016/j.quascirev.2015.07.009).
- 36 Chiodi, A.M. and D.E. Harrison, 2015: Global Seasonal Precipitation Anomalies Robustly Associated with El Niño and  
37 La Niña Events – An OLR Perspective. *Journal of Climate*, **28**(15), 6133–6159, doi:[10.1175/jcli-d-14-00387.1](https://doi.org/10.1175/jcli-d-14-00387.1).
- 38 Chipperfield, M.P. et al., 2018: On the Cause of Recent Variations in Lower Stratospheric Ozone. *Geophysical  
39 Research Letters*, **45**(11), 5718–5726, doi:[10.1029/2018gl078071](https://doi.org/10.1029/2018gl078071).
- 40 Choi, J.-W., I.-G. Kim, J.-Y. Kim, and C.-H. Park, 2016: The Recent Strengthening of Walker Circulation. *Sola*, **12**(0),  
41 96–99, doi:[10.2151/sola.2016-022](https://doi.org/10.2151/sola.2016-022).
- 42 Chor, T., J.C. McWilliams, and M. Chamecki, 2020: Diffusive-Nondiffusive Flux Decompositions in Atmospheric  
43 Boundary Layers. *Journal of the Atmospheric Sciences*, **77**(10), 3479–3494, doi:[10.1175/jas-d-20-0093.1](https://doi.org/10.1175/jas-d-20-0093.1).
- 44 Chou, C. et al., 2013: Increase in the range between wet and dry season precipitation. *Nature Geoscience*, **6**(4), 263–  
45 267, doi:[10.1038/ngeo1744](https://doi.org/10.1038/ngeo1744).
- 46 Christian, J.E., M. Koutnik, and G. Roe, 2018: Committed retreat: controls on glacier disequilibrium in a warming  
47 climate. *Journal of Glaciology*, **64**(246), 675–688, doi:[10.1017/jog.2018.57](https://doi.org/10.1017/jog.2018.57).
- 48 Christiansen, B. and F.C. Ljungqvist, 2017: Challenges and perspectives for large-scale temperature reconstructions of  
49 the past two millennia. *Reviews of Geophysics*, **55**(1), 40–96, doi:[10.1002/2016rg000521](https://doi.org/10.1002/2016rg000521).
- 50 Christy, J.R., R.W. Spencer, W.D. Braswell, and R. Junod, 2018: Examination of space-based bulk atmospheric  
51 temperatures used in climate research. *International Journal of Remote Sensing*, **39**(11), 3580–3607,  
52 doi:[10.1080/01431161.2018.1444293](https://doi.org/10.1080/01431161.2018.1444293).
- 53 Chung, E.S. et al., 2019: Reconciling opposing Walker circulation trends in observations and model projections. *Nature  
54 Climate Change*, **9**(5), 405–412, doi:[10.1038/s41558-019-0446-4](https://doi.org/10.1038/s41558-019-0446-4).
- 55 Church, J.A. and N.J. White, 2011: Sea-level rise from the late 19th to the early 21st Century. *Surveys in Geophysics*,  
56 **32**, 585, doi:[10.1007/s10712-011-9119-1](https://doi.org/10.1007/s10712-011-9119-1).
- 57 Chylek, P. et al., 2012: Greenland ice core evidence for spatial and temporal variability of the Atlantic Multidecadal  
58 Oscillation. *Geophysical Research Letters*, **39**(9), doi:[10.1029/2012gl051241](https://doi.org/10.1029/2012gl051241).
- 59 Ciraci, E., I. Velicogna, and S. Swenson, 2020: Continuity of the Mass Loss of the World's Glaciers and Ice Caps From  
60 the GRACE and GRACE Follow-On Missions. *Geophysical Research Letters*, **47**(9), e2019GL086926,
- 61

- 1 doi:[10.1029/2019gl086926](https://doi.org/10.1029/2019gl086926).
- 2 Clark, P.U. et al., 2020: Oceanic forcing of penultimate deglacial and last interglacial sea-level rise. *Nature*, **577**(7792),  
3 660–664, doi:[10.1038/s41586-020-1931-7](https://doi.org/10.1038/s41586-020-1931-7).
- 4 Clarkson, M.O. et al., 2015: Ocean acidification and the Permo-Triassic mass extinction. *Science*, **348**(6231), 229,  
5 doi:[10.1126/science.aaa0193](https://doi.org/10.1126/science.aaa0193).
- 6 Claustre, H., K.S. Johnson, and Y. Takeshita, 2020: Observing the Global Ocean with Biogeochemical-Argo. *Annual  
7 Review of Marine Science*, **12**(1), 23–48, doi:[10.1146/annurev-marine-010419-010956](https://doi.org/10.1146/annurev-marine-010419-010956).
- 8 Cleator, S.F., S.P. Harrison, N.K. Nichols, I.C. Prentice, and I. Roulstone, 2020: A new multivariable benchmark for  
9 Last Glacial Maximum climate simulations. *Climate of the Past*, **16**(2), 699–712, doi:[10.5194/cp-16-699-2020](https://doi.org/10.5194/cp-16-699-2020).
- 10 Clem, K.R., J.A. Renwick, and J. McGregor, 2017: Relationship between eastern tropical Pacific cooling and recent  
11 trends in the Southern Hemisphere zonal-mean circulation. *Climate Dynamics*, **49**(1–2), 113–129,  
12 doi:[10.1007/s00382-016-3329-7](https://doi.org/10.1007/s00382-016-3329-7).
- 13 Clette, F., L. Svalgaard, J.M. Vaquero, and E.W. Cliver, 2014: Revisiting the Sunspot Number. *Space Science Reviews*,  
14 **186**(1–4), 35–103, doi:[10.1007/s11214-014-0074-2](https://doi.org/10.1007/s11214-014-0074-2).
- 15 Clotten, C., R. Stein, K. Fahl, and S. De Schepper, 2018: Seasonal sea ice cover during the warm Pliocene: Evidence  
16 from the Iceland Sea (ODP Site 907). *Earth and Planetary Science Letters*, **481**, 61–72,  
17 doi:[10.1016/j.epsl.2017.10.011](https://doi.org/10.1016/j.epsl.2017.10.011).
- 18 Cobb, K.M. et al., 2013: Highly Variable El Niño-Southern Oscillation Throughout the Holocene. *Science*, **339**(6115),  
19 67–70, doi:[10.1126/science.1228246](https://doi.org/10.1126/science.1228246).
- 20 Coddington, O., J.L. Lean, P. Pilewskie, M. Snow, and D. Lindholm, 2016: A Solar Irradiance Climate Data Record.  
21 *Bulletin of the American Meteorological Society*, **97**(7), 1265–1282, doi:[10.1175/bams-d-14-00265.1](https://doi.org/10.1175/bams-d-14-00265.1).
- 22 Coen, M.C. et al., 2020: Multidecadal trend analysis of aerosol radiative properties at a global scale. *Atmospheric  
23 Chemistry and Physics*, **20**(14), 8867–8908, doi:[10.5194/acp-20-8867-2020](https://doi.org/10.5194/acp-20-8867-2020).
- 24 Cohen, J. et al., 2020: Divergent consensuses on Arctic amplification influence on midlatitude severe winter weather.  
25 *Nature Climate Change*, **10**, 20–29, doi:[10.1038/s41558-019-0662-y](https://doi.org/10.1038/s41558-019-0662-y).
- 26 Collins, M., M. Sutherland, L. Bower, and S.-M. Cheong, 2019: Extremes, Abrupt Changes and Managing Risks. In:  
27 *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate* [Pörtner, H.-O., D.C. Roberts, V.  
28 Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, and A. Okem  
29 (eds.)]. In Press, pp. 589–655.
- 30 Collins, W.J. et al., 2011: Development and evaluation of an Earth-System model – HadGEM2. *Geoscientific Model  
31 Development*, **4**(4), doi:[10.5194/gmd-4-1051-2011](https://doi.org/10.5194/gmd-4-1051-2011).
- 32 Comiso, J.C. et al., 2017: Positive Trend in the Antarctic Sea Ice Cover and Associated Changes in Surface  
33 Temperature.. *Journal of Climate*, **30**(6), 2251–2267, doi:[10.1175/jcli-d-16-0408.1](https://doi.org/10.1175/jcli-d-16-0408.1).
- 34 Connolly, R. et al., 2019: Northern Hemisphere Snow-Cover Trends (1967–2018): A Comparison between Climate  
35 Models and Observations. *Geosciences*, **9**(3), doi:[10.3390/geosciences9030135](https://doi.org/10.3390/geosciences9030135).
- 36 Conroy, J.L. et al., 2017: Spatiotemporal variability in the δ18O-salinity relationship of seawater across the tropical  
37 Pacific Ocean. *Paleoceanography*, **32**(5), 484–497, doi:[10.1002/2016pa003073](https://doi.org/10.1002/2016pa003073).
- 38 Cook, B.I., J.E. Smerdon, R. Seager, and E.R. Cook, 2014: Pan-Continental Droughts in North America over the Last  
39 Millennium. *Journal of Climate*, **27**(1), 383–397, doi:[10.1175/jcli-d-13-00100.1](https://doi.org/10.1175/jcli-d-13-00100.1).
- 40 Cook, E.R. et al., 2015: Old World megadroughts and pluvials during the Common Era. *Science Advances*, **1**(10),  
41 e1500561, doi:[10.1126/sciadv.1500561](https://doi.org/10.1126/sciadv.1500561).
- 42 Cook, E.R. et al., 2019: A Euro-Mediterranean tree-ring reconstruction of the winter NAO index since 910 C . E ..  
43 *Climate Dynamics*, **53**(3–4), 1567–1580, doi:[10.1007/s00382-019-04696-2](https://doi.org/10.1007/s00382-019-04696-2).
- 44 Cooper, O.R. et al., 2020: Multi-decadal surface ozone trends at globally distributed remote locations. *Elementa Sci.  
45 Anthropocene*, **8**(1), 23, doi:[10.1525/elementa.420](https://doi.org/10.1525/elementa.420).
- 46 Corbett, J.G. and N.G. Loeb, 2015: On the relative stability of CERES reflected shortwave and MISR and MODIS  
47 visible radiance measurements during the Terra satellite mission. *Journal of Geophysical Research: Atmospheres*, **120**(22), 11,608–11,616, doi:[10.1002/2015jd023484](https://doi.org/10.1002/2015jd023484).
- 48 Cornes, R.C., P.D. Jones, K.R. Briffa, and T.J. Osborn, 2013: Estimates of the North Atlantic Oscillation back to 1692  
49 using a Paris-London westerly index. *International Journal of Climatology*, **33**(1), 228–248,  
50 doi:[10.1002/joc.3416](https://doi.org/10.1002/joc.3416).
- 51 Cornes, R.C., E.C. Kent, D.I. Berry, and J.J. Kennedy, 2020: CLASSnmat: A global night marine air temperature data  
52 set, 1880–2019. *Geoscience Data Journal*, **7**(n/a), 170–184, doi:[10.1002/gdj3.100](https://doi.org/10.1002/gdj3.100).
- 53 Cortijo, E. et al., 1997: Changes in sea surface hydrology associated with Heinrich event 4 in the North Atlantic Ocean  
54 between 40° and 60°N. *Earth and Planetary Science Letters*, **146**(1–2), 29–45, doi:[10.1016/s0012-821x\(96\)00217-8](https://doi.org/10.1016/s0012-<br/>55 821x(96)00217-8).
- 56 Costa, K.M., J.F. McManus, and R.F. Anderson, 2018: Paleoproductivity and Stratification Across the Subarctic Pacific  
57 Over Glacial-Interglacial Cycles. *Paleoceanography and Paleoceanography*, **33**(9), 914–933,  
58 doi:[10.1029/2018pa003363](https://doi.org/10.1029/2018pa003363).
- 59 Cotté, C. and C. Guinet, 2007: Historical whaling records reveal major regional retreat of Antarctic sea ice. *Deep-Sea  
60 Research Part I: Oceanographic Research Papers*, **57**, 243–252, doi:[10.1016/j.dsr.2006.11.001](https://doi.org/10.1016/j.dsr.2006.11.001).

- 1 Coumou, D., J. Lehmann, and J. Beckmann, 2015: The weakening summer circulation in the Northern Hemisphere  
2 mid-latitudes. *Science*, **348**(6232), 324–327, doi:[10.1126/science.1261768](https://doi.org/10.1126/science.1261768).
- 3 Coumou, D., V. Petoukhov, S. Rahmstorf, S. Petri, and H.J. Schellnhuber, 2014: Quasi-resonant circulation regimes  
4 and hemispheric synchronization of extreme weather in boreal summer. *Proceedings of the National Academy  
5 of Sciences*, **111**(34), 12331–12336, doi:[10.1073/pnas.1412797111](https://doi.org/10.1073/pnas.1412797111).
- 6 Coumou, D., G. Di Capua, S. Vavrus, L. Wang, and S. Wang, 2018: The influence of Arctic amplification on mid-  
7 latitude summer circulation. *Nature Communications*, **9**(1), 2959, doi:[10.1038/s41467-018-05256-8](https://doi.org/10.1038/s41467-018-05256-8).
- 8 Cowtan, K. and R.G. Way, 2014: Coverage bias in the HadCRUT4 temperature series and its impact on recent  
9 temperature trends. *Quarterly Journal of the Royal Meteorological Society*, **140**(683), 1935–1944,  
10 doi:[10.1002/qj.2297](https://doi.org/10.1002/qj.2297).
- 11 Cowtan, K., R. Rohde, and Z. Hausfather, 2018: Evaluating biases in sea surface temperature records using coastal  
12 weather stations. *Quarterly Journal of the Royal Meteorological Society*, **144**(712), 670–681,  
13 doi:[10.1002/qj.3235](https://doi.org/10.1002/qj.3235).
- 14 Cowtan, K. et al., 2015: Robust comparison of climate models with observations using blended land air and ocean sea  
15 surface temperatures. *Geophysical Research Letters*, **42**(15), 6526–6534, doi:[10.1002/2015gl064888](https://doi.org/10.1002/2015gl064888).
- 16 Craig, P.M., D. Ferreira, and J. Methven, 2017: The contrast between Atlantic and Pacific surface water fluxes. *Tellus  
17 A: Dynamic Meteorology and Oceanography*, **69**(1), 1–15, doi:[10.1080/16000870.2017.1330454](https://doi.org/10.1080/16000870.2017.1330454).
- 18 Cramer, B.S., K.G. Miller, P.J. Barrett, and J.D. Wright, 2011: Late Cretaceous-Neogene trends in deep ocean  
19 temperature and continental ice volume: Reconciling records of benthic foraminiferal geochemistry ( $\delta^{18}\text{O}$  and  
20 Mg/Ca) with sea level history. *Journal of Geophysical Research: Oceans*, **116**(C12),  
21 doi:[10.1029/2011jc007255](https://doi.org/10.1029/2011jc007255).
- 22 Cropper, T., E. Hanna, M.A. Valente, and T. Jónsson, 2015: A daily Azores-Iceland North Atlantic Oscillation index  
23 back to 1850. *Geoscience Data Journal*, **2**(1), 12–24, doi:[10.1002/gdj3.23](https://doi.org/10.1002/gdj3.23).
- 24 Crosta, X. et al., 2021: Multi-decadal trends in Antarctic sea-ice extent driven by ENSO-SAM over the last 2,000 years.  
25 *Nature Geoscience*, **14**, 156–160, doi:[10.1038/s41561-021-00697-1](https://doi.org/10.1038/s41561-021-00697-1).
- 26 Cuesta-Valero, F.J., A. García-García, H. Beltrami, J.F. González-Rouco, and E. García-Bustamante, 2021: Long-Term  
27 Global Ground Heat Flux and Continental Heat Storage from Geothermal Data. *Climate of the Past*, **17**(1),  
28 451–468, doi:[10.5194/cp-17-451-2021](https://doi.org/10.5194/cp-17-451-2021).
- 29 Cui, Y. et al., 2011: Slow release of fossil carbon during the palaeocene-eocene thermal maximum. *Nature Geoscience*,  
30 **4**(7), 481–485, doi:[10.1038/ngeo1179](https://doi.org/10.1038/ngeo1179).
- 31 Cummins, P.F. and T. Ross, 2020: Secular trends in water properties at Station P in the northeast Pacific: An updated  
32 analysis. *Progress in Oceanography*, **186**, 102329, doi:[10.1016/j.pocean.2020.102329](https://doi.org/10.1016/j.pocean.2020.102329).
- 33 Curran, M.A.J., T.D. Van Ommen, V.I. Morgan, K.L. Phillips, and A.S. Palmer, 2003: Ice Core Evidence for Antarctic  
34 Sea Ice Decline since the 1950s. *Science*, **302**(5648), 1203–1206, doi:[10.1126/science.1087888](https://doi.org/10.1126/science.1087888).
- 35 D'Agostino, R. and P. Lionello, 2017: Evidence of global warming impact on the evolution of the Hadley Circulation in  
36 ECMWF centennial reanalyses. *Climate Dynamics*, **48**(9–10), 3047–3060, doi:[10.1007/s00382-016-3250-0](https://doi.org/10.1007/s00382-016-3250-0).
- 37 D'Arrigo, R. and C.C. Ummenhofer, 2015: The climate of Myanmar: evidence for effects of the Pacific Decadal  
38 Oscillation. *International Journal of Climatology*, **35**(4), 634–640, doi:[10.1002/joc.3995](https://doi.org/10.1002/joc.3995).
- 39 Da, J., Y.G. Zhang, G. Li, X. Meng, and J. Ji, 2019: Low CO<sub>2</sub> levels of the entire Pleistocene epoch. *Nature  
40 Communications*, **10**(1), 4342, doi:[10.1038/s41467-019-12357-5](https://doi.org/10.1038/s41467-019-12357-5).
- 41 Dahutia, P., B. Pathak, and P.K. Bhuyan, 2018: Aerosols characteristics, trends and their climatic implications over  
42 Northeast India and adjoining South Asia. *International Journal of Climatology*, **38**(3), 1234–1256,  
43 doi:[10.1002/joc.5240](https://doi.org/10.1002/joc.5240).
- 44 Dai, A., 2016: Historical and Future Changes in Streamflow and Continental Runoff: A Review. *Terrestrial Water  
45 Cycle and Climate Change: Natural and Human-Induced Impacts*, 17–37, doi:[10.1002/9781118971772.ch2](https://doi.org/10.1002/9781118971772.ch2).
- 46 Dai, A. and T. Zhao, 2017: Uncertainties in historical changes and future projections of drought . Part I : estimates of  
47 historical drought changes. *Climatic Change*, **144**, 519–533, doi:[10.1007/s10584-016-1705-2](https://doi.org/10.1007/s10584-016-1705-2).
- 48 Dai, A., T. Qian, K.E. Trenberth, and J.D. Milliman, 2009: Changes in continental freshwater discharge from 1948 to  
49 2004. *Journal of Climate*, **22**(10), 2773–2792, doi:[10.1175/2008jcli2592.1](https://doi.org/10.1175/2008jcli2592.1).
- 50 Daly, C., M.P. Widrlechner, M.D. Halbleib, J.I. Smith, and W.P. Gibson, 2012: Development of a new USDA plant  
51 hardiness zone map for the United States. *Journal of Applied Meteorology and Climatology*, **51**(2), 242–264,  
52 doi:[10.1175/2010jamc2536.1](https://doi.org/10.1175/2010jamc2536.1).
- 53 Dang, H. et al., 2020: Pacific warm pool subsurface heat sequestration modulated Walker circulation and ENSO activity  
54 during the Holocene. *Science Advances*, **6**(42), eabc0402, doi:[10.1126/sciadv.abc0402](https://doi.org/10.1126/sciadv.abc0402).
- 55 Dangendorf, S. et al., 2019: Persistent acceleration in global sea-level rise since the 1960s. *Nature Climate Change*,  
56 **9**(9), 705–710, doi:[10.1038/s41558-019-0531-8](https://doi.org/10.1038/s41558-019-0531-8).
- 57 Danzer, J., M. Schwaerz, G. Kirchengast, and S.B. Healy, 2020: Sensitivity Analysis and Impact of the Kappa-  
58 Correction of Residual Ionospheric Biases on Radio Occultation Climatologies. *Earth and Space Science*, **7**(7),  
59 e2019EA000942, doi:[10.1029/2019ea000942](https://doi.org/10.1029/2019ea000942).
- 60 Darby, D.A., J.D. Ortiz, C.E. Grosch, and S.P. Lund, 2012: 1,500-year cycle in the Arctic Oscillation identified in  
61 Holocene Arctic sea-ice drift. *Nature Geoscience*, **5**(12), 897–900, doi:[10.1038/ngeo1629](https://doi.org/10.1038/ngeo1629).

- 1 Dätwyler, C., N.J. Abram, M. Grosjean, E.R. Wahl, and R. Neukom, 2019: El Niño-Southern Oscillation variability,  
2 teleconnection changes and responses to large volcanic eruptions since AD 1000. *International Journal of  
3 Climatology*, **39(5)**, 2711–2724, doi:[10.1002/joc.5983](https://doi.org/10.1002/joc.5983).
- 4 Dätwyler, C. et al., 2018: Teleconnection stationarity, variability and trends of the Southern Annular Mode (SAM)  
5 during the last millennium. *Climate Dynamics*, **51(5–6)**, 2321–2339, doi:[10.1007/s00382-017-4015-0](https://doi.org/10.1007/s00382-017-4015-0).
- 6 Davini, P., C. Cagnazzo, S. Gualdi, and A. Navarra, 2012: Bidimensional diagnostics, variability, and trends of  
7 Northern Hemisphere blocking. *Journal of Climate*, **25(19)**, 6496–6509, doi:[10.1175/jcli-d-12-00032.1](https://doi.org/10.1175/jcli-d-12-00032.1).
- 8 Davis, L.L.B., D.W.J. Thompson, J.J. Kennedy, and E.C. Kent, 2019: The Importance of Unresolved Biases in  
9 Twentieth-Century Sea Surface Temperature Observations. *Bulletin of the American Meteorological Society*,  
10 **100(4)**, 621–629, doi:[10.1175/bams-d-18-0104.1](https://doi.org/10.1175/bams-d-18-0104.1).
- 11 Davis, N. and T. Birner, 2017: On the Discrepancies in Tropical Belt Expansion between Reanalyses and Climate  
12 Models and among Tropical Belt Width Metrics. *Journal of Climate*, **30**, 1211–1231, doi:[10.1175/jcli-d-16-0371.1](https://doi.org/10.1175/jcli-d-16-0371.1).
- 14 Davis, N.A. and T. Birner, 2013: Seasonal to multi-decadal variability of the width of the tropical belt. *Journal of  
15 Geophysical Research*, **118(14)**, 7773–7787, doi:[10.1002/jgrd.50610](https://doi.org/10.1002/jgrd.50610).
- 16 Davis, S.M. and K.H. Rosenlof, 2012: A multi-diagnostic intercomparison of tropical width time series using reanalyses  
17 and satellite observations. *Journal of Climate*, **25(4)**, 1061–1078, doi:[10.1175/jcli-d-11-00127.1](https://doi.org/10.1175/jcli-d-11-00127.1).
- 18 Davis, S.M., K.H. Rosenlof, D.F. Hurst, H.B. Selkirk, and H. Vömel, 2017: Global Climate: Atmospheric Composition]  
19 Stratospheric Water Vapor. *State of the Climate in 2016. Bulletin of the American Meteorological Society*, **98**,  
20 **S51–S5**, doi:[10.1175/2017bamsstateoftheclimate.1](https://doi.org/10.1175/2017bamsstateoftheclimate.1).
- 21 Davis, S.M. et al., 2016: The Stratospheric Water and Ozone Satellite Homogenized (SWOOSH) database: a long-term  
22 database for climate studies. *Earth System Science Data*, **8(2)**, 461–490, doi:[10.5194/essd-8-461-2016](https://doi.org/10.5194/essd-8-461-2016).
- 23 de Boer, B. et al., 2015: Simulating the Antarctic ice sheet in the late-Pliocene warm period: PLISMIP-ANT, an ice-  
24 sheet model intercomparison project. *The Cryosphere*, **9(3)**, 881–903, doi:[10.5194/tc-9-881-2015](https://doi.org/10.5194/tc-9-881-2015).
- 25 de Jong, M.F. and L. de Steur, 2016: Strong winter cooling over the Irminger Sea in winter 2014–2015, exceptional  
26 deep convection, and the emergence of anomalously low SST. *Geophysical Research Letters*, **43(13)**, 7106–  
27 7113, doi:[10.1002/2016gl069596](https://doi.org/10.1002/2016gl069596).
- 28 de Jong, M.F., M. Oltmanns, J. Karstensen, and L. de Steur, 2018: Deep convection in the Irminger Sea observed with a  
29 dense mooring array. *Oceanography*, **31(1)**, 50–59, doi:[10.5670/oceanog.2018.109](https://doi.org/10.5670/oceanog.2018.109).
- 30 de Jong, R., J. Verbesselt, M.E. Schaepman, and S. de Bruin, 2012: Trend changes in global greening and browning:  
31 Contribution of short-term trends to longer-term change. *Global Change Biology*, **18(2)**, 642–655,  
32 doi:[10.1111/j.1365-2486.2011.02578.x](https://doi.org/10.1111/j.1365-2486.2011.02578.x).
- 33 De La Mare, W.K., 1997: Abrupt mid-twentieth-century decline in Antarctic sea-ice extent from whaling records.  
34 *Nature*, **389**, 57–60, doi:[10.1038/37956](https://doi.org/10.1038/37956).
- 35 De La Mare, W.K., 2009: Changes in Antarctic sea-ice extent from direct historical observations and whaling records.  
36 *Climatic Change*, **92**, 461–493, doi:[10.1007/s10584-008-9473-2](https://doi.org/10.1007/s10584-008-9473-2).
- 37 de la Vega, E., T.B. Chalk, P.A. Wilson, R.P. Bysani, and G.L. Foster, 2020: Atmospheric CO<sub>2</sub> during the Mid-  
38 Piacenzian Warm Period and the M2 glaciation. *Scientific Reports*, **10(1)**, 11002, doi:[10.1038/s41598-020-67154-8](https://doi.org/10.1038/s41598-020-67154-8).
- 40 De Schepper, S., P.L. Gibbard, U. Salzmann, and J. Ehlers, 2014: A global synthesis of the marine and terrestrial  
41 evidence for glaciation during the Pliocene Epoch. *Earth-Science Reviews*, **135**,  
42 doi:[10.1016/j.earscirev.2014.04.003](https://doi.org/10.1016/j.earscirev.2014.04.003).
- 43 De Vernal, A. et al., 2013: Dinocyst-based reconstructions of sea ice cover concentration during the Holocene in the  
44 Arctic Ocean, the northern North Atlantic Ocean and its adjacent seas. *Quaternary Science Reviews*, **79**, 111–  
45 121, doi:[10.1016/j.quascirev.2013.07.006](https://doi.org/10.1016/j.quascirev.2013.07.006).
- 46 DeConto, R.M. and D. Pollard, 2016: Contribution of Antarctica to past and future sea-level rise. *Nature*, **531(7596)**,  
47 591–597, doi:[10.1038/nature17145](https://doi.org/10.1038/nature17145).
- 48 Dee, D.P. and S. Uppala, 2009: Variational bias correction of satellite radiance data in the ERA-Interim reanalysis.  
49 *Quarterly Journal of the Royal Meteorological Society*, **135(644)**, 1830–1841, doi:[10.1002/qj.493](https://doi.org/10.1002/qj.493).
- 50 Dee, D.P. et al., 2011: The ERA-Interim reanalysis: configuration and performance of the data assimilation system.  
51 *Quarterly Journal of the Royal Meteorological Society*, **137(656)**, 553–597, doi:[10.1002/qj.828](https://doi.org/10.1002/qj.828).
- 52 Delaygue, G., S. Brönnimann, P.D. Jones, J. Blanchet, and M. Schwander, 2019: Reconstruction of Lamb weather type  
53 series back to the eighteenth century. *Climate Dynamics*, **52**, 6131–6148, doi:[10.1007/s00382-018-4506-7](https://doi.org/10.1007/s00382-018-4506-7).
- 54 Dendy, S., J. Austermann, J.R. Creveling, and J.X. Mitrovica, 2017: Sensitivity of Last Interglacial sea-level high  
55 stands to ice sheet configuration during Marine Isotope Stage 6. *Quaternary Science Reviews*, **171**, 234–244,  
56 doi:[10.1016/j.quascirev.2017.06.013](https://doi.org/10.1016/j.quascirev.2017.06.013).
- 57 Deng, K., S. Yang, M. Ting, Y. Tan, and S. He, 2018: Global Monsoon Precipitation: Trends, Leading Modes, and  
58 Associated Drought and Heat Wave in the Northern Hemisphere. *Journal of Climate*, **31(17)**, 6947–6966,  
59 doi:[10.1175/jcli-d-17-0569.1](https://doi.org/10.1175/jcli-d-17-0569.1).
- 60 Deng, W. et al., 2013: Variations in the Pacific Decadal Oscillation since 1853 in a coral record from the northern South  
61 China Sea. *Journal of Geophysical Research: Oceans*, **118(5)**, 2358–2366, doi:[10.1002/jgrc.20180](https://doi.org/10.1002/jgrc.20180).

- 1 Deng, W. et al., 2017: A comparison of the climates of the Medieval Climate Anomaly, Little Ice Age, and Current  
2 Warm Period reconstructed using coral records from the northern South China Sea. *Journal of Geophysical*  
3 *Research: Oceans*, **122**(1), 264–275, doi:[10.1002/2016jc012458](https://doi.org/10.1002/2016jc012458).
- 4 Dennison, F.W., A.J. McDonald, and O. Morgenstern, 2016: The Influence of Ozone Forcing on Blocking in the  
5 Southern Hemisphere. *Journal of Geophysical Research: Atmospheres*, **121**(24), 14358–14371,  
6 doi:[10.1002/2016jd025033](https://doi.org/10.1002/2016jd025033).
- 7 Denniston, R.F. et al., 2016: Expansion and contraction of the indo-pacific tropical rain belt over the last three  
8 millennia. *Scientific Reports*, **6**, 1–9, doi:[10.1038/srep34485](https://doi.org/10.1038/srep34485).
- 9 Deplazes, G. et al., 2013: Links between tropical rainfall and North Atlantic climate during the last glacial period.  
10 *Nature Geoscience*, **6**(3), 213–217, doi:[10.1038/ngeo1712](https://doi.org/10.1038/ngeo1712).
- 11 Derksen, C. et al., 2019: Changes in Snow, Ice and Permafrost Across Canada. In: *Canada's Changing Climate Report*  
12 [Bush, E. and D.S. Lemmen (eds.)]. Government of Canada, Ottawa, ON, Canada, pp. 194–260.
- 13 Derksen, C., Brown, R., Mudryk, L., Luoju, K., Helfrich, S., 2018: Terrestrial snow cover in the Arctic [in “State of  
14 the Climate in 2017”]. *Bulletin of the American Meteorological Society*, **99**, S169–S171, doi:[10.1175/2018bamsstateoftheclimate.1](https://doi.org/10.1175/2018bamsstateoftheclimate.1).
- 15 Derksen, C., R. Brown, L. Mudryk, K.L., 2015: Snow. In: *Arctic Report Card 2015*.
- 16 Desbruyères, D.G., H. Mercier, G. Maze, and N. Daniault, 2019: Surface predictor of overturning circulation and heat  
17 content change in the subpolar North Atlantic. *Ocean Sci.*, **15**(3), 809–817, doi:[10.5194/os-15-809-2019](https://doi.org/10.5194/os-15-809-2019).
- 18 Deschamps, P. et al., 2012: Ice-sheet collapse and sea-level rise at the Bølling warming 14,600 years ago. *Nature*,  
19 **483**(7391), 559–564, doi:[10.1038/nature10902](https://doi.org/10.1038/nature10902).
- 20 Dessler, A.E. et al., 2016: Transport of ice into the stratosphere and the humidification of the stratosphere over the 21st  
21 century. *Geophysical research letters*, **43**(5), 2323–2329, doi:[10.1002/2016gl067991](https://doi.org/10.1002/2016gl067991).
- 22 Di Capua, G. and D. Coumou, 2016: Changes in meandering of the Northern Hemisphere circulation. *Environmental  
23 Research Letters*, **11**, 094028, doi:[10.1088/1748-9326/11/9/094028](https://doi.org/10.1088/1748-9326/11/9/094028).
- 24 Diallo, M. et al., 2018: Response of stratospheric water vapor and ozone to the unusual timing of El Niño and the QBO  
25 disruption in 2015–2016. *Atmospheric Chemistry and Physics*, **18**(17), 13055–13073, doi:[10.5194/acp-18-13055-2018](https://doi.org/10.5194/acp-18-13055-2018).
- 26 Dickson, A.J., A.S. Cohen, and A.L. Coe, 2012: Seawater oxygenation during the Paleocene-Eocene Thermal  
27 Maximum. *Geology*, **40**(7), 639–642, doi:[10.1130/g32977.1](https://doi.org/10.1130/g32977.1).
- 28 Dieng, H.B., A. Cazenave, B. Meyssignac, and M. Ablain, 2017: New estimate of the current rate of sea level rise from  
29 a sea level budget approach. *Geophysical Research Letters*, **44**(8), 3744–3751, doi:[10.1002/2017gl073308](https://doi.org/10.1002/2017gl073308).
- 30 DiNezio, P.N. and J.E. Tierney, 2013: The effect of sea level on glacial Indo-Pacific climate. *Nature Geoscience*, **6**(6),  
31 485–491, doi:[10.1038/ngeo1823](https://doi.org/10.1038/ngeo1823).
- 32 DiNezio, P.N. et al., 2018: Glacial changes in tropical climate amplified by the Indian Ocean. *Science Advances*, **4**(12),  
33 1–12, doi:[10.1126/sciadv.aat9658](https://doi.org/10.1126/sciadv.aat9658).
- 34 Dirksen, R.J. et al., 2014: Reference quality upper-air measurements: GRUAN data processing for the Vaisala RS92  
35 radiosonde. *Atmospheric Measurement Techniques*, **7**(12), 4463–4490, doi:[10.5194/amt-7-4463-2014](https://doi.org/10.5194/amt-7-4463-2014).
- 36 Do, H.X., S. Westra, and M. Leonard, 2017: A global-scale investigation of trends in annual maximum streamflow.  
37 *Journal of Hydrology*, **552**, 28–43, doi:[10.1016/j.jhydrol.2017.06.015](https://doi.org/10.1016/j.jhydrol.2017.06.015).
- 38 Do, H.X., L. Gudmundsson, M. Leonard, and S. Westra, 2018: The Global Streamflow Indices and Metadata Archive  
39 (GSIM)-Part 1: The production of a daily streamflow archive and metadata. *Earth System Science Data*, **10**(2),  
40 765–785, doi:[10.5194/essd-10-765-2018](https://doi.org/10.5194/essd-10-765-2018).
- 41 Dolman, A.M. and T. Laepple, 2018: Sedproxy: a forward model for sediment-archived climate proxies. *Climate of the  
42 Past*, **14**(12), 1851–1868, doi:[10.5194/cp-14-1851-2018](https://doi.org/10.5194/cp-14-1851-2018).
- 43 Domingues, C.M. et al., 2008: Improved estimates of upper-ocean warming and multi-decadal sea-level rise. *Nature*,  
44 **453**(7198), 1090–1093, doi:[10.1038/nature07080](https://doi.org/10.1038/nature07080).
- 45 Donat, M.G. et al., 2013a: Global land-based datasets for monitoring climatic extremes. *Bulletin of the American  
46 Meteorological Society*, **94**(7), 997–1006, doi:[10.1175/bams-d-12-00109.1](https://doi.org/10.1175/bams-d-12-00109.1).
- 47 Donat, M.G. et al., 2013b: Updated analyses of temperature and precipitation extreme indices since the beginning of the  
48 twentieth century: The HadEX2 dataset. *Journal of Geophysical Research Atmospheres*, **118**(5), 2098–2118,  
49 doi:[10.1002/2012jd018150](https://doi.org/10.1002/2012jd018150).
- 50 Dong, B. and R. Lu, 2013: Interdecadal enhancement of the walker circulation over the Tropical Pacific in the late  
51 1990s. *Advances in Atmospheric Sciences*, **30**(2), 247–262, doi:[10.1007/s00376-012-2069-9](https://doi.org/10.1007/s00376-012-2069-9).
- 52 Dong, B., A. Dai, M. Vuille, and O.E. Timm, 2018: Asymmetric Modulation of ENSO Teleconnections by the  
53 Interdecadal Pacific Oscillation. *Journal of Climate*, **31**(18), 7337–7361, doi:[10.1175/jcli-d-17-0663.1](https://doi.org/10.1175/jcli-d-17-0663.1).
- 54 Dong, L. et al., 2016: The Footprint of the Inter-decadal Pacific Oscillation in Indian Ocean Sea Surface Temperatures.  
55 *Scientific Reports*, **6**, 21251, doi:[10.1038/srep21251](https://doi.org/10.1038/srep21251).
- 56 Dong, S., M.O. Baringer, and G.J. Goni, 2019: Slow Down of the Gulf Stream during 1993–2016. *Scientific Reports*,  
57 **9**(1), 6672, doi:[10.1038/s41598-019-42820-8](https://doi.org/10.1038/s41598-019-42820-8).
- 58 Dornelas, M. et al., 2014: Assemblage Time Series Reveal Biodiversity Change but Not Systematic Loss. *Science*,  
59 **344**(6181), 296–299, doi:[10.1126/science.1248484](https://doi.org/10.1126/science.1248484).

- 1 Dornelas, M. et al., 2018: BioTIME: A database of biodiversity time series for the Anthropocene. *Global Ecology and*  
2 *Biogeography*, **27**(7), 760–786, doi:[10.1111/geb.12729](https://doi.org/10.1111/geb.12729).
- 3 Dowdeswell, J.A. et al., 2020: Delicate seafloor landforms reveal past Antarctic grounding-line retreat of kilometers per  
4 year. *Science*, **368**(6494), 1020–1024, doi:[10.1126/science.aaz3059](https://doi.org/10.1126/science.aaz3059).
- 5 Dowsett, H.J. et al., 2019: The mid-Piacenzian of the North Atlantic Ocean. *Stratigraphy*, **16**(3), 119–144,  
6 doi:[10.29041/strat.16.3.119-144](https://doi.org/10.29041/strat.16.3.119-144).
- 7 Droste, E.S. et al., 2020: Trends and emissions of six perfluorocarbons in the Northern Hemisphere and Southern  
8 Hemisphere. *Atmospheric Chemistry and Physics*, **20**(8), 4787–4807, doi:[10.5194/acp-20-4787-2020](https://doi.org/10.5194/acp-20-4787-2020).
- 9 Druzhinin, O., Y. Troitskaya, and S. Zilitinkevich, 2019: The study of the unstably-stratified marine atmospheric  
10 boundary layer by direct numerical simulation. *Journal of Physics: Conference Series*, **1163**, 12018,  
11 doi:[10.1088/1742-6596/1163/1/012018](https://doi.org/10.1088/1742-6596/1163/1/012018).
- 12 Du, X. et al., 2021: High-resolution interannual precipitation reconstruction of Southern California: Implications for  
13 Holocene ENSO evolution. *Earth and Planetary Science Letters*, **554**, 116670,  
14 doi:[10.1016/j.epsl.2020.116670](https://doi.org/10.1016/j.epsl.2020.116670).
- 15 Du, Y., J.J. Xiao, and K.F. Yu, 2014: Tropical Indian Ocean Basin Mode recorded in coral oxygen isotope data from  
16 the Seychelles over the past 148 years. *Science China Earth Sciences*, **57**(11), 2597–2605,  
17 doi:[10.1007/s11430-014-4956-7](https://doi.org/10.1007/s11430-014-4956-7).
- 18 Duchesne, C., Smith, S. L., Ednie, M., Bonnaveire, P.P., 2015: Active layer variability and Change in the Mackenzie  
19 Valley, Northwest Territories. In: *68th Canadian Geotechnical Conference and 7th Canadian Permafrost  
20 Conference*.
- 21 Dumitru, O.A. et al., 2019: Constraints on global mean sea level during Pliocene warmth. *Nature*, **574**(7777), 233–236,  
22 doi:[10.1038/s41586-019-1543-2](https://doi.org/10.1038/s41586-019-1543-2).
- 23 Dunn, R.J.H., K.M. Willett, C.P. Morice, and D.E. Parker, 2014: Pairwise homogeneity assessment of HadISD. *Climate  
24 of the Past*, **10**(4), 1501–1522, doi:[10.5194/cp-10-1501-2014](https://doi.org/10.5194/cp-10-1501-2014).
- 25 Dunn, R.J.H., K.M. Willett, D.E. Parker, and L. Mitchell, 2016: Expanding HadISD: quality-controlled, sub-daily  
26 station data from 1931. *Geoscientific Instrumentation, Methods and Data Systems*, **5**(2), 473–491,  
27 doi:[10.5194/gim-5-473-2016](https://doi.org/10.5194/gim-5-473-2016).
- 28 Dunn, R.J.H., K.M. Willett, A. Ciavarella, and P.A. Stott, 2017: Comparison of land surface humidity between  
29 observations and CMIP5 models. *Earth System Dynamics*, **8**(3), 719–747, doi:[10.5194/esd-8-719-2017](https://doi.org/10.5194/esd-8-719-2017).
- 30 Dunn, R.J.H. et al., 2012: HadISD: A Quality Controlled global synoptic report database for selected variables at long-  
31 term stations from 1973–2011. *Climate of the Past*, **8**(5), 1649–1679, doi:[10.5194/cp-8-1649-2012](https://doi.org/10.5194/cp-8-1649-2012).
- 32 Dunn, R., 2020: Development of an updated global in situ-based dataset of temperature and precipitation extremes:  
33 HadEX3. *Journal of Geophysical Research - Atmospheres*, **125**(16), doi:[10.1029/2019jd032263](https://doi.org/10.1029/2019jd032263).
- 34 Durack, P.J., 2015: Ocean salinity and the global water cycle. *Oceanography*, **28**, 20–31, doi:[10.5670/oceanog\\_2015.03](https://doi.org/10.5670/oceanog_2015.03).
- 35 Durack, P.J. and S.E. Wijffels, 2010: Fifty-Year Trends in Global Ocean Salinities and Their Relationship to Broad-  
36 Scale Warming. *Journal of Climate*, **23**(16), 4342–4362, doi:[10.1175/2010jcli3377.1](https://doi.org/10.1175/2010jcli3377.1).
- 37 Durack, P.J., S.E. Wijffels, and R.J. Matear, 2012: Ocean salinities reveal strong global water cycle intensification  
38 during 1950 to 2000. *Science*, **336**(6080), 455–458, doi:[10.1126/science.1212222](https://doi.org/10.1126/science.1212222).
- 39 Duruisseau, F., N. Huret, A. Andral, and C. Camy-Peyret, 2017: Assessment of the ERA-Interim Winds Using High-  
40 Altitude Stratospheric Balloons. *Journal of the Atmospheric Sciences*, **74**(6), 2065–2080, doi:[10.1175/jas-d-16-0137.1](https://doi.org/10.1175/jas-d-<br/>41 16-0137.1).
- 42 Dutton, A. et al., 2015: Sea-level rise due to polar ice-sheet mass loss during past warm periods. *Science*, **349**(6244),  
43 doi:[10.1126/science.aaa4019](https://doi.org/10.1126/science.aaa4019).
- 44 Dyez, K.A., B. Hönsch, and G.A. Schmidt, 2018: Early Pleistocene Obliquity-Scale pCO<sub>2</sub> Variability at ~1.5 Million  
45 Years Ago. *Paleoceanography and Paleoclimatology*, **33**(11), 1270–1291, doi:[10.1029/2018pa003349](https://doi.org/10.1029/2018pa003349).
- 46 Ebita, A. et al., 2011: The Japanese 55-year Reanalysis "JRA-55": An Interim Report. *SOLA*, **7**, 149–152,  
47 doi:[10.2151/sola.2011-038](https://doi.org/10.2151/sola.2011-038).
- 48 Edinburgh, T. and J.J. Day, 2016: Estimating the extent of Antarctic summer sea ice during the Heroic Age of Antarctic  
49 exploration. *Cryosphere*, **10**(6), 2721–2730, doi:[10.5194/tc-10-2721-2016](https://doi.org/10.5194/tc-10-2721-2016).
- 50 Edwards, J.M., A.C.M. Beljaars, A.A.M. Holtslag, and A.P. Lock, 2020: Representation of Boundary-Layer Processes  
51 in Numerical Weather Prediction and Climate Models. *Boundary-Layer Meteorology*, **177**, 511–539,  
52 doi:[10.1007/s10546-020-00530-z](https://doi.org/10.1007/s10546-020-00530-z).
- 53 Edwards, M. and A.J. Richardson, 2004: Impact of climate change on marine pelagic phenology and trophic mismatch.  
54 *Nature*, **430**(7002), 881–884, doi:[10.1038/nature02808](https://doi.org/10.1038/nature02808).
- 55 Edwards, M., Helouet P., Alhaija, R.A., Batten S., Beaugrand G., C.S., 2016: *Global Marine Ecological Status  
56 Report: results from the global CPR survey 2014/2015*. Global Marine Ecological Status Report No. 11. Sir  
57 Alister Hardy Foundation for Continuous Plankton Recorder Survey, Plymouth, UK, 32 pp.
- 58 Egorova, T. et al., 2018: Revised historical solar irradiance forcing. *A&A*, **615**, A85, doi:[10.1051/0004-6361/201731199](https://doi.org/10.1051/0004-<br/>59 6361/201731199).
- 60 Eguchi, N., K. Kodera, and T. Nasuno, 2015: A global non-hydrostatic model study of a downward coupling through  
61 the tropical tropopause layer during a stratospheric sudden warming. *Atmospheric Chemistry and Physics*,

- 1                   **15(1)**, 297–304, doi:[10.5194/acp-15-297-2015](https://doi.org/10.5194/acp-15-297-2015).
- 2       Eliot, S. and L.M. Beal, 2018: Observed Agulhas Current sensitivity to interannual and long-term trend atmospheric  
3       forcings. *Journal of Climate*, **31(8)**, 3077–3098, doi:[10.1175/jcli-d-17-0597.1](https://doi.org/10.1175/jcli-d-17-0597.1).
- 4       Elmendorf, S.C. et al., 2015: Experiment, monitoring, and gradient methods used to infer climate change effects on  
5       plant communities yield consistent patterns. *Proceedings of the National Academy of Sciences*, **112(2)**, 448–  
6       452, doi:[10.1073/pnas.1410088112](https://doi.org/10.1073/pnas.1410088112).
- 7       Emile-Geay, J. et al., 2016: Links between tropical Pacific seasonal, interannual and orbital variability during the  
8       Holocene. *Nature Geoscience*, **9**, 168, doi:[10.1038/ngeo2608](https://doi.org/10.1038/ngeo2608).
- 9       Engel, A. et al., 2018: Update on Ozone-Depleting Substances (ODSs) and Other Gases of Interest to the Montreal  
10      Protocol. In: *Scientific Assessment of Ozone Depletion: 2018*. Global Ozone Research and Monitoring Project  
11      – Report No. 58, World Meteorological Organization (WMO), Geneva, Switzerland, pp. 1.1–1.87.
- 12       England, M.H. et al., 2014: Recent intensification of wind-driven circulation in the Pacific and the ongoing warming  
13       hiatus. *Nature Climate Change*, **4(3)**, 222–227, doi:[10.1038/nclimate2106](https://doi.org/10.1038/nclimate2106).
- 14       Erb, K.H. et al., 2017: Land management: data availability and process understanding for global change studies. *Global  
15      Change Biology*, **23(2)**, doi:[10.1111/gcb.13443](https://doi.org/10.1111/gcb.13443).
- 16       Eriksen, H. et al., 2018: Recent Acceleration of a Rock Glacier Complex, Ádjet, Norway, Documented by 62 Years of  
17       Remote Sensing Observations. *Geophysical Research Letters*, **45(16)**, 8314–8323, doi:[10.1029/2018gl077605](https://doi.org/10.1029/2018gl077605).
- 18       Estilow, T.W., A.H. Young, and D.A. Robinson, 2015: A long-term Northern Hemisphere snow cover extent data  
19       record for climate studies and monitoring. *Earth System Science Data*, **7(1)**, 137–142, doi:[10.5194/essd-7-137-2015](https://doi.org/10.5194/essd-7-137-2015).
- 20       Evan, S., K.H. Rosenlof, T. Thornberry, A. Rollins, and S. Khaykin, 2015: TTL cooling and drying during the January  
21       2013 stratospheric sudden warming. *Quarterly Journal of the Royal Meteorological Society*, **141(693)**, 3030–  
22       3039, doi:[10.1002/qj.2587](https://doi.org/10.1002/qj.2587).
- 23       Evans, G., P. Augustinus, P. Gadd, A. Zawadzki, and A. Ditchfield, 2019: A multi-proxy  $\mu$ -XRF inferred lake sediment  
24       record of environmental change spanning the last ca. 2230 years from Lake Kanono, Northland, New Zealand.  
25       *Quaternary Science Reviews*, **225**, doi:[10.1016/j.quascirev.2019.106000](https://doi.org/10.1016/j.quascirev.2019.106000).
- 26       Evans, P. and C.D. Brown, 2017: The boreal–temperate forest ecotone response to climate change. *Environmental  
27      Reviews*, **25(4)**, doi:[10.1139\(er-2017-0009](https://doi.org/10.1139(er-2017-0009)
- 28       Evtushevsky, O.M., A. Grytsai, and G.P. Milneovsky, 2018: Decadal changes in the central tropical Pacific  
29       teleconnection to the Southern Hemisphere extratropics. *Climate Dynamics*, **52**, 4027–4055,  
30       doi:[10.1007/s00382-018-4354-5](https://doi.org/10.1007/s00382-018-4354-5).
- 31       Ezat, M.M., T.L. Rasmussen, B. Hönnisch, J. Groeneveld, and P. deMenocal, 2017: Episodic release of CO<sub>2</sub> from the  
32       high-latitude North Atlantic Ocean during the last 135 kyr. *Nature Communications*, **8(1)**, 14498,  
33       doi:[10.1038/ncomms14498](https://doi.org/10.1038/ncomms14498).
- 34       Ezer, T., 2013: Sea level rise, spatially uneven and temporally unsteady: why the US east coast, the global tide gauge  
35       record and the global altimeter data show different trends. *Geophysical Research Letters*, **40(20)**, 5439–5444,  
36       doi:[10.1002/2013gl057952](https://doi.org/10.1002/2013gl057952).
- 37       Famiglietti, C.A., J.B. Fisher, G. Halverson, and E.E. Borbas, 2018: Global Validation of MODIS Near-Surface Air and  
38       Dew Point Temperatures. *Geophysical Research Letters*, **45(15)**, 7772–7780, doi:[10.1029/2018gl077813](https://doi.org/10.1029/2018gl077813).
- 39       Fan, L., Q. Liu, C. Wang, and F. Guo, 2016: Indian Ocean Dipole Modes Associated with Different Types of ENSO  
40       Development. *Journal of Climate*, **30(6)**, 2233–2249, doi:[10.1175/jcli-d-16-0426.1](https://doi.org/10.1175/jcli-d-16-0426.1).
- 41       Farinotti, D. et al., 2019: A consensus estimate for the ice thickness distribution of all glaciers on Earth. *Nature  
42      Geoscience*, **12**, 168–173, doi:[10.1038/s41561-019-0300-3](https://doi.org/10.1038/s41561-019-0300-3).
- 43       Farquharson, L.M. et al., 2019: Climate Change Drives Widespread and Rapid Thermokarst Development in Very Cold  
44       Permafrost in the Canadian High Arctic. *Geophysical Research Letters*, **46(12)**, 6681–6689,  
45       doi:[10.1029/2019gl082187](https://doi.org/10.1029/2019gl082187).
- 46       Faust, J.C., K. Fabian, G. Milzer, J. Giraudeau, and J. Knies, 2016: Norwegian fjord sediments reveal NAO related  
47       winter temperature and precipitation changes of the past 2800 years. *Earth and Planetary Science Letters*, **435**,  
48       84–93, doi:[10.1016/j.epsl.2015.12.003](https://doi.org/10.1016/j.epsl.2015.12.003).
- 49       Fedorov, A., 2006: The Pliocene Paradox (Mechanisms for a Permanent El Niño). *Science*, **312(5779)**, 1485–1489,  
50       doi:[10.1126/science.1122666](https://doi.org/10.1126/science.1122666).
- 51       Felis, T., A. Suzuki, H. Kuhnert, N. Rimbu, and H. Kawahata, 2010: Pacific Decadal Oscillation documented in a coral  
52       record of North Pacific winter temperature since 1873. *Geophysical Research Letters*, **37(14)**,  
53       doi:[10.1029/2010gl043572](https://doi.org/10.1029/2010gl043572).
- 54       Feng, M., X. Zhang, B. Sloyan, and M. Chamberlain, 2017: Contribution of the deep ocean to the centennial changes of  
55       the Indonesian Throughflow. *Geophysical Research Letters*, **44(6)**, 2859–2867, doi:[10.1002/2017gl072577](https://doi.org/10.1002/2017gl072577).
- 56       Feng, M., N. Zhang, Q. Liu, and S. Wijffels, 2018: The Indonesian throughflow, its variability and centennial change.  
57       *Geoscience Letters*, **5(1)**, 3, doi:[10.1186/s40562-018-0102-2](https://doi.org/10.1186/s40562-018-0102-2).
- 58       Feng, R., B.L. Otto-Bliesner, E.C. Brady, and N. Rosenbloom, 2020: Increased Climate Response and Earth System  
59       Sensitivity From CCSM4 to CESM2 in Mid-Pliocene Simulations. *Journal of Advances in Modeling Earth  
60      Systems*, **12(8)**, e2019MS002033, doi:[10.1029/2019ms002033](https://doi.org/10.1029/2019ms002033).
- 61

- 1 Feng, R. et al., 2019: Contributions of aerosol-cloud interactions to mid-Piacenzian seasonally sea ice-free Arctic  
2 Ocean. *Geophysical Research Letters*, **46(16)**, 9920–9929, doi:[10.1029/2019gl083960](https://doi.org/10.1029/2019gl083960).
- 3 Feng, X., A. Porporato, and I. Rodriguez-Iturbe, 2013: Changes in rainfall seasonality in the tropics. *Nature Climate  
4 Change*, **3(6)**, 1–5, doi:[10.1038/nclimate1907](https://doi.org/10.1038/nclimate1907).
- 5 Filonchyk, M. et al., 2019: Combined use of satellite and surface observations to study aerosol optical depth in different  
6 regions of China. *Scientific Reports*, **9(1)**, 6174, doi:[10.1038/s41598-019-42466-6](https://doi.org/10.1038/s41598-019-42466-6).
- 7 Finsinger, W., T. Giesecke, S. Brewer, and M. Leydet, 2017: Emergence patterns of novelty in European vegetation  
8 assemblages over the past 15 000 years. *Ecology Letters*, **20**, 336–346, doi:[10.1111/ele.12731](https://doi.org/10.1111/ele.12731).
- 9 Fischer, H. et al., 2018: Palaeoclimate constraints on the impact of 2°C anthropogenic warming and beyond. *Nature  
10 Geoscience*, **11(7)**, 474–485, doi:[10.1038/s41561-018-0146-0](https://doi.org/10.1038/s41561-018-0146-0).
- 11 Fitzsimmons, K.E., N. Stern, C. Murray-Wallace, W. Truscott, and C. Pop, 2015: The Mungo mega-lake event, semi-  
12 arid Australia: Non-linear descent into the last ice age, implications for human behaviour. *PLoS ONE*, **10(6)**,  
13 1–19, doi:[10.1371/journal.pone.0127008](https://doi.org/10.1371/journal.pone.0127008).
- 14 Fletcher, M.- et al., 2018: Centennial-scale trends in the Southern Annular Mode revealed by hemisphere-wide fire and  
15 hydroclimatic trends over the past 2400 years. *Geology*, **46(4)**, 363–366, doi:[10.1130/g39661.1](https://doi.org/10.1130/g39661.1).
- 16 Fletcher, M.S. and P.I. Moreno, 2012: Have the Southern Westerlies changed in a zonally symmetric manner over the  
17 last 14,000 years? A hemisphere-wide take on a controversial problem. *Quaternary International*, **253**, 32–46,  
18 doi:[10.1016/j.quaint.2011.04.042](https://doi.org/10.1016/j.quaint.2011.04.042).
- 19 Fletcher, T., R. Feng, A.M. Telka, J. Matthews, and A. Ballantyne, 2017: Floral Dissimilarity and the Influence of  
20 Climate in the Pliocene High Arctic: Biotic and Abiotic Influences on Five Sites on the Canadian Arctic  
21 Archipelago. *Frontiers in Ecology and Evolution*, **5**, 19, doi:[10.3389/fevo.2017.00019](https://doi.org/10.3389/fevo.2017.00019).
- 22 Flores-Aqueveque, V., M. Rojas, C. Aguirre, P.A. Arias, and C. González, 2020: South Pacific Subtropical High from  
23 the late Holocene to the end of the 21st century: insights from climate proxies and general circulation models.  
24 *Climate of the Past*, **16(1)**, 79–99, doi:[10.5194/cp-16-79-2020](https://doi.org/10.5194/cp-16-79-2020).
- 25 Flückiger, J. et al., 1999: Variations in atmospheric N2O concentration during abrupt climatic changes. *Science*,  
26 **285(5425)**, 227–230, doi:[10.1126/science.285.5425.227](https://doi.org/10.1126/science.285.5425.227).
- 27 Flückiger, J. et al., 2002: High-resolution Holocene N2O ice core record and its relationship with CH4 and CO2. *Global  
28 Biogeochemical Cycles*, **16(1)**, 10–18, doi:[10.1029/2001gb001417](https://doi.org/10.1029/2001gb001417).
- 29 Fogt, R.L. and G.J. Marshall, 2020: The Southern Annular Mode: Variability, trends, and climate impacts across the  
30 Southern Hemisphere. *Wiley Interdisciplinary Reviews: Climate Change*, **11(4)**, 1–24, doi:[10.1002/wcc.652](https://doi.org/10.1002/wcc.652).
- 31 Foley, K.M. and H.J. Dowsett, 2019: Community sourced mid-Piacenzian sea surface temperature (SST) data.,  
32 doi:[10.5066/p9yp3dty](https://doi.org/10.5066/p9yp3dty).
- 33 Foltz, G.R. and M.J. McPhaden, 2010: Abrupt equatorial wave-induced cooling of the Atlantic cold tongue in 2009.  
34 *Geophysical Research Letters*, **37(24)**, doi:[10.1029/2010gl045522](https://doi.org/10.1029/2010gl045522).
- 35 Foltz, G.R., M.J. McPhaden, and R. Lumpkin, 2012: A Strong Atlantic Meridional Mode Event in 2009: The Role of  
36 Mixed Layer Dynamics. *Journal of Climate*, **25(1)**, 363–380, doi:[10.1175/jcli-d-11-00150.1](https://doi.org/10.1175/jcli-d-11-00150.1).
- 37 Foltz, G.R. et al., 2019: The Tropical Atlantic Observing System. *Frontiers in Marine Science*, **6**, 206,  
38 doi:[10.3389/fmars.2019.00206](https://doi.org/10.3389/fmars.2019.00206).
- 39 Ford, H.L., A.C. Ravelo, and P.J. Polissar, 2015: Reduced El Niño-Southern Oscillation during the last glacial  
40 maximum. *Science*, **347(6219)**, 255–258, doi:[10.1126/science.1258437](https://doi.org/10.1126/science.1258437).
- 41 Ford, H.L., C.L. McChesney, J.E. Hertzberg, and J.F. McManus, 2018: A Deep Eastern Equatorial Pacific Thermocline  
42 During the Last Glacial Maximum. *Geophysical Research Letters*, **45(21)**, 11,806–811,816,  
43 doi:[10.1029/2018gl079710](https://doi.org/10.1029/2018gl079710).
- 44 Forkel, M. et al., 2014: Identifying environmental controls on vegetation greenness phenology through model-data  
45 integration. *Biogeosciences*, **11(23)**, 7025–7050, doi:[10.5194/bg-11-7025-2014](https://doi.org/10.5194/bg-11-7025-2014).
- 46 Forkel, M. et al., 2016: Enhanced seasonal CO2 exchange caused by amplified plant productivity in northern  
47 ecosystems. *Science*, **351(6274)**, doi:[10.1126/science.aac4971](https://doi.org/10.1126/science.aac4971).
- 48 Forzieri, G., R. Alkama, D.G. Miralles, and A. Cescatti, 2017: Satellites reveal contrasting responses of regional climate  
49 to the widespread greening of Earth. *Science*, **356(6343)**, 1180–1184, doi:[10.1126/science.aal1727](https://doi.org/10.1126/science.aal1727).
- 50 Foster, G.L., 2008: Seawater pH, pCO2 and [CO2-3] variations in the Caribbean Sea over the last 130 kyr: A boron  
51 isotope and B/Ca study of planktic foraminifera. *Earth and Planetary Science Letters*, **271(1)**, 254–266,  
52 doi:[10.1016/j.epsl.2008.04.015](https://doi.org/10.1016/j.epsl.2008.04.015).
- 53 Foster, G.L. and J.W.B. Rae, 2016: Reconstructing Ocean pH with Boron Isotopes in Foraminifera. *Annual Review of  
54 Earth and Planetary Sciences*, **44(1)**, 207–237, doi:[10.1146/annurev-earth-060115-012226](https://doi.org/10.1146/annurev-earth-060115-012226).
- 55 Foster, G.L., D.L. Royer, and D.J. Lunt, 2017: Future climate forcing potentially without precedent in the last 420  
56 million years. *Nature Communications*, **8(14845)**, doi:[10.1038/ncomms14845](https://doi.org/10.1038/ncomms14845).
- 57 Fourteau, K. et al., 2020: Estimation of gas record alteration in very low-accumulation ice cores. *Climate of the Past*,  
58 **16(2)**, 503–522, doi:[10.5194/cp-16-503-2020](https://doi.org/10.5194/cp-16-503-2020).
- 59 Frajka-Williams, E., 2015: Estimating the Atlantic overturning at 26°N using satellite altimetry and cable  
60 measurements. *Geophysical Research Letters*, **42(9)**, 3458–3464, doi:[10.1002/2015gl063220](https://doi.org/10.1002/2015gl063220).
- 61 Francis, J.A. and S.J. Vavrus, 2012: Evidence linking Arctic amplification to extreme weather in mid-latitudes.

- 1                    *Geophysical Research Letters*, **39(L06801)**, doi:10.1029/2012GL051000.
- 2 Francis, J.A. and S.J. Vavrus, 2015: Evidence for a wavier jet stream in response to rapid Arctic warming.  
3                    *Environmental Research Letters*, **10(1)**, doi:[10.1088/1748-9326/10/1/014005](https://doi.org/10.1088/1748-9326/10/1/014005).
- 4 Frank, N. et al., 2006: Open system U-series ages of corals from a subsiding reef in New Caledonia: Implications for  
5                    sea level changes, and subsidence rate. *Earth and Planetary Science Letters*, **249(3)**, 274–289,  
6                    doi:[10.1016/j.epsl.2006.07.029](https://doi.org/10.1016/j.epsl.2006.07.029).
- 7 Franklin, J., J.M. Serra-Diaz, A.D. Syphard, and H.M. Regan, 2016: Global change and terrestrial plant community  
8                    dynamics. *Proceedings of the National Academy of Sciences*, **113(14)**, 3725–3734,  
9                    doi:[10.1073/pnas.1519911113](https://doi.org/10.1073/pnas.1519911113).
- 10 Frederikse, T. et al., 2020: The causes of sea-level rise since 1900. *Nature*, **584(7821)**, 393–397, doi:[10.1038/s41586-020-2591-3](https://doi.org/10.1038/s41586-020-2591-3).
- 11 Freeman, E. et al., 2017: ICOADS Release 3.0: a major update to the historical marine climate record. *International  
12                    Journal of Climatology*, **37(5)**, 2211–2232, doi:[10.1002/joc.4775](https://doi.org/10.1002/joc.4775).
- 13 Freeman, E. et al., 2019: The International Comprehensive Ocean-Atmosphere Data Set – Meeting Users Needs and  
14                    Future Priorities. *Frontiers in Marine Science*, **6**, 435, doi:[10.3389/fmars.2019.00435](https://doi.org/10.3389/fmars.2019.00435).
- 15 French, H.M. and S.W.S. Millar, 2014: Permafrost at the time of the Last Glacial Maximum (LGM) in North America.  
16                    *Boreas*, **43(3)**, doi:[10.1111/bor.12036](https://doi.org/10.1111/bor.12036).
- 17 Freund, M.B. et al., 2019: Higher frequency of Central Pacific El Niño events in recent decades relative to past  
18                    centuries. *Nature Geoscience*, **12(6)**, 450–455, doi:[10.1038/s41561-019-0353-3](https://doi.org/10.1038/s41561-019-0353-3).
- 19 Frezzotti, M., C. Scarchilli, S. Becagli, M. Proposito, and S. Urbini, 2013: A synthesis of the Antarctic surface mass  
20                    balance during the last 800 yr. *Cryosphere*, **7(1)**, 303–319, doi:[10.5194/tc-7-303-2013](https://doi.org/10.5194/tc-7-303-2013).
- 21 Friedman, A.R., G. Reverdin, M. Khodri, and G. Gastineau, 2017: A new record of Atlantic sea surface salinity from  
22                    1896 to 2013 reveals the signatures of climate variability and long-term trends. *Geophysical Research Letters*,  
23                    **44(4)**, 1866–1876, doi:[10.1002/2017gl072582](https://doi.org/10.1002/2017gl072582).
- 24 Friedrich, T. and A. Timmermann, 2020: Using Late Pleistocene sea surface temperature reconstructions to constrain  
25                    future greenhouse warming. *Earth and Planetary Science Letters*, **530**, 115911, doi:[10.1016/j.epsl.2019.115911](https://doi.org/10.1016/j.epsl.2019.115911).
- 26 Friedrich, T., A. Timmermann, M. Tigchelaar, O. Elison Timm, and A. Ganopolski, 2016: Nonlinear climate sensitivity  
27                    and its implications for future greenhouse warming. *Science Advances*, **2(11)**, doi:[10.1126/sciadv.1501923](https://doi.org/10.1126/sciadv.1501923).
- 28 Frieling, J. et al., 2016: Thermogenic methane release as a cause for the long duration of the PETM. *Proceedings of the  
29                    National Academy of Sciences*, 201603348, doi:[10.1073/pnas.1603348113](https://doi.org/10.1073/pnas.1603348113).
- 30 Froidevaux, L. et al., 2015: Global OZone Chemistry And Related trace gas Data records for the Stratosphere  
31                    (GOZCARDS): methodology and sample results with a focus on HCl, H<sub>2</sub>O, and O<sub>3</sub>. *Atmospheric Chemistry  
32                    and Physics*, **15(18)**, 10471–10507, doi:[10.5194/acp-15-10471-2015](https://doi.org/10.5194/acp-15-10471-2015).
- 33 Fu, Q. and P. Lin, 2011: Poleward shift of subtropical jets inferred from satellite-observed lower-stratospheric  
34                    temperatures. *Journal of Climate*, **24(21)**, 5597–5603, doi:[10.1175/jcli-d-11-00027.1](https://doi.org/10.1175/jcli-d-11-00027.1).
- 35 Fu, Y., F. Li, J. Karstensen, and C. Wang, 2020: A stable Atlantic Meridional Overturning Circulation in a changing  
36                    North Atlantic Ocean since the 1990s. *Science Advances*, **6(48)**, doi:[10.1126/sciadv.abc7836](https://doi.org/10.1126/sciadv.abc7836).
- 37 Fuchs, H.L. et al., 2020: Wrong-way migrations of benthic species driven by ocean warming and larval transport.  
38                    *Nature Climate Change*, **10(11)**, 1052–1056, doi:[10.1038/s41558-020-0894-x](https://doi.org/10.1038/s41558-020-0894-x).
- 39 Funk, C. et al., 2015: The climate hazards infrared precipitation with stations - a new environmental record for  
40                    monitoring extremes. *Scientific Data*, 1–21, doi:[10.1038/sdata.2015.66](https://doi.org/10.1038/sdata.2015.66).
- 41 Funk, C. et al., 2019: A High-Resolution 1983–2016 Tmax Climate Data Record Based on Infrared Temperatures and  
42                    Stations by the Climate Hazard Center. *Journal of Climate*, **32(17)**, 5639–5658, doi:[10.1175/jcli-d-18-0698.1](https://doi.org/10.1175/jcli-d-18-0698.1).
- 43 Fyfe, R.M., J. Woodbridge, and N. Roberts, 2015: From forest to farmland: Pollen-inferred land cover change across  
44                    Europe using the pseudobiomization approach. *Global Change Biology*, **21(3)**, 1197–1212,  
45                    doi:[10.1111/gcb.12776](https://doi.org/10.1111/gcb.12776).
- 46 Găinușă-Bogdan, A., P. Braconnot, and J. Servonnat, 2015: Using an ensemble data set of turbulent air-sea fluxes to  
47                    evaluate the IPSL climate model in tropical regions. *Journal of Geophysical Research: Atmospheres*, **120(10)**,  
48                    4483–4505, doi:[10.1002/2014jd022985](https://doi.org/10.1002/2014jd022985).
- 49 Galaasen, E.V. et al., 2014: Rapid Reductions in North Atlantic Deep Water During the Peak of the Last Interglacial  
50                    Period. *Science*, **343(6175)**, 1129, doi:[10.1126/science.1248667](https://doi.org/10.1126/science.1248667).
- 51 Galaasen, E.V. et al., 2020: Interglacial instability of North Atlantic Deep Water ventilation. *Science*, **367(6485)**, 1485,  
52                    doi:[10.1126/science.aay6381](https://doi.org/10.1126/science.aay6381).
- 53 Galbraith, E.D. and S.L. Jaccard, 2015: Deglacial weakening of the oceanic soft tissue pump: Global constraints from  
54                    sedimentary nitrogen isotopes and oxygenation proxies. *Quaternary Science Reviews*, **109**, 38–48,  
55                    doi:[10.1016/j.quascirev.2014.11.012](https://doi.org/10.1016/j.quascirev.2014.11.012).
- 56 Gallagher, S.J. et al., 2015: The Pliocene to recent history of the Kuroshio and Tsushima Currents: a multi-proxy  
57                    approach. *Progress in Earth and Planetary Science*, **2(1)**, 17, doi:[10.1186/s40645-015-0045-6](https://doi.org/10.1186/s40645-015-0045-6).
- 58 Gallaher, D.W., G.G. Campbell, and W.N. Meier, 2014: Anomalous variability in Antarctic sea ice extents during the  
59                    1960s with the use of Nimbus data. *IEEE Journal of Selected Topics in Applied Earth Observations and*
- 60                    *Remote Sensing*, **7(10)**, 4230–4240, doi:[10.1109/JSTARS.2014.2830001](https://doi.org/10.1109/JSTARS.2014.2830001).
- 61

- 1                   *Remote Sensing*, **7(3)**, doi:[10.1109/jstars.2013.2264391](https://doi.org/10.1109/jstars.2013.2264391).
- 2 Gallant, A.J.E., S.J. Phipps, D.J. Karoly, A.B. Mullan, and A.M. Lorrey, 2013: Nonstationary Australasian  
3                   Teleconnections and Implications for Paleoclimate Reconstructions. *Journal of Climate*, **26(22)**, 8827–8849,  
4                   doi:[10.1175/jcli-d-12-00338.1](https://doi.org/10.1175/jcli-d-12-00338.1).
- 5 Gao, P., X. Xu, and X. Zhang, 2015: Characteristics of the Trends in the Global Tropopause Estimated From COSMIC  
6                   Radio Occultation Data. *IEEE Transactions on Geoscience and Remote Sensing*, **53(12)**, 6813–6822,  
7                   doi:[10.1109/tgrs.2015.2449338](https://doi.org/10.1109/tgrs.2015.2449338).
- 8 Gao, X., S. Liang, and B. He, 2019: Detected global agricultural greening from satellite data. *Agricultural and Forest  
9                   Meteorology*, **276–277**, doi:[10.1016/j.agrformet.2019.107652](https://doi.org/10.1016/j.agrformet.2019.107652).
- 10 Garfinkel, C.I., M.M. Hurwitz, and L.D. Oman, 2015a: Effect of recent sea surface temperature trends on the Arctic  
11                   stratospheric vortex (2015a). *Journal of Geophysical Research*, **120(11)**, 5404–5416,  
12                   doi:[10.1002/2015jd023284](https://doi.org/10.1002/2015jd023284).
- 13 Garfinkel, C.I., D.W. Waugh, and L.M. Polvani, 2015b: Recent Hadley cell expansion : The role of internal  
14                   atmospheric variability in reconciling modeled and observed trends (2015b). *Geophysical Research Letters*,  
15                   **42**, 10824–10831, doi:[10.1002/2015gl066942.1](https://doi.org/10.1002/2015gl066942.1).
- 16 Garfinkel, C.I., S.W. Son, K. Song, V. Aquila, and L.D. Oman, 2017: Stratospheric variability contributed to and  
17                   sustained the recent hiatus in Eurasian winter warming. *Geophysical Research Letters*, **44(1)**, 374–382,  
18                   doi:[10.1002/2016gl072035](https://doi.org/10.1002/2016gl072035).
- 19 Garfinkel, C.I. et al., 2018: Nonlinear response of tropical lower-stratospheric temperature and water vapor to ENSO.  
20                   *Atmospheric Chemistry and Physics*, **18(7)**, 4597–4615, doi:[10.5194/acp-18-4597-2018](https://doi.org/10.5194/acp-18-4597-2018).
- 21 Garonna, I., R. de Jong, and M.E. Schaepman, 2016: Variability and evolution of global land surface phenology over  
22                   the past three decades (1982–2012). *Global Change Biology*, **22(4)**, 1456–1468, doi:[10.1111/gcb.13168](https://doi.org/10.1111/gcb.13168).
- 23 Garonna, I. et al., 2014: Strong contribution of autumn phenology to changes in satellite-derived growing season length  
24                   estimates across Europe (1982–2011). *Global Change Biology*, **20(11)**, 3457–3470, doi:[10.1111/gcb.12625](https://doi.org/10.1111/gcb.12625).
- 25 Garry, F.K. et al., 2019: Model-Derived Uncertainties in Deep Ocean Temperature Trends Between 1990 and 2010.  
26                   *Journal of Geophysical Research: Oceans*, **124(2)**, 1155–1169, doi:[10.1029/2018jc014225](https://doi.org/10.1029/2018jc014225).
- 27 Gautier, E. et al., 2019: 2600-years of stratospheric volcanism through sulfate isotopes. *Nature Communications*, **10(1)**,  
28                   466, doi:[10.1038/s41467-019-10835-0](https://doi.org/10.1038/s41467-019-10835-0).
- 29 Gebbie, G., 2014: How much did Glacial North Atlantic Water shoal? *Paleoceanography*, **29(3)**, 190–209,  
30                   doi:[10.1002/2013pa002557](https://doi.org/10.1002/2013pa002557).
- 31 Gebbie, G., 2021: Combining Modern and Paleoceanographic Perspectives on Ocean Heat Uptake. *Annual Review of  
32                   Marine Science*, **13(1)**, 255–281, doi:[10.1146/annurev-marine-010419-010844](https://doi.org/10.1146/annurev-marine-010419-010844).
- 33 Gebbie, G. and P. Huybers, 2019: The Little Ice Age and 20th-century deep Pacific cooling. *Science*, **363(6422)**, 70–74,  
34                   doi:[10.1126/science.aar8413](https://doi.org/10.1126/science.aar8413).
- 35 Gehlen, M., T.t.T. Chau, A. Conchon, A. Denvil-Sommer, F. Chevallier, M. Vrac, C.M., 2020: Ocean acidification. In  
36                   The Copernicus Marine Service Ocean State Report, issue 4. *Journal of Operational Oceanography*,  
37                   **13(suppl)**, s64–s67, doi:[10.1080/1755876x.2020.1785097](https://doi.org/10.1080/1755876x.2020.1785097).
- 38 Gelaro, R. et al., 2017: The Modern-Era Retrospective Analysis for Research and Applications, Version 2 (MERRA-2).  
39                   *Journal of Climate*, **30(14)**, 5419–5454, doi:[10.1175/jcli-d-16-0758.1](https://doi.org/10.1175/jcli-d-16-0758.1).
- 40 Georgoulias, A.K. et al., 2016: Spatiotemporal variability and contribution of different aerosol types to the aerosol  
41                   optical depth over the Eastern Mediterranean. *Atmospheric Chemistry and Physics*, **16(21)**, 13853–13884,  
42                   doi:[10.5194/acp-16-13853-2016](https://doi.org/10.5194/acp-16-13853-2016).
- 43 Gergis, J.L. and A.M. Fowler, 2009: A history of ENSO events since A.D. 1525: implications for future climate change.  
44                   *Climatic Change*, **92(3)**, 343–387, doi:[10.1007/s10584-008-9476-z](https://doi.org/10.1007/s10584-008-9476-z).
- 45 Ghiggi, G., V. Humphrey, S.I. Seneviratne, and L. Gudmundsson, 2019: GRUN: An observations-based global gridded  
46                   runoff dataset from 1902 to 2014. *Earth System Science Data*, **11**, 1655–1674, doi:[10.5194/essd-2019-32](https://doi.org/10.5194/essd-2019-32).
- 47 Ghimire, B. et al., 2014: Global albedo change and radiative cooling from anthropogenic land cover change, 1700 to  
48                   2005 based on MODIS, land use harmonization, radiative kernels, and reanalysis. *Geophysical Research  
49                   Letters*, **41(24)**, 9087–9096, doi:[10.1002/2014gl061671](https://doi.org/10.1002/2014gl061671).
- 50 Gibson-Reinemer, D.K. and F.J. Rahel, 2015: Inconsistent range shifts within species highlight idiosyncratic responses  
51                   to climate warming. *PLoS ONE*, **10(7)**, e0132103, doi:[10.1371/journal.pone.0132103](https://doi.org/10.1371/journal.pone.0132103).
- 52 Gibson-Reinemer, D.K., K.S. Sheldon, and F.J. Rahel, 2015: Climate change creates rapid species turnover in montane  
53                   communities. *Ecology and Evolution*, **5(12)**, 2340–2347, doi:[10.1002/ece3.1518](https://doi.org/10.1002/ece3.1518).
- 54 Giese, B.S. and S. Ray, 2011: El Niño variability in simple ocean data assimilation (SODA), 1871–2008. *Journal of  
55                   Geophysical Research: Oceans*, **116(C2)**, doi:[10.1029/2010jc006695](https://doi.org/10.1029/2010jc006695).
- 56 Gillett, N.P. et al., 2021: Constraining human contributions to observed warming since the pre-industrial period. *Nature  
57                   Climate Change*, doi:[10.1038/s41558-020-00965-9](https://doi.org/10.1038/s41558-020-00965-9).
- 58 Gingerich, P.D., 2019: Temporal Scaling of Carbon Emission and Accumulation Rates: Modern Anthropogenic  
59                   Emissions Compared to Estimates of PETM-Onset Accumulation. *Paleoceanography and Paleoclimatology*,  
60                   **34(3)**, 329–335, doi:[10.1029/2018pa003379](https://doi.org/10.1029/2018pa003379).
- 61 Giraudeau, J. et al., 2010: Millennial-scale variability in Atlantic water advection to the Nordic Seas derived from

- 1 Holocene coccolith concentration records. *Quaternary Science Reviews*, **29(9–10)**, 1276–1287,  
2 doi:[10.1016/j.quascirev.2010.02.014](https://doi.org/10.1016/j.quascirev.2010.02.014).
- 3 Gladyshev, S., V.S. Gladyshev, S.K. Gulev, and A. Sokov, 2016: Anomalously deep convection in the Irminger Sea  
4 during the winter of 2014–2015. *Doklady Earth Sciences*, **469(1)**, 766–770, doi:[10.1134/s1028334x16070229](https://doi.org/10.1134/s1028334x16070229).
- 5 Gobron, N., 2018: Terrestrial Vegetation Activity [in "State of the Climate in 2017"]. *Bulletin of the American  
6 Meteorological Society*, **99**, S62–S63, doi:[10.1175/2018bamsstateoftheclimate.1](https://doi.org/10.1175/2018bamsstateoftheclimate.1).
- 7 Goelzer, H., P. Huybrechts, M.-F.M.-F.M.-F. Loutre, and T. Fichefet, 2016: Last Interglacial climate and sea-level  
8 evolution from a coupled ice sheet-climate model. *Clim. Past*, **12(12)**, 2195–2213, doi:[10.5194/cp-12-2195-  
9 2016](https://doi.org/10.5194/cp-12-2195-2016).
- 10 Goldner, A., N. Herold, and M. Huber, 2014: The challenge of simulating the warmth of the mid-Miocene climatic  
11 optimum in CESM1. *Climate of the Past*, **10(2)**, 523–536, doi:[10.5194/cp-10-523-2014](https://doi.org/10.5194/cp-10-523-2014).
- 12 Golledge, N.R., 2020: Long-term projections of sea-level rise from ice sheets. *WIREs Climate Change*, **11(2)**, e634,  
13 doi:[10.1002/wcc.634](https://doi.org/10.1002/wcc.634).
- 14 Golledge, N.R. et al., 2014: Antarctic contribution to meltwater pulse 1A from reduced Southern Ocean overturning.  
15 *Nature Communications*, **5**, doi:[10.1038/ncomms6107](https://doi.org/10.1038/ncomms6107).
- 16 Gong, H., L. Wang, W. Chen, and D. Nath, 2018: Multidecadal fluctuation of the wintertime Arctic Oscillation pattern  
17 and its implication. *Journal of Climate*, **31(14)**, 5595–5608, doi:[10.1175/jcli-d-17-0530.1](https://doi.org/10.1175/jcli-d-17-0530.1).
- 18 Good, S.A., 2017: The impact of observational sampling on time series of global 0–700 m ocean average temperature: a  
19 case study. *International Journal of Climatology*, **37(5)**, 2260–2268, doi:[10.1002/joc.4654](https://doi.org/10.1002/joc.4654).
- 20 Good, S.A., M.J. Martin, and N.A. Rayner, 2013a: EN4: Quality controlled ocean temperature and salinity profiles and  
21 monthly objective analyses with uncertainty estimates. *Journal of Geophysical Research: Oceans*, **118(12)**,  
22 6704–6716, doi:[10.1002/2013jc009067](https://doi.org/10.1002/2013jc009067).
- 23 Good, S.A., M.J. Martin, and N.A. Rayner, 2013b: EN4: Quality controlled ocean temperature and salinity profiles and  
24 monthly objective analyses with uncertainty estimates. *Journal of Geophysical Research: Oceans*, **118(12)**,  
25 6704–6716, doi:[10.1002/2013jc009067](https://doi.org/10.1002/2013jc009067).
- 26 Goodwin, I.D. et al., 2014: A reconstruction of extratropical Indo-Pacific sea-level pressure patterns during the  
27 Medieval Climate Anomaly. *Climate Dynamics*, **43(5–6)**, 1197–1219, doi:[10.1007/s00382-013-1899-1](https://doi.org/10.1007/s00382-013-1899-1).
- 28 Goring, S.J. et al., 2016: Novel and lost forests in the upper Midwestern United States, from new estimates of  
29 settlement-era composition, stem density, and biomass. *PLoS ONE*, **11(12)**, e0151935,  
30 doi:[10.1371/journal.pone.0151935](https://doi.org/10.1371/journal.pone.0151935).
- 31 Gottschalk, J. et al., 2016: Biological and physical controls in the Southern Ocean on past millennial-scale atmospheric  
32 CO<sub>2</sub> changes. *Nature Communications*, **7**, doi:[10.1038/ncomms11539](https://doi.org/10.1038/ncomms11539).
- 33 Gottschalk, J. et al., 2020: Southern Ocean link between changes in atmospheric CO<sub>2</sub> levels and northern-hemisphere  
34 climate anomalies during the last two glacial periods. *Quaternary Science Reviews*, **230**, 106067,  
35 doi:[10.1016/j.quascirev.2019.106067](https://doi.org/10.1016/j.quascirev.2019.106067).
- 36 Gouretski, V. and L. Cheng, 2020: Correction for Systematic Errors in the Global Dataset of Temperature Profiles from  
37 Mechanical Bathymeterographs. *Journal of Atmospheric and Oceanic Technology*, **37(5)**, 841–855,  
38 doi:[10.1175/jtech-d-19-0205.1](https://doi.org/10.1175/jtech-d-19-0205.1).
- 39 Gouretski, V., J. Kennedy, T. Boyer, and A. Köhl, 2012: Consistent near-surface ocean warming since 1900 in two  
40 largely independent observing networks. *Geophysical Research Letters*, **39(19)**, doi:[10.1029/2012gl052975](https://doi.org/10.1029/2012gl052975).
- 41 Graham, N.E., C.M. Ammann, D. Fleitmann, K.M. Cobb, and J. Luterbacher, 2011: Support for global climate  
42 reorganization during the 'Medieval Climate Anomaly'. *Climate Dynamics*, **37(5)**, 1217–1245,  
43 doi:[10.1007/s00382-010-0914-z](https://doi.org/10.1007/s00382-010-0914-z).
- 44 Grant, G.R. et al., 2019: The amplitude and origin of sea-level variability during the Pliocene epoch. *Nature*, **574(7777)**,  
45 237–241, doi:[10.1038/s41586-019-1619-z](https://doi.org/10.1038/s41586-019-1619-z).
- 46 Grant, K.M. et al., 2014: Sea-level variability over five glacial cycles. *Nature Communications*, **5(1)**, 5076,  
47 doi:[10.1038/ncomms6076](https://doi.org/10.1038/ncomms6076).
- 48 Graven, H.D. et al., 2013a: Enhanced seasonal exchange of CO<sub>2</sub> by Northern ecosystems since 1960. *Science*,  
49 doi:[10.1126/science.1239207](https://doi.org/10.1126/science.1239207).
- 50 Graven, H.D. et al., 2013b: Enhanced seasonal exchange of CO<sub>2</sub> by Northern ecosystems since 1960. *Science*,  
51 doi:[10.1126/science.1239207](https://doi.org/10.1126/science.1239207).
- 52 Gray, A.R. et al., 2018: Autonomous Biogeochemical Floats Detect Significant Carbon Dioxide Outgassing in the  
53 High-Latitude Southern Ocean. *Geophysical Research Letters*, **45(17)**, 9049–9057,  
54 doi:[10.1029/2018gl078013](https://doi.org/10.1029/2018gl078013).
- 55 Gregg, W.W. and C.S. Rousseaux, 2019: Global ocean primary production trends in the modern ocean color satellite  
56 record (1998–2015). *Environmental Research Letters*, **14(12)**, 124011, doi:[10.1088/1748-9326/ab4667](https://doi.org/10.1088/1748-9326/ab4667).
- 57 Gregor, L. and N. Gruber, 2021: OceanSODA-ETHZ: a global gridded data set of the surface ocean carbonate system  
58 for seasonal to decadal studies of ocean acidification. *Earth System Science Data*, **13(2)**, 777–808,  
59 doi:[10.5194/essd-13-777-2021](https://doi.org/10.5194/essd-13-777-2021).
- 60 Greve, P. et al., 2014: Global assessment of trends in wetting and drying over land. *Nature Geoscience*, **7(10)**, 716–721,  
61 doi:[10.1038/ngeo2247](https://doi.org/10.1038/ngeo2247).

- 1 Grieger, J., G.C. Leckebusch, C.C. Raible, I. Rudeva, and I. Simmonds, 2018: Subantarctic cyclones identified by 14  
2 tracking methods, and their role for moisture transports into the continent. *Tellus A: Dynamic Meteorology and*  
3 *Oceanography*, **70(1)**, 1454808, doi:[10.1080/16000870.2018.1454808](https://doi.org/10.1080/16000870.2018.1454808).
- 4 Griffiths, M.L. et al., 2016: Western Pacific hydroclimate linked to global climate variability over the past two  
5 millennia. *Nature Communications*, **7**, 1–9, doi:[10.1038/ncomms11719](https://doi.org/10.1038/ncomms11719).
- 6 Griffiths, M.L. et al., 2020: End of Green Sahara amplified mid- to late Holocene megadroughts in mainland Southeast  
7 Asia. *Nature Communications*, **11(1)**, 4204, doi:[10.1038/s41467-020-17927-6](https://doi.org/10.1038/s41467-020-17927-6).
- 8 Grise, K., S. Davis, P. Staten, and O. Adam, 2018: Regional and Seasonal Characteristics of the Recent Expansion of  
9 the Tropics. *Journal of Climate*, **31(17)**, 6839–6856, doi:[10.1175/jcli-d-18-0060.1](https://doi.org/10.1175/jcli-d-18-0060.1).
- 10 Grise, K.M. and S.M. Davis, 2020: Hadley cell expansion in CMIP6 models. *Atmospheric Chemistry and Physics*,  
11 **20(9)**, 5249–5268, doi:[10.5194/acp-20-5249-2020](https://doi.org/10.5194/acp-20-5249-2020).
- 12 Grise, K.M. et al., 2019: Recent tropical expansion: Natural variability or forced response? *Journal of Climate*, **32(5)**,  
13 1551–1571, doi:[10.1175/jcli-d-18-0444.1](https://doi.org/10.1175/jcli-d-18-0444.1).
- 14 Grist, J.P., S.A. Josey, J.D. Zika, D.G. Evans, and N. Skliris, 2016: Assessing recent air-sea freshwater flux changes  
15 using a surface temperature-salinity space framework. *Journal of Geophysical Research: Oceans*, **121(12)**,  
16 8787–8806, doi:[10.1002/2016jc012091](https://doi.org/10.1002/2016jc012091).
- 17 Groß, J.-U. and R. Müller, 2020: Simulation of the record Arctic stratospheric ozone depletion in 2020. *JGR*, **17**,  
18 doi:[10.1002/essoar.10503569.1](https://doi.org/10.1002/essoar.10503569.1).
- 19 Grothe, P.R. et al., 2019: Enhanced El Niño-Southern Oscillation variability in recent decades. *Geophysical Research  
20 Letters*, **46(7)**, e2019GL083906, doi:[10.1029/2019gl083906](https://doi.org/10.1029/2019gl083906).
- 21 Gu, G. and R.F. Adler, 2013: Interdecadal variability/long-term changes in global precipitation patterns during the past  
22 three decades: Global warming and/or pacific decadal variability? *Climate Dynamics*, **40(11–12)**, 3009–3022,  
23 doi:[10.1007/s00382-012-1443-8](https://doi.org/10.1007/s00382-012-1443-8).
- 24 Gu, G. and R.F. Adler, 2015: Spatial patterns of global precipitation change and variability during 1901–2010. *Journal  
25 of Climate*, **28(11)**, 4431–4453, doi:[10.1175/jcli-d-14-00201.1](https://doi.org/10.1175/jcli-d-14-00201.1).
- 26 Gudmundsson, L., H.X. Do, M. Leonard, and S. Westra, 2018: The Global Streamflow Indices and Metadata Archive  
27 (GSIM)-Part 2: Quality control, time-series indices and homogeneity assessment. *Earth System Science Data*,  
28 **10(2)**, 787–804, doi:[10.5194/essd-10-787-2018](https://doi.org/10.5194/essd-10-787-2018).
- 29 Gudmundsson, L., M. Leonard, H.X. Do, S. Westra, and S.I. Seneviratne, 2019a: Observed Trends in Global Indicators  
30 of Mean and Extreme Streamflow. *Geophys. Res. Lett.*, **46(2)**, 756–766, doi:[10.1029/2018gl079725](https://doi.org/10.1029/2018gl079725).
- 31 Gudmundsson, L., M. Leonard, H.X. Do, S. Westra, and S.I. Seneviratne, 2019b: Observed Trends in Global Indicators  
32 of Mean and Extreme Streamflow. *Geophys. Res. Lett.*, **46(2)**, 756–766, doi:[10.1029/2018gl079725](https://doi.org/10.1029/2018gl079725).
- 33 Gulev, S.K., M. Latif, N. Keenlyside, W. Park, and K.P. Koltermann, 2013: North Atlantic Ocean control on surface  
34 heat flux on multidecadal timescales. *Nature*, **499**, 464, doi:[10.1038/nature12268](https://doi.org/10.1038/nature12268).
- 35 Guo, F., Q. Liu, S. Sun, and J. Yang, 2015: Three Types of Indian Ocean Dipoles. *Journal of Climate*, **28(8)**, 3073–  
36 3092, doi:[10.1175/jcli-d-14-00507.1](https://doi.org/10.1175/jcli-d-14-00507.1).
- 37 Gutjahr, M. et al., 2017: Very large release of mostly volcanic carbon during the Palaeocene-Eocene Thermal  
38 Maximum. *Nature*, **548(7669)**, 573–577, doi:[10.1038/nature23646](https://doi.org/10.1038/nature23646).
- 39 Haas, C. et al., 2017: Ice and Snow Thickness Variability and Change in the High Arctic Ocean Observed by In Situ  
40 Measurements. *Geophysical Research Letters*, **44(20)**, 10,410–462,469, doi:[10.1002/2017gl075434](https://doi.org/10.1002/2017gl075434).
- 41 Haimberger, L. and M. Mayer, 2018: Upper air winds [in “State of the Climate in 2017”]. *Bulletin of the American  
42 Meteorological Society*, **98(8)**, S39–S41, doi:[10.1175/2017bamsstateoftheclimate.1](https://doi.org/10.1175/2017bamsstateoftheclimate.1).
- 43 Haimberger, L., C. Tayolato, and S. Sperka, 2012: Homogenization of the Global Radiosonde Temperature Dataset  
44 through Combined Comparison with Reanalysis Background Series and Neighboring Stations. *Journal of  
45 Climate*, **25(23)**, 8108–8131, doi:[10.1175/jcli-d-11-00668.1](https://doi.org/10.1175/jcli-d-11-00668.1).
- 46 Hain, M.P., G.L. Foster, and T. Chalk, 2018: Robust Constraints on Past CO<sub>2</sub> Climate Forcing From the Boron Isotope  
47 Proxy. *Paleoceanography and Paleoclimatology*, **33(10)**, 1099–1115, doi:[10.1029/2018pa003362](https://doi.org/10.1029/2018pa003362).
- 48 Hakkinen, S., A. Proshutinsky, and I. Ashik, 2008: Sea ice drift in the Arctic since the 1950s. *Geophysical Research  
49 Letters*, **35(19)**, doi:[10.1029/2008gl103479](https://doi.org/10.1029/2008gl103479).
- 50 Hammer, M.S. et al., 2018: Insight into global trends in aerosol composition from 2005 to 2015 inferred from the OMI  
51 Ultraviolet Aerosol Index. *Atmospheric Chemistry and Physics*, **18(11)**, 8097–8112, doi:[10.5194/acp-18-8097-2018](https://doi.org/10.5194/acp-18-8097-<br/>52 2018).
- 53 Hammond, J.C., F.A. Saavedra, and S.K. Kampf, 2018: Global snow zone maps and trends in snow persistence 2001–  
54 2016. *International Journal of Climatology*, **38(12)**, 4369–4383, doi:[10.1002/joc.5674](https://doi.org/10.1002/joc.5674).
- 55 Han, W. et al., 2014: Intensification of decadal and multi-decadal sea level variability in the western tropical Pacific  
56 during recent decades. *Climate Dynamics*, **43(5–6)**, 1357–1379, doi:[10.1007/s00382-013-1951-1](https://doi.org/10.1007/s00382-013-1951-1).
- 57 Han, Z. et al., 2019: Changes in global monsoon precipitation and the related dynamic and thermodynamic mechanisms  
58 in recent decades. *International Journal of Climatology*, **39(3)**, 1490–1503, doi:[10.1002/joc.5896](https://doi.org/10.1002/joc.5896).
- 59 Hanna, E., T.E. Cropper, R.J. Hall, and J. Cappelen, 2016: Greenland Blocking Index 1851–2015: a regional climate  
60 change signal. *International Journal of Climatology*, **36(15)**, 4847–4861, doi:[10.1002/joc.4673](https://doi.org/10.1002/joc.4673).
- 61 Hanna, E., T.E. Cropper, P.D. Jones, A.A. Scaife, and R. Allan, 2015: Recent seasonal asymmetric changes in the NAO

- 1 (a marked summer decline and increased winter variability) and associated changes in the AO and Greenland  
2 Blocking Index. *International Journal of Climatology*, **35(9)**, 2540–2554, doi:[10.1002/joc.4157](https://doi.org/10.1002/joc.4157).
- 3 Hanna, E. et al., 2018: Greenland blocking index daily series 1851–2015: Analysis of changes in extremes and links  
4 with North Atlantic and UK climate variability and change. *International Journal of Climatology*, **38(9)**,  
5 3546–3564, doi:[10.1002/joc.5516](https://doi.org/10.1002/joc.5516).
- 6 Hansen, B. et al., 2015: Transport of volume, heat, and salt towards the Arctic in the Faroe Current 1993–2013. *Ocean  
7 Sci.*, **11(5)**, 743–757, doi:[10.5194/os-11-743-2015](https://doi.org/10.5194/os-11-743-2015).
- 8 Hansen, E. et al., 2013a: Thinning of Arctic sea ice observed in Fram Strait: 1990–2011. *Journal of Geophysical  
9 Research: Oceans*, doi:[10.1002/jgrc.20393](https://doi.org/10.1002/jgrc.20393).
- 10 Hansen, E. et al., 2013b: Thinning of Arctic sea ice observed in Fram Strait: 1990–2011. *Journal of Geophysical  
11 Research: Oceans*, doi:[10.1002/jgrc.20393](https://doi.org/10.1002/jgrc.20393).
- 12 Hansen, J., M. Sato, G. Russell, and P. Kharecha, 2013: Climate sensitivity, sea level and atmospheric carbon dioxide.  
13 *Philosophical transactions. Series A, Mathematical, physical, and engineering sciences*, **371(2001)**, 20120294,  
14 doi:[10.1098/rsta.2012.0294](https://doi.org/10.1098/rsta.2012.0294).
- 15 Harada, Y. et al., 2016: The JRA-55 Reanalysis: Representation of atmospheric circulation and climate variability.  
16 *Journal of the Meteorological Society of Japan*, **94(3)**, 269–302, doi:[10.2151/jmsj.2016-015](https://doi.org/10.2151/jmsj.2016-015).
- 17 Harning, D.J., Geirsdóttir, and G.H. Miller, 2018: Punctuated Holocene climate of Vestfjardir, Iceland, linked to  
18 internal/external variables and oceanographic conditions. *Quaternary Science Reviews*, **189**, 31–42,  
19 doi:[10.1016/j.quascirev.2018.04.009](https://doi.org/10.1016/j.quascirev.2018.04.009).
- 20 Harning, D.J., Geirsdóttir, G.H. Miller, and L. Anderson, 2016: Episodic expansion of Drangajökull, Vestfjardir, Iceland,  
21 over the last 3 ka culminating in its maximum dimension during the Little Ice Age. *Quaternary Science  
22 Reviews*, **152**, 118–131, doi:[10.1016/j.quascirev.2016.10.001](https://doi.org/10.1016/j.quascirev.2016.10.001).
- 23 Harper, D.T. et al., 2020: The Magnitude of Surface Ocean Acidification and Carbon Release During Eocene Thermal  
24 Maximum 2 (ETM-2) and the Paleocene-Eocene Thermal Maximum (PETM). *Paleoceanography and  
25 Paleoceanography*, **35(2)**, e2019PA003699, doi:[10.1029/2019pa003699](https://doi.org/10.1029/2019pa003699).
- 26 Harris, I., P.D. Jones, T.J. Osborn, and D.H. Lister, 2014: Updated high-resolution grids of monthly climatic  
27 observations - the CRU TS3.10 Dataset. *International Journal of Climatology*, **34(3)**, 623–642,  
28 doi:[10.1002/joc.3711](https://doi.org/10.1002/joc.3711).
- 29 Harrison, S.P., P.J. Bartlein, and I.C. Prentice, 2016: What have we learnt from palaeoclimate simulations? *Journal of  
30 Quaternary Science*, **31(4)**, 363–385, doi:[10.1002/jqs.2842](https://doi.org/10.1002/jqs.2842).
- 31 Harrison, S.P. et al., 2014: Climate model benchmarking with glacial and mid-Holocene climates. *Climate Dynamics*,  
32 **43(3)**, 671–688, doi:[10.1007/s00382-013-1922-6](https://doi.org/10.1007/s00382-013-1922-6).
- 33 Harrison, S.P. et al., 2015: Evaluation of CMIP5 palaeo-simulations to improve climate projections. *Nature Climate  
34 Change*, **5**, 735, doi:[10.1038/nclimate2649](https://doi.org/10.1038/nclimate2649).
- 35 Harrison, S.P. et al., 2020: Development and testing scenarios for implementing land use and land cover changes during  
36 the Holocene in Earth system model experiments. *Geoscientific Model Development*, **13(2)**, 805–824,  
37 doi:[10.5194/gmd-13-805-2020](https://doi.org/10.5194/gmd-13-805-2020).
- 38 Harsch, M.A., P.E. Hulme, M.S. McGlone, and R.P. Duncan, 2009a: Are treelines advancing? A global meta-analysis  
39 of treeline response to climate warming. *Ecology Letters*, doi:[10.1111/j.1461-0248.2009.01355.x](https://doi.org/10.1111/j.1461-0248.2009.01355.x).
- 40 Harsch, M.A., P.E. Hulme, M.S. McGlone, and R.P. Duncan, 2009b: Are treelines advancing? A global meta-analysis  
41 of treeline response to climate warming. *Ecology Letters*, doi:[10.1111/j.1461-0248.2009.01355.x](https://doi.org/10.1111/j.1461-0248.2009.01355.x).
- 42 Hartmann, D.L. et al., 2013: Observations: Atmosphere and surface. *Climate Change 2013 the Physical Science Basis:  
43 Working Group I Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate  
44 Change*, **9781107057**, 159–254, doi:[10.1017/cbo9781107415324.008](https://doi.org/10.1017/cbo9781107415324.008).
- 45 Hassanzadeh, P., Z. Kuang, and B.F. Farrell, 2014: Responses of midlatitude blocks and wave amplitude to changes in  
46 the meridional temperature gradient in an idealized dry GCM. *Geophysical Research Letters*, **41(14)**, 5223–  
47 5232, doi:[10.1002/2014gl060764](https://doi.org/10.1002/2014gl060764).
- 48 Haug, T. et al., 2017: Future harvest of living resources in the Arctic Ocean north of the Nordic and Barents Seas: A  
49 review of possibilities and constraints. *Fisheries Research*, **188**, 38–57, doi:[10.1016/j.fishres.2016.12.002](https://doi.org/10.1016/j.fishres.2016.12.002).
- 50 Hausfather, Z. et al., 2017: Assessing recent warming using instrumentally homogeneous sea surface temperature  
51 records. *Science Advances*, **3(1)**, doi:[10.1126/sciadv.1601207](https://doi.org/10.1126/sciadv.1601207).
- 52 Haustein, K. et al., 2019: A Limited Role for Unforced Internal Variability in Twentieth-Century Warming. *Journal of  
53 Climate*, **32(16)**, 4893–4917, doi:[10.1175/jcli-d-18-0555.1](https://doi.org/10.1175/jcli-d-18-0555.1).
- 54 Hay, C.C., E. Morrow, R.E. Kopp, and J.X. Mitrovica, 2015: Probabilistic reanalysis of twentieth-century sea-level rise.  
55 *Nature*, **517(7535)**, 481–484, doi:[10.1038/nature14093](https://doi.org/10.1038/nature14093).
- 56 Hayes, C.T. et al., 2014: A stagnation event in the deep South Atlantic during the last interglacial period. *Science*,  
57 **346(6216)**, 1514, doi:[10.1126/science.1256620](https://doi.org/10.1126/science.1256620).
- 58 Haywood, A.M., H.J. Dowsett, and A.M. Dolan, 2016: Integrating geological archives and climate models for the mid-  
59 Pliocene warm period. *Nature Communications*, **7**, 10646, doi:[10.1038/ncomms10646](https://doi.org/10.1038/ncomms10646).
- 60 Haywood, A.M. et al., 2013: On the identification of a pliocene time slice for data-model comparison. *Philosophical  
61 Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, **371(2001)**, 20120515,

- 1 doi:[10.1098/rsta.2012.0515](https://doi.org/10.1098/rsta.2012.0515).
- 2 Haywood, A.M. et al., 2020: The Pliocene Model Intercomparison Project Phase 2: large-scale climate features and  
3 climate sensitivity. *Climate of the Past*, **16**(6), 2095–2123, doi:[10.5194/cp-16-2095-2020](https://doi.org/10.5194/cp-16-2095-2020).
- 4 He, F. et al., 2014: Simulating global and local surface temperature changes due to Holocene anthropogenic land cover  
5 change. *Geophysical Research Letters*, **41**(2), 623–631, doi:[10.1002/2013gl058085](https://doi.org/10.1002/2013gl058085).
- 6 He, S., H. Wang, and J. Liu, 2013: Changes in the Relationship between ENSO and Asia-Pacific Midlatitude Winter  
7 Atmospheric Circulation. *Journal of Climate*, **26**(10), 3377–3393, doi:[10.1175/jcli-d-12-00355.1](https://doi.org/10.1175/jcli-d-12-00355.1).
- 8 Hearty, P.J. et al., 2020: Pliocene-Pleistocene Stratigraphy and Sea-Level Estimates, Republic of South Africa With  
9 Implications for a 400 ppmv CO<sub>2</sub> World. *Paleoceanography and Paleoclimatology*, **35**(7), e2019PA003835,  
10 doi:[10.1029/2019pa003835](https://doi.org/10.1029/2019pa003835).
- 11 Hegerl, G.C., T.J. Crowley, W.T. Hyde, and D.J. Frame, 2006: Climate sensitivity constrained by temperature  
12 reconstructions over the past seven centuries. *Nature*, **440**(7087), 1029–1032, doi:[10.1038/nature04679](https://doi.org/10.1038/nature04679).
- 13 Hegerl, G.C. et al., 2015: Challenges in quantifying changes in the global water cycle. *Bull. Amer. Meteor. Soc.*, **96**(7),  
14 1097–1116, doi:[10.1175/bams-d-13-00212.1](https://doi.org/10.1175/bams-d-13-00212.1).
- 15 Hegglin, M.I. et al., 2014: Vertical structure of stratospheric water vapour trends derived from merged satellite data.  
16 *Nature Geoscience*, **7**, 768, doi:[10.1038/ngeo2236](https://doi.org/10.1038/ngeo2236).
- 17 Hein, A.S. et al., 2016: Mid-Holocene pulse of thinning in the Weddell Sea sector of the West Antarctic ice sheet.  
18 *Nature Communications*, **7**(12511), doi:[10.1038/ncomms12511](https://doi.org/10.1038/ncomms12511).
- 19 Helsen, M.M., W.J. van de Berg, R.S.W. van de Wal, M.R. van den Broeke, and J. Oerlemans, 2013: Coupled regional  
20 climate-ice-sheet simulation shows limited Greenland ice loss during the Eemian. *Clim. Past*, **9**(4), 1773–1788,  
21 doi:[10.5194/cp-9-1773-2013](https://doi.org/10.5194/cp-9-1773-2013).
- 22 Henehan, M. et al., 2020: Revisiting the Middle Eocene Climatic Optimum “Carbon Cycle Conundrum” With New  
23 Estimates of Atmospheric pCO<sub>2</sub> From Boron Isotopes. *Paleoceanography and Paleoclimatology*, **35**,  
24 e2019PA003713, doi:[10.1029/2019pa003713](https://doi.org/10.1029/2019pa003713).
- 25 Henehan, M.J. et al., 2013a: Calibration of the boron isotope proxy in the planktonic foraminifera Globigerinoides ruber  
26 for use in palaeo-CO<sub>2</sub> reconstruction. *Earth and Planetary Science Letters*, **364**, 111–122,  
27 doi:[10.1016/j.epsl.2012.12.029](https://doi.org/10.1016/j.epsl.2012.12.029).
- 28 Henehan, M.J. et al., 2013b: Calibration of the boron isotope proxy in the planktonic foraminifera Globigerinoides  
29 ruber for use in palaeo-CO<sub>2</sub> reconstruction. *Earth and Planetary Science Letters*, **364**, 111–122,  
30 doi:[10.1016/j.epsl.2012.12.029](https://doi.org/10.1016/j.epsl.2012.12.029).
- 31 Henehan, M.J. et al., 2019: Rapid ocean acidification and protracted Earth system recovery followed the end-  
32 Cretaceous Chicxulub impact. *Proceedings of the National Academy of Sciences*, **116**(45), 22500,  
33 doi:[10.1073/pnas.1905989116](https://doi.org/10.1073/pnas.1905989116).
- 34 Henley, B.J., 2017: Pacific decadal climate variability: Indices, patterns and tropical-extratropical interactions. *Global  
35 and Planetary Change*, **155**, 42–55, doi:[10.1016/j.gloplacha.2017.06.004](https://doi.org/10.1016/j.gloplacha.2017.06.004).
- 36 Henry, L.G. et al., 2016a: North Atlantic ocean circulation and abrupt climate change during the last glaciation. *Science*,  
37 **353**(6298), 470–474, doi:[10.1126/science.aaf5529](https://doi.org/10.1126/science.aaf5529).
- 38 Henry, L.G. et al., 2016b: North Atlantic ocean circulation and abrupt climate change during the last glaciation.  
39 *Science*, **353**(6298), 470–474, doi:[10.1126/science.aaf5529](https://doi.org/10.1126/science.aaf5529).
- 40 Hermann, N.W., J.L. Oster, and D.E. Ibarra, 2018: Spatial patterns and driving mechanisms of mid-Holocene  
41 hydroclimate in western North America. *Journal of Quaternary Science*, **33**(4), 421–434,  
42 doi:[10.1002/jqs.3023](https://doi.org/10.1002/jqs.3023).
- 43 Hernández, A. et al., 2020: Modes of climate variability: Synthesis and review of proxy-based reconstructions through  
44 the Holocene. *Earth-Science Reviews*, **209**(103286), 103286, doi:[10.1016/j.earscirev.2020.103286](https://doi.org/10.1016/j.earscirev.2020.103286).
- 45 Hernández-Henríquez, M.A., S.J. Déry, and C. Derksen, 2015: Polar amplification and elevation-dependence in trends  
46 of Northern Hemisphere snow cover extent, 1971–2014. *Environmental Research Letters*, **10**(044010),  
47 doi:[10.1088/1748-9326/10/4/044010](https://doi.org/10.1088/1748-9326/10/4/044010).
- 48 Hersbach, H. et al., 2020: The ERA5 global reanalysis. *Quarterly Journal of the Royal Meteorological Society*, **146**,  
49 1999–2049, doi:[10.1002/qj.3803](https://doi.org/10.1002/qj.3803).
- 50 Herzschuh, U. et al., 2016: Glacial legacies on interglacial vegetation at the Pliocene-Pleistocene transition in NE Asia.  
51 *Nature Communications*, **7**(1), doi:[10.1038/ncomms11967](https://doi.org/10.1038/ncomms11967).
- 52 Hessl, A., K.J. Allen, T. Vance, N.J. Abram, and K.M. Saunders, 2017: Reconstructions of the southern annular mode  
53 (SAM) during the last millennium. *Progress in Physical Geography*, **41**(6), 834–849,  
54 doi:[10.1177/0309133117743165](https://doi.org/10.1177/0309133117743165).
- 55 Hibbert, F.D., F.H. Williams, S.J. Fallon, and E.J. Rohling, 2018: A database of biological and geomorphological sea-  
56 level markers from the Last Glacial Maximum to present. *Scientific Data*, **5**(1), 180088,  
57 doi:[10.1038/sdata.2018.88](https://doi.org/10.1038/sdata.2018.88).
- 58 Hiemstra, J.F., 2018: Permafrost and environmental dynamics: A virtual issue of The Holocene. *Holocene*, **28**(8),  
59 1201–1204, doi:[10.1177/0959683618785835](https://doi.org/10.1177/0959683618785835).
- 60 Higgins, J.A. et al., 2015: Atmospheric composition 1 million years ago from blue ice in the Allan Hills, Antarctica.  
61 *Proceedings of the National Academy of Sciences*, **112**(22), 6887–6891, doi:[10.1073/pnas.1420232112](https://doi.org/10.1073/pnas.1420232112).

- 1 Hirahara, S., M. Ishii, and Y. Fukuda, 2014: Centennial-Scale Sea Surface Temperature Analysis and Its Uncertainty.  
2      *Journal of Climate*, **27(1)**, 57–75, doi:[10.1175/jcli-d-12-00837.1](https://doi.org/10.1175/jcli-d-12-00837.1).
- 3 Ho, S.- et al., 2012: Reproducibility of GPS radio occultation data for climate monitoring: Profile-to-profile inter-  
4      comparison of CHAMP climate records 2002 to 2008 from six data centers. *Journal of Geophysical Research: Atmospheres*, **117(D18)**, doi:[10.1029/2012jd017665](https://doi.org/10.1029/2012jd017665).
- 5 Ho, S.-P., L. Peng, and H. Vömel, 2017: Characterization of the long-term radiosonde temperature biases in the upper  
6      troposphere and lower stratosphere using COSMIC and Metop-A/GRAS data from 2006 to 2014. *Atmospheric  
7      Chemistry and Physics*, **17(7)**, 4493–4511, doi:[10.5194/acp-17-4493-2017](https://doi.org/10.5194/acp-17-4493-2017).
- 8 Ho, S.-P. et al., 2020: The COSMIC/FORMOSAT-3 Radio Occultation Mission after 12 years: Accomplishments,  
9      Remaining Challenges, and Potential Impacts of COSMIC-2. *Bulletin of the American Meteorological Society*,  
10     **101**, E1107–E1136, doi:[10.1175/bams-d-18-0290.1](https://doi.org/10.1175/bams-d-18-0290.1).
- 11 Hobbs, R.J., E. Higgs, and J.A. Harris, 2009: Novel ecosystems: implications for conservation and restoration. *Trends  
12      in Ecology and Evolution*, **24(11)**, 599–605, doi:[10.1016/j.tree.2009.05.012](https://doi.org/10.1016/j.tree.2009.05.012).
- 13 Hobbs, W., M. Curran, N. Abram, and E.R. Thomas, 2016: Century-scale perspectives on observed and simulated  
14      Southern Ocean sea ice trends from proxy reconstructions. *Journal of Geophysical Research: Oceans*, **121(10)**,  
15      7804–7818, doi:[10.1002/2016jc012111](https://doi.org/10.1002/2016jc012111).
- 16 Hobbs, W.R. et al., 2016: A review of recent changes in Southern Ocean sea ice, their drivers and forcings. *Global and  
17      Planetary Change*, **143**, 228–250, doi:[10.1016/j.gloplacha.2016.06.008](https://doi.org/10.1016/j.gloplacha.2016.06.008).
- 18 Hodges, K.I., R.W. Lee, and L. Bengtsson, 2011: A comparison of extratropical cyclones in recent reanalyses ERA-  
19      Interim, NASA MERRA, NCEP CFSR, and JRA-25. *Journal of Climate*, **24**, 4888–4906,  
20      doi:[10.1175/2011jcli4097.1](https://doi.org/10.1175/2011jcli4097.1).
- 21 Hoelzmann, P. et al., 1998: Mid-Holocene land-surface conditions in northern Africa and the Arabian peninsula: A data  
22      set for the analysis of biogeophysical feedbacks in the climate system. *Global Biogeochemical Cycles*, **12(1)**,  
23      35–51, doi:[10.1029/97gb02733](https://doi.org/10.1029/97gb02733).
- 24 Hoffman, J.S., P.U. Clark, A.C. Parnell, and F. He, 2017: Regional and global sea-surface temperatures during the last  
25      interglaciation. *Science*, **355(6322)**, 276–279, doi:[10.1126/science.aai8464](https://doi.org/10.1126/science.aai8464).
- 26 Hoffmann, S.S., J.F. McManus, and E. Swank, 2018: Evidence for Stable Holocene Basin-Scale Overturning  
27      Circulation Despite Variable Currents Along the Deep Western Boundary of the North Atlantic Ocean.  
28      *Geophysical Research Letters*, **45(24)**, 13, 413–427, 436, doi:[10.1029/2018gl080187](https://doi.org/10.1029/2018gl080187).
- 29 Hogda, K., H. Tømmervik, and S. Karlsen, 2013: Trends in the Start of the Growing Season in Fennoscandia 1982–  
30      2011. *Remote Sensing*, vol. 5, issue 9, pp. 4304–4318, **5(9)**, 4304–4318, doi:[10.3390/rs5094304](https://doi.org/10.3390/rs5094304).
- 31 Holland, P.R., 2014: The seasonality of Antarctic sea ice trends. *Geophysical Research Letters*, **41(12)**, 4230–4237,  
32      doi:[10.1002/2014gl060172](https://doi.org/10.1002/2014gl060172).
- 33 Hollis, C.J. et al., 2019: The DeepMIP contribution to PMIP4: methodologies for selection, compilation and analysis of  
34      latest Paleocene and early Eocene climate proxy data, incorporating version 0.1 of the DeepMIP database.  
35      *Geoscientific Model Development Discussions*, **2019**, 1–98, doi:[10.5194/gmd-2018-309](https://doi.org/10.5194/gmd-2018-309).
- 36 Holloway, J.E. and A.G. Lewkowicz, 2020: Half a century of discontinuous permafrost persistence and degradation in  
37      western Canada. *Permafrost and Periglacial Processes*, **31(1)**, 85–96, doi:[10.1002/ppp.2017](https://doi.org/10.1002/ppp.2017).
- 38 Holloway, M.D. et al., 2016: Antarctic last interglacial isotope peak in response to sea ice retreat not ice-sheet collapse.  
39      *Nature Communications*, **7**, 1–9, doi:[10.1038/ncomms12293](https://doi.org/10.1038/ncomms12293).
- 40 Hönisch, B. and N.G. Hemming, 2005: Surface ocean pH response to variations in pCO<sub>2</sub> through two full glacial  
41      cycles. *Earth and Planetary Science Letters*, **236(1)**, 305–314, doi:[10.1016/j.epsl.2005.04.027](https://doi.org/10.1016/j.epsl.2005.04.027).
- 42 Hönisch, B., N.G. Hemming, D. Archer, M. Siddall, and J.F. McManus, 2009: Atmospheric carbon dioxide  
43      concentration across the mid-pleistocene transition. *Science*, doi:[10.1126/science.1171477](https://doi.org/10.1126/science.1171477).
- 44 Hoogakker, B.A.A., H. Elderfield, G. Schmiedl, I.N. McCave, and R.E.M. Rickaby, 2015: Glacial-interglacial changes  
45      in bottom-water oxygen content on the Portuguese margin. *Nature Geoscience*, **8(1)**, 40–43,  
46      doi:[10.1038/ngeo2317](https://doi.org/10.1038/ngeo2317).
- 47 Hoogakker, B.A.A. et al., 2016: Terrestrial biosphere changes over the last 120 kyr. *Climate of the Past*, **12(1)**,  
48      doi:[10.5194/cp-12-51-2016](https://doi.org/10.5194/cp-12-51-2016).
- 49 Hoogakker, B.A.A. et al., 2018: Glacial expansion of oxygen-depleted seawater in the eastern tropical Pacific. *Nature*,  
50      **562(7727)**, 410–413, doi:[10.1038/s41586-018-0589-x](https://doi.org/10.1038/s41586-018-0589-x).
- 51 Hope, P., B.J. Henley, J. Gergis, J. Brown, and H. Ye, 2017: Time-varying spectral characteristics of ENSO over the  
52      Last Millennium. *Climate Dynamics*, **49(5–6)**, 1705–1727, doi:[10.1007/s00382-016-3393-z](https://doi.org/10.1007/s00382-016-3393-z).
- 53 Höpfner, M. et al., 2015: Sulfur dioxide (SO<sub>2</sub>) from MIPAS in the upper troposphere and lower stratosphere  
54      2002–2012. *Atmospheric Chemistry and Physics*, **15(12)**, 7017–7037, doi:[10.5194/acp-15-7017-2015](https://doi.org/10.5194/acp-15-7017-2015).
- 55 Hori, M. et al., 2017: A 38-year (1978–2015) Northern Hemisphere daily snow cover extent product derived using  
56      consistent objective criteria from satellite-borne optical sensors. *Remote Sensing of Environment*, **191**, 402–  
57      418, doi:[10.1016/j.rse.2017.01.023](https://doi.org/10.1016/j.rse.2017.01.023).
- 58 Hou, J., C.-G. Li, and S. Lee, 2019: The temperature record of the Holocene: progress and controversies. *Science  
59      Bulletin*, **64(9)**, 565–566, doi:[10.1016/j.scib.2019.02.012](https://doi.org/10.1016/j.scib.2019.02.012).
- 60 Hou, X., J. Cheng, S. Hu, and G. Feng, 2018: Interdecadal variations in the walker circulation and its connection to

- 1 inhomogeneous air temperature changes from 1961–2012. *Atmosphere*, **9**(12), doi:[10.3390/atmos9120469](https://doi.org/10.3390/atmos9120469).
- 2 Howell, F.W. et al., 2016: Arctic sea ice simulation in the PlioMIP ensemble. *Climate of the Past*, **12**(3), 749–767,  
3 doi:[10.5194/cp-12-749-2016](https://doi.org/10.5194/cp-12-749-2016).
- 4 Howell, S.E.L., C.R. Duguay, and T. Markus, 2009: Sea ice conditions and melt season duration variability within the  
5 Canadian Arctic Archipelago: 1979–2008. *Geophysical Research Letters*, **36**(10), doi:[10.1029/2009gl037681](https://doi.org/10.1029/2009gl037681).
- 6 Hrbáček, F. et al., 2018: Active layer monitoring in Antarctica: an overview of results from 2006 to 2015. *Polar  
7 Geography*, doi:[10.1080/1088937x.2017.1420105](https://doi.org/10.1080/1088937x.2017.1420105).
- 8 Hsin, Y.C., 2015: Multidecadal variations of the surface Kuroshio between 1950s and 2000s and its impacts on  
9 surrounding waters. *Journal of Geophysical Research: Oceans*, **120**(3), 1792–1808,  
10 doi:[10.1002/2014jc010582](https://doi.org/10.1002/2014jc010582).
- 11 Hu, D., Z. Guan, W. Tian, and R. Ren, 2018: Recent strengthening of the stratospheric Arctic vortex response to  
12 warming in the central North Pacific. *Nature Communications*, **9**(1), doi:[10.1038/s41467-018-04138-3](https://doi.org/10.1038/s41467-018-04138-3).
- 13 Hu, Q. et al., 2019: Rainfall spatial estimations: A review from spatial interpolation to multi-source data merging.  
14 *Water (Switzerland)*, **11**(3), 1–30, doi:[10.3390/w11030579](https://doi.org/10.3390/w11030579).
- 15 Hu, Y., H. Huang, and C. Zhou, 2018: Widening and weakening of the Hadley circulation under global warming.  
16 *Science Bulletin*, **63**(10), 640–644, doi:[10.1016/j.scib.2018.04.020](https://doi.org/10.1016/j.scib.2018.04.020).
- 17 Hu, Z.-Z. et al., 2013: Weakened Interannual Variability in the Tropical Pacific Ocean since 2000. *Journal of Climate*,  
18 **26**(8), 2601–2613, doi:[10.1175/jcli-d-12-00265.1](https://doi.org/10.1175/jcli-d-12-00265.1).
- 19 Huang, B., M. L'Heureux, Z.-Z. Hu, X. Yin, and H.-M. Zhang, 2020: How Significant Was the 1877/78 El Niño?  
20 *Journal of Climate*, **33**(11), 4853–4869, doi:[10.1175/jcli-d-19-0650.1](https://doi.org/10.1175/jcli-d-19-0650.1).
- 21 Huang, B. et al., 2015: Extended Reconstructed Sea Surface Temperature Version 4 (ERSST.v4). Part I: Upgrades and  
22 Intercomparisons. *Journal of Climate*, **28**(3), 911–930, doi:[10.1175/jcli-d-14-00006.1](https://doi.org/10.1175/jcli-d-14-00006.1).
- 23 Huang, B. et al., 2016: Further Exploring and Quantifying Uncertainties for Extended Reconstructed Sea Surface  
24 Temperature (ERSST) Version 4 (v4). *Journal of Climate*, **29**(9), 3119–3142, doi:[10.1175/jcli-d-15-0430.1](https://doi.org/10.1175/jcli-d-15-0430.1).
- 25 Huang, B. et al., 2017: Extended Reconstructed Sea Surface Temperature, Version 5 (ERSSTv5): Upgrades,  
26 Validations, and Intercomparisons. *Journal of Climate*, **30**(20), 8179–8205, doi:[10.1175/jcli-d-16-0836.1](https://doi.org/10.1175/jcli-d-16-0836.1).
- 27 Huang, B. et al., 2018: Evaluating SST Analyses with Independent Ocean Profile Observations. *Journal of Climate*,  
28 **31**(13), 5015–5030, doi:[10.1175/jcli-d-17-0824.1](https://doi.org/10.1175/jcli-d-17-0824.1).
- 29 Huang, B. et al., 2019: Uncertainty estimates for sea surface temperature and land surface air temperature in  
30 NOAAGlobalTemp version 5. *Journal of Climate*, **33**(4), 1351–1379, doi:[10.1175/jcli-d-19-0395.1](https://doi.org/10.1175/jcli-d-19-0395.1).
- 31 Huang, H., M. Gutjahr, A. Eisenhauer, and G. Kuhn, 2020: No detectable Weddell Sea Antarctic Bottom Water export  
32 during the Last and Penultimate Glacial Maximum. *Nature Communications*, **11**(1), 424, doi:[10.1038/s41467-020-14302-3](https://doi.org/10.1038/s41467-020-14302-3).
- 33 Huang, R., S. Chen, W. Chen, P. Hu, and B. Yu, 2019: Recent Strengthening of the Regional Hadley Circulation over  
34 the Western Pacific during Boreal Spring. *Advances in Atmospheric Sciences*, **36**, 1251–1264.
- 35 Huang, X. et al., 2019a: Northwestward Migration of the Northern Edge of the East Asian Summer Monsoon During  
36 the Mid-Pliocene Warm Period: Simulations and Reconstructions. *Journal of Geophysical Research: Atmospheres*,  
37 **124**(3), 1392–1404, doi:[10.1029/2018jd028995](https://doi.org/10.1029/2018jd028995).
- 38 Huang, X. et al., 2019b: Northern Hemisphere land monsoon precipitation changes in the twentieth century revealed by  
39 multiple reanalysis datasets. *Climate Dynamics*, **53**(11), 7131–7149, doi:[10.1007/s00382-019-04982-z](https://doi.org/10.1007/s00382-019-04982-z).
- 40 Huffman, G.J. et al., 2007: The TRMM Multisatellite Precipitation Analysis ( TMPA ): Quasi-Global , Multiyear ,  
41 Combined-Sensor Precipitation Estimates at Fine Scales. *Journal of Hydrometeorology*, **8**, 38–55,  
42 doi:[10.1175/jhm560.1](https://doi.org/10.1175/jhm560.1).
- 43 Hugonet, R. et al., 2021: Accelerated global glacier mass loss in the early twenty-first century. *Nature* (in press).
- 44 Hummels, R. et al., 2015: Interannual to decadal changes in the western boundary circulation in the Atlantic at 11°S.  
45 *Geophysical Research Letters*, **42**(18), 7615–7622, doi:[10.1002/2015gl065254](https://doi.org/10.1002/2015gl065254).
- 46 Hurd, C.L., A. Lenton, B. Tilbrook, and P.W. Boyd, 2018: Current understanding and challenges for oceans in a higher-  
47 CO<sub>2</sub> world. *Nature Climate Change*, **8**(8), 686–694, doi:[10.1038/s41558-018-0211-0](https://doi.org/10.1038/s41558-018-0211-0).
- 48 Hyland, E.G., N.D. Sheldon, and J.M. Cotton, 2017: Constraining the early Eocene climatic optimum: A terrestrial  
49 interhemispheric comparison. *Geological Society of America Bulletin*, **129**(1–2), 244–252,  
50 doi:[10.1130/b31493.1](https://doi.org/10.1130/b31493.1).
- 51 Ibarra, D.E. et al., 2018: Warm and cold wet states in the western United States during the Pliocene-Pleistocene.  
52 *Geology*, **46**(4), 355–358, doi:[10.1130/g39962.1](https://doi.org/10.1130/g39962.1).
- 53 IMBIE Consortium, 2018: Mass balance of the Antarctic Ice Sheet from 1992 to 2017. *Nature*, doi:[10.1038/s41586-018-0179-y](https://doi.org/10.1038/s41586-018-0179-y).
- 54 IMBIE Consortium, 2020: BB Mass balance of the Greenland Ice Sheet from 1992 to 2018. *Nature*, **579**(7798), 233–  
55 239, doi:[10.1038/s41586-019-1855-2](https://doi.org/10.1038/s41586-019-1855-2).
- 56 Inglis, G.N. et al., 2020: Global mean surface temperature and climate sensitivity of the EECO, PETM and latest  
57 Paleocene. *Climate of the Past*, **16**(5), 1953–1968, doi:[10.5194/cp-16-1953-2020](https://doi.org/10.5194/cp-16-1953-2020).
- 58 IPCC, 2013: Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis. Contribution of  
59 Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Stocker,  
60 61

- 1 T.F., D. Qin, G.K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex, and P.M. Midgley  
2 (eds.).] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, United Kingdom  
3 and New York, NY, USA, pp. 3–29, doi:[10.1017/cbo9781107415324.004](https://doi.org/10.1017/cbo9781107415324.004).
- 4 IPCC, 2018: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-  
5 industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the  
6 global response to the threat of climate change,. [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J.  
7 Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y.  
8 Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. In Press, 616 pp.
- 9 IPCC, 2019: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate. [Pörtner, H.-O., D.C. Roberts,  
10 V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, and A.  
11 Okem (eds.)]. In Press, 755 pp.
- 12 Irvali, N. et al., 2016: Evidence for regional cooling, frontal advances, and East Greenland Ice Sheet changes during the  
13 demise of the last interglacial. *Quaternary Science Reviews*, **150**, 184–199,  
14 doi:[10.1016/j.quascirev.2016.08.029](https://doi.org/10.1016/j.quascirev.2016.08.029).
- 15 Ishii, M., Fakuda, Y., Hirahara, S., Yasui, S., Suzuki, T., and Sato, K., 2017: Accuracy of global upper ocean heat  
16 content estimation expected from present observational data sets. *SOLA*, **13**, 163–167, doi:[10.2151/sola.2017-030](https://doi.org/10.2151/sola.2017-030).
- 17 Ishino, S. and I. Suto, 2020: Late Pliocene sea-ice expansion and its influence on diatom species turnover in the  
18 Southern Ocean. *Marine Micropaleontology*, **160**, 101895, doi:[10.1016/j.marmicro.2020.101895](https://doi.org/10.1016/j.marmicro.2020.101895).
- 19 Ito, T., A. Nenes, M.S. Johnson, N. Meskhidze, and C. Deutsch, 2016: Acceleration of oxygen decline in the tropical  
20 Pacific over the past decades by aerosol pollutants. *Nature Geoscience*, **9**(6), 443–447, doi:[10.1038/ngeo2717](https://doi.org/10.1038/ngeo2717).
- 21 Ivanova, D.P., P.J. Gleckler, K.E. Taylor, P.J. Durack, and K.D. Marvel, 2016: Moving beyond the total sea ice extent  
22 in gauging model biases. *Journal of Climate*, **29**(24), 8965–8987, doi:[10.1175/jcli-d-16-0026.1](https://doi.org/10.1175/jcli-d-16-0026.1).
- 23 Ivy, D.J., S. Solomon, and H.E. Rieder, 2016: Radiative and dynamical influences on polar stratospheric temperature  
24 trends. *Journal of Climate*, **29**(13), 4927–4938, doi:[10.1175/jcli-d-15-0503.1](https://doi.org/10.1175/jcli-d-15-0503.1).
- 25 Ivy, D.J. et al., 2017: Observed changes in the Southern Hemispheric circulation in May. *Journal of Climate*, **30**(2),  
26 527–536, doi:[10.1175/jcli-d-16-0394.1](https://doi.org/10.1175/jcli-d-16-0394.1).
- 27 Jaber, S.M. and M.M. Abu-Allaban, 2020: TRMM 3B43 Product-Based Spatial and Temporal Anatomy of  
28 Precipitation Trends: Global Perspective. *Environmental Monitoring and Assessment*, **192**(7),  
29 doi:[10.1007/s10661-020-08405-z](https://doi.org/10.1007/s10661-020-08405-z).
- 30 Jaccard, S.L. and E.D. Galbraith, 2012: Large climate-driven changes of oceanic oxygen concentrations during the last  
31 deglaciation. *Nature Geoscience*, **5**(2), 151–156, doi:[10.1038/ngeo1352](https://doi.org/10.1038/ngeo1352).
- 32 Jaccard, S.L., E.D. Galbraith, A. Martínez-García, and R.F. Anderson, 2016: Covariation of deep Southern Ocean  
33 oxygenation and atmospheric CO<sub>2</sub> through the last ice age. *Nature*, **530**(7589), 207–210,  
34 doi:[10.1038/nature16514](https://doi.org/10.1038/nature16514).
- 35 Jackson, L.C. and R.A. Wood, 2020: Fingerprints for Early Detection of Changes in the AMOC. *Journal of Climate*,  
36 **33**(16), 7027–7044, doi:[10.1175/jcli-d-20-0034.1](https://doi.org/10.1175/jcli-d-20-0034.1).
- 37 Jackson, L.C., K.A. Peterson, C.D. Roberts, and R.A. Wood, 2016: Recent slowing of Atlantic overturning circulation  
38 as a recovery from earlier strengthening. *Nature Geoscience*, **9**(7), 518–522, doi:[10.1038/ngeo2715](https://doi.org/10.1038/ngeo2715).
- 39 Jackson, T., H.A. Bouman, S. Sathyendranath, and E. Devred, 2011: Regional-scale changes in diatom distribution in  
40 the Humboldt upwelling system as revealed by remote sensing: implications for fisheries. *ICES Journal of  
41 Marine Science*, **68**(4), 729–736, doi:[10.1093/icesjms/fsq181](https://doi.org/10.1093/icesjms/fsq181).
- 42 Jacobel, A.W., J.F. McManus, R.F. Anderson, and G. Winckler, 2017: Climate-related response of dust flux to the  
43 central equatorial Pacific over the past 150 kyr. *Earth and Planetary Science Letters*, **457**, 160–172,  
44 doi:[10.1016/j.epsl.2016.09.042](https://doi.org/10.1016/j.epsl.2016.09.042).
- 45 James, M., A.G. Lewkowicz, S.L. Smith, and C.M. Miceli, 2013: Multi-decadal degradation and persistence of  
46 permafrost in the Alaska Highway corridor, northwest Canada. *Environmental Research Letters*, **8**(4), 045013,  
47 doi:[10.1088/1748-9326/8/4/045013](https://doi.org/10.1088/1748-9326/8/4/045013).
- 48 Jansen, E. et al., 2020: Past perspectives on the present era of abrupt Arctic climate change. *Nature Climate Change*,  
49 **10**(8), 714–721, doi:[10.1038/s41558-020-0860-7](https://doi.org/10.1038/s41558-020-0860-7).
- 50 Jaramillo, F. and G. Destouni, 2015: Local flow regulation and irrigation raise global human water consumption and  
51 footprint. *Science*, **350**(6265), 1248–1251, doi:[10.1126/science.aad1010](https://doi.org/10.1126/science.aad1010).
- 52 Jeong, D., L. Sushama, and M. Naveed Khaliq, 2017: Attribution of spring snow water equivalent (SWE) changes over  
53 the northern hemisphere to anthropogenic effects. *Climate Dynamics*, **48**, 3645–3658, doi:[10.1007/s00382-016-3291-4](https://doi.org/10.1007/s00382-016-3291-4).
- 54 Jian, Z. et al., 2000: Holocene variability of the Kuroshio Current in the Okinawa Trough, northwestern Pacific Ocean.  
55 *Earth and Planetary Science Letters*, **184**(1), 305–319, doi:[10.1016/s0012-821x\(00\)00321-6](https://doi.org/10.1016/s0012-821x(00)00321-6).
- 56 Jiang, C. et al., 2017: Inconsistencies of interannual variability and trends in long-term satellite leaf area index products.  
57 *Global Change Biology*, **23**(10), 4133–4146, doi:[10.1111/gcb.13787](https://doi.org/10.1111/gcb.13787).
- 58 Jiang, N. and C. Zhu, 2018: Asymmetric Changes of ENSO Diversity Modulated by the Cold Tongue Mode Under  
59 Recent Global Warming. *Geophysical Research Letters*, **45**(22), 12,506–512,513, doi:[10.1029/2018gl079494](https://doi.org/10.1029/2018gl079494).

- 1 Jiang, N., W. Qian, and J.C.H. Leung, 2016: The global monsoon division combining the k-means clustering method  
2 and low-level cross-equatorial flow. *Climate Dynamics*, **47(7–8)**, 2345–2359, doi:[10.1007/s00382-015-2967-5](https://doi.org/10.1007/s00382-015-2967-5).
- 3 Jin, D., S.N. Hameed, and L. Huo, 2016: Recent Changes in ENSO Teleconnection over the Western Pacific Impacts  
4 the Eastern China Precipitation Dipole. *Journal of Climate*, **29(21)**, 7587–7598, doi:[10.1175/jcli-d-16-0235.1](https://doi.org/10.1175/jcli-d-16-0235.1).
- 5 Jin, X. et al., 2018: Influences of Pacific Climate Variability on Decadal Subsurface Ocean Heat Content Variations in  
6 the Indian Ocean. *Journal of Climate*, **31(10)**, 4157–4174, doi:[10.1175/jcli-d-17-0654.1](https://doi.org/10.1175/jcli-d-17-0654.1).
- 7 Johnson, G.C. and J.M. Lyman, 2020: Warming trends increasingly dominate global ocean. *Nature Climate Change*,  
8 **10(8)**, 757–761, doi:[10.1038/s41558-020-0822-0](https://doi.org/10.1038/s41558-020-0822-0).
- 9 Johnson, G.C. et al., 2020: Ocean heat content. In State of the Climate in 2019, Global Oceans. *Bull. Am. Meteorol.  
10 Soc.*, **101(8)**, S140–S144, doi:[10.1175/bams-d-20-0105.1](https://doi.org/10.1175/bams-d-20-0105.1).
- 11 Johnson, J.S., K.A. Nichols, B.M. Goehring, G. Balco, and J.M. Schaefer, 2019: Abrupt mid-Holocene ice loss in the  
12 western Weddell Sea Embayment of Antarctica. *Earth and Planetary Science Letters*, **518**, 127–135,  
13 doi:[10.1016/j.epsl.2019.05.002](https://doi.org/10.1016/j.epsl.2019.05.002).
- 14 Johnson, J.S. et al., 2014: Rapid thinning of pine island glacier in the early holocene. *Science*, **343(6174)**, 999–1001,  
15 doi:[10.1126/science.1247385](https://doi.org/10.1126/science.1247385).
- 16 Johnson, N.C., 2013: How Many ENSO Flavors Can We Distinguish? *Journal of Climate*, **26(13)**, 4816–4827,  
17 doi:[10.1175/jcli-d-12-00649.1](https://doi.org/10.1175/jcli-d-12-00649.1).
- 18 Jones, B.M. et al., 2016: Presence of rapidly degrading permafrost plateaus in south-central Alaska. *The Cryosphere*,  
19 **10(6)**, 2673–2692, doi:[10.5194/tc-10-2673-2016](https://doi.org/10.5194/tc-10-2673-2016).
- 20 Jones, E.M. et al., 2017: Ocean acidification and calcium carbonate saturation states in the coastal zone of the West  
21 Antarctic Peninsula. *Deep Sea Research Part II: Topical Studies in Oceanography*, **139**, 181–194,  
22 doi:[10.1016/j.dsr2.2017.01.007](https://doi.org/10.1016/j.dsr2.2017.01.007).
- 23 Jones, G.S., 2020: 'Apples and Oranges': On comparing simulated historic near-surface temperature changes with  
24 observations. *Quarterly Journal of the Royal Meteorological Society*, **146**, 3747–3771, doi:[10.1002/qj.3871](https://doi.org/10.1002/qj.3871).
- 25 Jones, J.M. et al., 2016: Assessing recent trends in high-latitude Southern Hemisphere surface climate. *Nature Climate  
Change*, **6**, 917, doi:[10.1038/nclimate3103](https://doi.org/10.1038/nclimate3103).
- 26 Jones, P.D., C. Harpham, and B.M. Vinther, 2014: Winter-responding proxy temperature reconstructions and the North  
27 Atlantic Oscillation. *Journal of Geophysical Research: Atmospheres*, **119**, 6497–6505,  
28 doi:[10.1002/2014jd021561](https://doi.org/10.1002/2014jd021561).
- 29 Jones, P.D. et al., 2012: Hemispheric and large-scale land-surface air temperature variations: An extensive revision and  
30 an update to 2010. *Journal of Geophysical Research: Atmospheres*, **117(D5)**, doi:[10.1029/2011jd017139](https://doi.org/10.1029/2011jd017139).
- 31 Jones, R.S. et al., 2015: Rapid Holocene thinning of an East Antarctic outlet glacier driven by marine ice sheet  
32 instability. *Nature Communications*, **6**, doi:[10.1038/ncomms9910](https://doi.org/10.1038/ncomms9910).
- 33 Jongeward, A.R., Z. Li, H. He, and X. Xiong, 2016: Natural and Anthropogenic Aerosol Trends from Satellite and  
34 Surface Observations and Model Simulations over the North Atlantic Ocean from 2002 to 2012. *Journal of the  
35 Atmospheric Sciences*, **73(11)**, 4469–4485, doi:[10.1175/jas-d-15-0308.1](https://doi.org/10.1175/jas-d-15-0308.1).
- 36 Jonkers, L., H. Hillebrand, and M. Kucera, 2019: Global change drives modern plankton communities away from the  
37 pre-industrial state. *Nature*, **570(7761)**, 372–375, doi:[10.1038/s41586-019-1230-3](https://doi.org/10.1038/s41586-019-1230-3).
- 38 Josey, S.A. et al., 2018: The Recent Atlantic Cold Anomaly: Causes, Consequences, and Related Phenomena. *Annual  
39 Review of Marine Science*, **10**, 475–501, doi:[10.1146/annurev-marine-121916-063102](https://doi.org/10.1146/annurev-marine-121916-063102).
- 40 Joyce, R.J., J.E. Janowiak, P.A. Arkin, and P. Xie, 2004: CMORPH : A Method that Produces Global Precipitation  
41 Estimates from Passive Microwave and Infrared Data at High Spatial and Temporal Resolution. *Journal of  
42 Hydrometeorology*, **5(3)**, 487–503, doi:[10.1175/1525-7541\(2004\)005<0487:camtpg>2.0.co;2](https://doi.org/10.1175/1525-7541(2004)005<0487:camtpg>2.0.co;2).
- 43 Jung, M.-P., K.-M. Shim, Y. Kim, and I.-T. Choi, 2015: Change of Climatic Growing Season in Korea. *Korean Journal  
44 of Environmental Agriculture*, **34**, 192–195, doi:[10.5338/kjea.2015.34.3.27](https://doi.org/10.5338/kjea.2015.34.3.27).
- 45 Jungclaus, J.H. et al., 2017: The PMIP4 contribution to CMIP6 - Part 3: The last millennium, scientific objective, and  
46 experimental design for the PMIP4 past1000 simulations. *Geoscientific Model Development*, **10(11)**, 4005–  
47 4033, doi:[10.5194/gmd-10-4005-2017](https://doi.org/10.5194/gmd-10-4005-2017).
- 48 Junod, R.A. and J.R. Christy, 2020a: A new compilation of globally gridded night-time marine air temperatures: The  
49 UAHNMATv1 dataset. *International Journal of Climatology*, **40(5)**, 2609–2623, doi:[10.1002/joc.6354](https://doi.org/10.1002/joc.6354).
- 50 Junod, R.A. and J.R. Christy, 2020b: A new compilation of globally gridded night-time marine air temperatures: The  
51 UAHNMATv1 dataset. *International Journal of Climatology*, **40(5)**, 2609–2623, doi:[10.1002/joc.6354](https://doi.org/10.1002/joc.6354).
- 52 Jurikova, H. et al., 2020: Permian–Triassic mass extinction pulses driven by major marine carbon cycle perturbations.  
53 *Nature Geoscience*, **13(11)**, 745–750, doi:[10.1038/s41561-020-00646-4](https://doi.org/10.1038/s41561-020-00646-4).
- 54 Kadow, C., D.M. Hall, and U. Ulbrich, 2020a: Artificial intelligence reconstructs missing climate information. *Nature  
55 Geoscience*, **13(6)**, 408–413, doi:[10.1038/s41561-020-0582-5](https://doi.org/10.1038/s41561-020-0582-5).
- 56 Kadow, C., D.M. Hall, and U. Ulbrich, 2020b: Artificial intelligence reconstructs missing climate information. *Nature  
57 Geoscience*, **13(6)**, 408–413, doi:[10.1038/s41561-020-0582-5](https://doi.org/10.1038/s41561-020-0582-5).
- 58 Kageyama, M. et al., 2017: The PMIP4 contribution to CMIP6 – Part 4: Scientific objectives and experimental design  
59 of the PMIP4-CMIP6 Last Glacial Maximum experiments and PMIP4 sensitivity experiments. *Geoscientific  
60 Model Development*, **10(11)**, 4035–4055, doi:[10.5194/gmd-10-4035-2017](https://doi.org/10.5194/gmd-10-4035-2017).

- 1 Kageyama, M. et al., 2020: The PMIP4-CMIP6 Last Glacial Maximum experiments: preliminary results and  
2 comparison with the PMIP3-CMIP5 simulations. *Climate of the Past Discussions*, **2020**, 1–37, doi:[10.5194/cp-  
3 2019-169](https://doi.org/10.5194/cp-2019-169).
- 4 Kageyama, M. et al., 2021: A multi-model CMIP6-PMIP4 study of Arctic sea ice at 127ka: sea ice data compilation and  
5 model differences. *Climate of the Past*, **17**(1), 37–62, doi:[10.5194/cp-17-37-2021](https://doi.org/10.5194/cp-17-37-2021).
- 6 Kalansky, J., Rosenthal, Y., Herbert, T., Bova, S., Altabet, M., 2015: Southern Ocean contributions to the Eastern  
7 Equatorial Pacific heat content during the Holocene. *Earth and Planetary Science Letters*, **424**, 158–167,  
8 doi:[10.1016/j.epsl.2015.05.013](https://doi.org/10.1016/j.epsl.2015.05.013).
- 9 Kamae, Y., X. Li, S.P. Xie, and H. Ueda, 2017: Atlantic effects on recent decadal trends in global monsoon. *Climate  
10 Dynamics*, **49**(9–10), 3443–3455, doi:[10.1007/s00382-017-3522-3](https://doi.org/10.1007/s00382-017-3522-3).
- 11 Kanner, L.C., S.J. Burns, H. Cheng, R.L. Edwards, and M. Vuille, 2013: High-resolution variability of the South  
12 American summer monsoon over the last seven millennia: Insights from a speleothem record from the central  
13 Peruvian Andes. *Quaternary Science Reviews*, **75**, 1–10, doi:[10.1016/j.quascirev.2013.05.008](https://doi.org/10.1016/j.quascirev.2013.05.008).
- 14 Kao, A., X. Jiang, L. Li, H. Su, and Y. Yung, 2017: Precipitation, circulation, and cloud variability over the past two  
15 decades. *Earth and Space Science*, **4**, 597–606, doi:[10.1002/2017ea000319](https://doi.org/10.1002/2017ea000319).
- 16 Kaplan, J. et al., 2017: Constraining the Deforestation History of Europe: Evaluation of Historical Land Use Scenarios  
17 with Pollen-Based Land Cover Reconstructions. *Land*, **6**(4), 91, doi:[10.3390/land6040091](https://doi.org/10.3390/land6040091).
- 18 Kaplan, M.R. et al., 2016: Patagonian and southern South Atlantic view of Holocene climate. *Quaternary Science  
19 Reviews*, doi:[10.1016/j.quascirev.2016.03.014](https://doi.org/10.1016/j.quascirev.2016.03.014).
- 20 Karamperidou, C., P.N. Di Nezio, A. Timmermann, F.-F. Jin, and K.M. Cobb, 2015: The response of ENSO flavors to  
21 mid-Holocene climate: Implications for proxy interpretation. *Paleoceanography*, **30**(5), 527–547,  
22 doi:[10.1002/2014pa002742](https://doi.org/10.1002/2014pa002742).
- 23 Kassi, J.-B. et al., 2018: Remotely Sensing the Biophysical Drivers of Sardinella aurita Variability in Ivorian Waters.  
24 *Remote Sensing*, **10**(5), 785, doi:[10.3390/rs10050785](https://doi.org/10.3390/rs10050785).
- 25 Kaufman, D. et al., 2020a: Holocene global mean surface temperature, a multi-method reconstruction approach (2020a).  
26 *Scientific Data*, **7**(1), 201, doi:[10.1038/s41597-020-0530-7](https://doi.org/10.1038/s41597-020-0530-7).
- 27 Kaufman, D. et al., 2020b: A global database of Holocene paleotemperature records (2020b). *Scientific Data*, **7**(1), 115,  
28 doi:[10.1038/s41597-020-0445-3](https://doi.org/10.1038/s41597-020-0445-3).
- 29 Kayano, M.T., R.V. Andreoli, and R.A.F. Souza, 2019: El Niño–Southern Oscillation related teleconnections over  
30 South America under distinct Atlantic Multidecadal Oscillation and Pacific Interdecadal Oscillation  
31 backgrounds: La Niña. *International Journal of Climatology*, **39**(3), 1359–1372, doi:[10.1002/joc.5886](https://doi.org/10.1002/joc.5886).
- 32 Keeling, C.D., J.F.S. Chin, and T.P. Whorf, 1996: Increased activity of northern vegetation inferred from atmospheric  
33 CO<sub>2</sub> measurements. *Nature*, **382**, 146–149, doi:[10.1038/382146a0](https://doi.org/10.1038/382146a0).
- 34 Keenan, T.F. and W.J. Riley, 2018: Greening of the land surface in the world’s cold regions consistent with recent  
35 warming. *Nature Climate Change*, **8**, 825–828, doi:[10.1038/s41558-018-0258-y](https://doi.org/10.1038/s41558-018-0258-y).
- 36 Keenlyside, N. et al., 2015: North Atlantic Multi-Decadal Variability – Mechanisms and Predictability. In: *Climate  
37 Change: Multidecadal and Beyond* [Chang, C.-P., M. Ghil, M. Latif, and J.M. Wallace (eds.)]. World  
38 Scientific, pp. 141–157, doi:[10.1142/9789814579933\\_0007](https://doi.org/10.1142/9789814579933_0007).
- 39 Keigwin, L.D. and M.S. Cook, 2007: A role for North Pacific salinity in stabilizing North Atlantic climate.  
40 *Paleoceanography*, **22**(3), doi:[10.1029/2007pa001420](https://doi.org/10.1029/2007pa001420).
- 41 Keil, P. et al., 2020: Multiple drivers of the North Atlantic warming hole. *Nature Climate Change*, **10**(7), 667–671,  
42 doi:[10.1038/s41558-020-0819-8](https://doi.org/10.1038/s41558-020-0819-8).
- 43 Kemp, A.C. et al., 2018a: Relative sea-level change in Newfoundland, Canada, during the past ~3000 years.  
44 *Quaternary Science Reviews*, **201**, 89–110, doi:[10.1016/j.quascirev.2018.10.012](https://doi.org/10.1016/j.quascirev.2018.10.012).
- 45 Kemp, A.C. et al., 2018b: Relative sea-level change in Newfoundland, Canada, during the past ~3000 years.  
46 *Quaternary Science Reviews*, **201**, 89–110, doi:[10.1016/j.quascirev.2018.10.012](https://doi.org/10.1016/j.quascirev.2018.10.012).
- 47 Kennedy, J.J., 2014: A review of uncertainty in in situ measurements and data sets of sea surface temperature. *Reviews  
48 of Geophysics*, **52**(1), 1–32, doi:[10.1002/2013rg000434](https://doi.org/10.1002/2013rg000434).
- 49 Kennedy, J.J., N.A. Rayner, C.P. Atkinson, and R.E. Killick, 2019: An ensemble data set of sea-surface temperature  
50 change from 1850: the Met Office 1 Hadley Centre HadSST.4.0.0.0 data set. *Journal of Geophysical Research  
51 Atmospheres*, **124**(14), 7719–7763, doi:[10.1029/2018jd029867](https://doi.org/10.1029/2018jd029867).
- 52 Kennedy, J.J., N.A. Rayner, R.O. Smith, D.E. Parker, and M. Saunby, 2011: Reassessing biases and other uncertainties  
53 in sea surface temperature observations measured in situ since 1850: 1. Measurement and sampling  
54 uncertainties. *Journal of Geophysical Research: Atmospheres*, **116**(D14), doi:[10.1029/2010jd015218](https://doi.org/10.1029/2010jd015218).
- 55 Kent, E.C. and A. Kaplan, 2006: Toward Estimating Climatic Trends in SST. Part III: Systematic Biases. *Journal of  
56 Atmospheric and Oceanic Technology*, **23**(3), 487–500, doi:[10.1175/jtech1845.1](https://doi.org/10.1175/jtech1845.1).
- 57 Kent, E.C. and J.J. Kennedy, 2021: Historical Estimates of Surface Marine Temperatures. *Annual Review of Marine  
58 Science*, **13**(1), 283–311, doi:[10.1146/annurev-marine-042120-111807](https://doi.org/10.1146/annurev-marine-042120-111807).
- 59 Kent, E.C., S. Fangohr, and D.I. Berry, 2013: A comparative assessment of monthly mean wind speed products over the  
60 global ocean. *International Journal of Climatology*, **33**, 2520–2541, doi:[10.1002/joc.3606](https://doi.org/10.1002/joc.3606).
- 61 Kent, E.C., D.I. Berry, and J.B. Roberts, 2014a: A comparison of global marine surface-specific humidity datasets from

- 1           in situ observations and atmospheric reanalysis. *International Journal of Climatology*, **37***6*, 355–376,  
2           doi:[10.1002/joc.3691](https://doi.org/10.1002/joc.3691).
- 3 Kent, E.C., D.I. Berry, and J.B. Roberts, 2014b: A comparison of global marine surface-specific humidity datasets from  
4           in situ observations and atmospheric reanalysis. *International Journal of Climatology*, **37***6*, 355–376,  
5           doi:[10.1002/joc.3691](https://doi.org/10.1002/joc.3691).
- 6 Kent, E.C. et al., 2017: A Call for New Approaches to Quantifying Biases in Observations of Sea Surface Temperature.  
7           *Bulletin of the American Meteorological Society*, **98**(8), 1601–1616, doi:[10.1175/bams-d-15-00251.1](https://doi.org/10.1175/bams-d-15-00251.1).
- 8 Kersalé, M. et al., 2020: Highly variable upper and abyssal overturning cells in the South Atlantic. *Science Advances*,  
9           **6**(32), eaba7573, doi:[10.1126/sciadv.aba7573](https://doi.org/10.1126/sciadv.aba7573).
- 10 Khan, N.S. et al., 2017: Drivers of Holocene sea-level change in the Caribbean. *Quaternary Science Reviews*, **155**, 13–  
11           36, doi:[10.1016/j.quascirev.2016.08.032](https://doi.org/10.1016/j.quascirev.2016.08.032).
- 12 Khan, S.A. et al., 2020: Centennial response of Greenland's three largest outlet glaciers. *Nature Communications*,  
13           **11**(1), doi:[10.1038/s41467-020-19580-5](https://doi.org/10.1038/s41467-020-19580-5).
- 14 Khaykin, S.M. et al., 2017: Postmillennium changes in stratospheric temperature consistently resolved by GPS radio  
15           occultation and AMSU observations. *Geophysical Research Letters*, **44**(14), 7510–7518,  
16           doi:[10.1002/2017gl074353](https://doi.org/10.1002/2017gl074353).
- 17 Kilbourne, K.H., M.A. Alexander, and J.A. Nye, 2014: A low latitude paleoclimate perspective on Atlantic  
18           multidecadal variability. *Journal of Marine Systems*, **133**, 4–13, doi:[10.1016/j.jmarsys.2013.09.004](https://doi.org/10.1016/j.jmarsys.2013.09.004).
- 19 Kim, B.-M. et al., 2014: Weakening of the stratospheric polar vortex by Arctic sea-ice loss. *Nature Communications*,  
20           **5**(1), 4646, doi:[10.1038/ncomms5646](https://doi.org/10.1038/ncomms5646).
- 21 Kim, H., 2019: Hydrological cycle: river discharge and runoff [in “State of the Climate in 2018”]. *Bull. Am. Meteorol.  
22 Soc.*, **100**(9), S35–S37, doi:[10.1175/2019bamsstateoftheclimate.1](https://doi.org/10.1175/2019bamsstateoftheclimate.1).
- 23 Kim, J.C. and K. Pai, 2015: Recent recovery of surface wind speed after decadal decrease: a focus on South Korea.  
24           *Climate Dynamics*, **45**, 1699–1712, doi:[10.1007/s00382-015-2546-9](https://doi.org/10.1007/s00382-015-2546-9).
- 25 Kim, S.-H. and K.-J. Ha, 2015: Two leading modes of Northern Hemisphere blocking variability in the boreal  
26           wintertime and their relationship with teleconnection patterns. *Climate Dynamics*, **44**, 2479–2491,  
27           doi:[10.1007/s00382-014-2304-4](https://doi.org/10.1007/s00382-014-2304-4).
- 28 King, A.D., D.J. Karoly, and B.J. Henley, 2017: Australian climate extremes at 1.5 °C and 2 °C of global warming.  
29           *Nature Climate Change*, **7**(6), 412–416, doi:[10.1038/nclimate3296](https://doi.org/10.1038/nclimate3296).
- 30 King, J. et al., 2018: Comparison of Freeboard Retrieval and Ice Thickness Calculation From ALS, ASIRAS, and  
31           CryoSat-2 in the Norwegian Arctic to Field Measurements Made During the N-ICE2015 Expedition. *Journal  
32           of Geophysical Research: Oceans*, **123**(2), 1123–1141, doi:[10.1002/2017jc013233](https://doi.org/10.1002/2017jc013233).
- 33 King, J.C. and S.A. Harangozo, 1998: Climate change in the western Antarctic Peninsula since 1945: Observations and  
34           possible causes. *Annals of Glaciology*, 571–575, doi:[10.3189/1998aog27-1-571-575](https://doi.org/10.3189/1998aog27-1-571-575).
- 35 Kingslake, J. et al., 2018: Extensive retreat and re-advance of the West Antarctic Ice Sheet during the Holocene.  
36           *Nature*, **558**(7710), 430–434, doi:[10.1038/s41586-018-0208-x](https://doi.org/10.1038/s41586-018-0208-x).
- 37 Kinne, S., 2019: Aerosol radiative effects with MACv2. *Atmospheric Chemistry and Physics*, **19**(16), 10919–10959,  
38           doi:[10.5194/acp-19-10919-2019](https://doi.org/10.5194/acp-19-10919-2019).
- 39 Kirschke, S. et al., 2013: Three decades of global methane sources and sinks. *Nature Geoscience*, **6**, 813–823,  
40           doi:[10.1038/ngeo1955](https://doi.org/10.1038/ngeo1955).
- 41 Kirtland Turner, S., 2018: Constraints on the onset duration of the Paleocene–Eocene Thermal Maximum.  
42           *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*,  
43           doi:[10.1098/rsta.2017.0082](https://doi.org/10.1098/rsta.2017.0082).
- 44 Kitoh, A. et al., 2013a: Monsoons in a changing world : A regional perspective in a global context. *Journal of  
45           Geophysical Research Atmospheres*, **118**, 3053–3065, doi:[10.1002/jgrd.50258](https://doi.org/10.1002/jgrd.50258).
- 46 Kitoh, A. et al., 2013b: Monsoons in a changing world : A regional perspective in a global context. *Journal of  
47           Geophysical Research Atmospheres*, **118**, 3053–3065, doi:[10.1002/jgrd.50258](https://doi.org/10.1002/jgrd.50258).
- 48 Kjeldsen, K.K. et al., 2015: Spatial and temporal distribution of mass loss from the Greenland Ice Sheet since AD 1900.  
49           *Nature*, **528**, 396–400, doi:[10.1038/nature16183](https://doi.org/10.1038/nature16183).
- 50 Knies, J. et al., 2014: The emergence of modern sea ice cover in the Arctic Ocean. *Nature Communications*, **5**(1), 5608,  
51           doi:[10.1038/ncomms6608](https://doi.org/10.1038/ncomms6608).
- 52 Knutson, T.R. and F. Zeng, 2018: Model assessment of observed precipitation trends over land regions: Detectable  
53           human influences and possible low bias in model trends. *Journal of Climate*, **31**(12), 4617–4637,  
54           doi:[10.1175/jcli-d-17-0672.1](https://doi.org/10.1175/jcli-d-17-0672.1).
- 55 Knutz, P.C. et al., 2019: Eleven phases of Greenland Ice Sheet shelf-edge advance over the past 2.7 million years.  
56           *Nature Geoscience*, **12**(5), doi:[10.1038/s41561-019-0340-8](https://doi.org/10.1038/s41561-019-0340-8).
- 57 Kobashi, T. et al., 2017: Volcanic influence on centennial to millennial Holocene Greenland temperature change.  
58           *Scientific Reports*, **7**(1), 1441, doi:[10.1038/s41598-017-01451-7](https://doi.org/10.1038/s41598-017-01451-7).
- 59 Kobayashi, S. et al., 2015: The JRA-55 reanalysis: General specifications and basic characteristics. *Journal of the  
60           Meteorological Society of Japan. Ser. II*, **93**(1), 5–48, doi:[10.2151/jmsj.2015-001](https://doi.org/10.2151/jmsj.2015-001).
- 61 Koeller, P. et al., 2009: Basin-Scale Coherence in Phenology of Shrimps and Phytoplankton in the North Atlantic

- 1 Ocean. *Science*, **324**(5928), 791, doi:[10.1126/science.1170987](https://doi.org/10.1126/science.1170987).
- 2 Koenig, S.J. et al., 2015: Ice sheet model dependency of the simulated Greenland Ice Sheet in the mid-Pliocene.  
*Climate of the Past*, **11**(3), doi:[10.5194/cp-11-369-2015](https://doi.org/10.5194/cp-11-369-2015).
- 3 Koffman, B.G. et al., 2014: Centennial-scale variability of the Southern Hemisphere westerly wind belt in the eastern  
4 Pacific over the past two millennia. *Climate of the Past*, **10**(3), 112–125, doi:[10.5194/cp-10-1125-2014](https://doi.org/10.5194/cp-10-1125-2014).
- 5 Köhler, P., B. de Boer, A.S. von der Heydt, L.B. Stap, and R.S.W. van de Wal, 2015: On the state dependency of the  
6 equilibrium climate sensitivity during the last 5 million years. *Climate of the Past*, **11**(12), 1801–1823,  
7 doi:[10.5194/cp-11-1801-2015](https://doi.org/10.5194/cp-11-1801-2015).
- 8 Kokelj, S., T.C. Lantz, J. Tunnicliffe, R. Segal, and D. Lacelle, 2017: Climate-driven thaw of permafrost preserved  
9 glacial landscapes, northwestern Canada. *Geology*, **45**(4), 371–374, doi:[10.1130/g38626.1](https://doi.org/10.1130/g38626.1).
- 10 Kong, D., Q. Zhang, V.P. Singh, and P. Shi, 2017: Seasonal vegetation response to climate change in the Northern  
11 Hemisphere (1982–2013). *Global and Planetary Change*, doi:[10.1016/j.gloplacha.2016.10.020](https://doi.org/10.1016/j.gloplacha.2016.10.020).
- 12 Kononova, N.K. and A.R. Lupo, 2020: Changes in the dynamics of the Northern Hemisphere atmospheric circulation  
13 and the relationship to surface temperature in the 20th and 21st centuries. *Atmosphere*, **11**(255),  
14 doi:[10.3390/atmos11030255](https://doi.org/10.3390/atmos11030255).
- 15 Konopka, P., F. Ploeger, M. Tao, and M. Riese, 2016: Zonally resolved impact of ENSO on the stratospheric circulation  
16 and water vapor entry values. *Journal of Geophysical Research: Atmospheres*, **121**(19), 11,411–486,501,  
17 doi:[10.1002/2015jd024698](https://doi.org/10.1002/2015jd024698).
- 18 Kopp, R.E. et al., 2016a: Temperature-driven global sea-level variability in the Common Era. *Proceedings of the  
19 National Academy of Sciences*, **113**(11), E1434–E1441, doi:[10.1073/pnas.1517056113](https://doi.org/10.1073/pnas.1517056113).
- 20 Kopp, R.E. et al., 2016b: Temperature-driven global sea-level variability in the Common Era. *Proceedings of the  
21 National Academy of Sciences*, **113**(11), E1434–E1441, doi:[10.1073/pnas.1517056113](https://doi.org/10.1073/pnas.1517056113).
- 22 Kosaka, Y. and S.-P. Xie, 2013: Recent global-warming hiatus tied to equatorial Pacific surface cooling. *Nature*,  
23 **501**(7467), 403–407, doi:[10.1038/nature12534](https://doi.org/10.1038/nature12534).
- 24 Kousari, M.R., H. Ahani, and H. Hakimelahi, 2013: An investigation of near-surface wind speed trends in arid and  
25 semiarid regions of Iran. *Theoretical and Applied Climatology*, **114**, 153–168, doi:[10.1007/s00704-012-0811-y](https://doi.org/10.1007/s00704-012-0811-y).
- 26 Koutavas, A. and S. Joanides, 2012: El Niño–Southern Oscillation extrema in the Holocene and Last Glacial Maximum.  
27 *Paleoceanography*, **27**(4), PA4208, doi:[10.1029/2012pa002378](https://doi.org/10.1029/2012pa002378).
- 28 Kovács, T. et al., 2017: Determination of the atmospheric lifetime and global warming potential of sulfur hexafluoride  
29 using a three-dimensional model. *Atmospheric Chemistry and Physics*, **17**(2), 883–898, doi:[10.5194/acp-17-883-2017](https://doi.org/10.5194/acp-17-883-2017).
- 30 Kremer, A. et al., 2018: Changes in sea ice cover and ice sheet extent at the Yermak Plateau during the last 160 ka –  
31 Reconstructions from biomarker records. *Quaternary Science Reviews*, **182**, 93–108,  
32 doi:[10.1016/j.quascirev.2017.12.016](https://doi.org/10.1016/j.quascirev.2017.12.016).
- 33 Kremser, S. et al., 2016: Stratospheric aerosol - Observations, processes, and impact on climate. *Reviews of Geophysics*,  
34 **54**, doi:[10.1002/2015rg000511](https://doi.org/10.1002/2015rg000511).
- 35 Kretschmer, M. et al., 2018: More-persistent weak stratospheric polar vortex States linked to cold extremes. *Bulletin of  
36 the American Meteorological Society*, **99**(1), 49–60, doi:[10.1175/bams-d-16-0259.1](https://doi.org/10.1175/bams-d-16-0259.1).
- 37 Krishnamurthy, L. and V. Krishnamurthy, 2016: Decadal and interannual variability of the Indian Ocean SST. *Climate  
38 Dynamics*, **46**(1), 57–70, doi:[10.1007/s00382-015-2568-3](https://doi.org/10.1007/s00382-015-2568-3).
- 39 Krivova, N. A., Solanki, S. K., and Floyd, L., 2006: Reconstruction of solar UV irradiance in cycle~23. *A&A*, **452**(2),  
40 631–639, doi:[10.1051/0004-6361:20064809](https://doi.org/10.1051/0004-6361:20064809).
- 41 Krumpen, T. et al., 2019: Arctic warming interrupts the Transpolar Drift and affects long-range transport of sea ice and  
42 ice-rafterd matter. *Scientific Reports*, **9**(1), 5459, doi:[10.1038/s41598-019-41456-y](https://doi.org/10.1038/s41598-019-41456-y).
- 43 Kukal, M.S. and S. Irmak, 2018: U.S. Agro-Climate in 20th Century: Growing Degree Days, First and Last Frost,  
44 Growing Season Length, and Impacts on Crop Yields. *Scientific Reports*, **8**(6977), doi:[10.1038/s41598-018-25212-2](https://doi.org/10.1038/s41598-018-25212-2).
- 45 Kunkel, K.E. et al., 2016: Trends and Extremes in Northern Hemisphere Snow Characteristics. *Current Climate Change  
46 Reports*, **2**, 65–73, doi:[10.1007/s40641-016-0036-8](https://doi.org/10.1007/s40641-016-0036-8).
- 47 Kürschner, W.M., J. van der Burgh, H. Visscher, and D.L. Dilcher, 1996: Oak leaves as biosensors of late neogene and  
48 early pleistocene paleoatmospheric CO<sub>2</sub> concentrations. *Marine Micropaleontology*, **27**(1–4), 299–312,  
49 doi:[10.1016/0377-8398\(95\)00067-4](https://doi.org/10.1016/0377-8398(95)00067-4).
- 50 Kuusela, M. and M.L. Stein, 2018: Locally stationary spatio-temporal interpolation of Argo profiling float data.  
51 *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, **474**(2220), 20180400,  
52 doi:[10.1098/rspa.2018.0400](https://doi.org/10.1098/rspa.2018.0400).
- 53 Kwok, R., 2018a: Arctic sea ice thickness, volume, and multiyear ice coverage: Losses and coupled variability (1958–  
54 2018). *Environmental Research Letters*, **13**(10), 105005, doi:[10.1088/1748-9326/aae3ec](https://doi.org/10.1088/1748-9326/aae3ec).
- 55 Kwok, R., 2018b: Arctic sea ice thickness, volume, and multiyear ice coverage: Losses and coupled variability (1958–  
56 2018). *Environmental Research Letters*, **13**(10), 105005, doi:[10.1088/1748-9326/aae3ec](https://doi.org/10.1088/1748-9326/aae3ec).
- 57 Kwok, R. and G.F. Cunningham, 2015: Variability of arctic sea ice thickness and volume from CryoSat-2.

- 1                   *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, **373**,  
2                   2045, doi:[10.1098/rsta.2014.0157](https://doi.org/10.1098/rsta.2014.0157).
- 3 Kwon, M.H., S.-W. Yeh, Y.-G. Park, and Y.-K. Lee, 2013: Changes in the linear relationship of ENSO–PDO under the  
4                   global warming. *International Journal of Climatology*, **33**(5), 1121–1128, doi:[10.1002/joc.3497](https://doi.org/10.1002/joc.3497).
- 5 Kylander, M.E. et al., 2016: Potentials and problems of building detailed dust records using peat archives: An example  
6                   from Store Mosse (the “Great Bog”), Sweden. *Geochim. Cosmochim.*, **190**, 156–174,  
7                   doi:[10.1016/j.gca.2016.06.028](https://doi.org/10.1016/j.gca.2016.06.028).
- 8 L’Heureux, M.L., S. Lee, and B. Lyon, 2013: Recent multidecadal strengthening of the Walker circulation across the  
9                   tropical Pacific. *Nature Climate Change*, **3**(6), 571–576, doi:[10.1038/nclimate1840](https://doi.org/10.1038/nclimate1840).
- 10 Lachkar, Z., M. Lévy, and K.S. Smith, 2019: Strong Intensification of the Arabian Sea Oxygen Minimum Zone in  
11                   Response to Arabian Gulf Warming. *Geophysical Research Letters*, **46**(10), 5420–5429,  
12                   doi:[10.1029/2018gl081631](https://doi.org/10.1029/2018gl081631).
- 13 Ladstädter, F., A.K. Steiner, M. Schwärz, and G. Kirchengast, 2015: Climate intercomparison of GPS radio occultation,  
14                   RS90/92 radiosondes and GRUAN from 2002 to 2013. *Atmospheric Measurement Techniques*, **8**(4), 1819–  
15                   1834, doi:[10.5194/amt-8-1819-2015](https://doi.org/10.5194/amt-8-1819-2015).
- 16 Lambeck, K., H. Rouby, A. Purcell, Y. Sun, and M. Cambridge, 2014: Sea level and global ice volumes from the Last  
17                   Glacial Maximum to the Holocene. *Proceedings of the National Academy of Sciences*, **111**(43), 15296–15303,  
18                   doi:[10.1073/pnas.1411762111](https://doi.org/10.1073/pnas.1411762111).
- 19 Lambert, F. et al., 2015: Dust fluxes and iron fertilization in Holocene and Last Glacial Maximum climates.  
20                   *Geophysical Research Letters*, **42**(14), 6014–6023, doi:[10.1002/2015gl064250](https://doi.org/10.1002/2015gl064250).
- 21 Lamping, N. et al., 2020: Highly branched isoprenoids reveal onset of deglaciation followed by dynamic sea-ice  
22                   conditions in the western Amundsen Sea, Antarctica. *Quaternary Science Reviews*, **228**, 106103,  
23                   doi:[10.1016/j.quascirev.2019.106103](https://doi.org/10.1016/j.quascirev.2019.106103).
- 24 Lamy, F. et al., 2010: Holocene changes in the position and intensity of the southern westerly wind belt. *Nature  
25                   Geoscience*, **3**(10), 695–699, doi:[10.1038/ngeo959](https://doi.org/10.1038/ngeo959).
- 26 Lamy, F. et al., 2014: Increased Dust Deposition in the Pacific Southern Ocean During Glacial Periods. *Science*,  
27                   **343**(6169), 403–407, doi:[10.1126/science.1245424](https://doi.org/10.1126/science.1245424).
- 28 Lamy, F. et al., 2015: Glacial reduction and millennial-scale variations in Drake Passage throughflow. *Proceedings of  
29                   the National Academy of Sciences*, **112**(44), 13496, doi:[10.1073/pnas.1509203112](https://doi.org/10.1073/pnas.1509203112).
- 30 Langematz, U. et al., 2018: Polar Stratospheric Ozone: Past, Present and Future. In: *Scientific Assessment of Ozone  
31                   Depletion: 2018. Global Ozone Research and Monitoring Project – Report No. 58*, pp. 4.1–4.63.
- 32 Lapointe, F. et al., 2017: Influence of North Pacific decadal variability on the western Canadian Arctic over the past  
33                   700 years. *Climate of the Past*, **13**(4), 411–420, doi:[10.5194/cp-13-411-2017](https://doi.org/10.5194/cp-13-411-2017).
- 34 Larsen, N.K. et al., 2014: Rapid early Holocene ice retreat in West Greenland. *Quaternary Science Reviews*, **92**, 310–  
35                   323, doi:[10.1016/j.quascirev.2013.05.027](https://doi.org/10.1016/j.quascirev.2013.05.027).
- 36 Larsen, N.K. et al., 2015: The response of the southern Greenland ice sheet to the Holocene thermal maximum.  
37                   *Geology*, **43**(4), 291–294, doi:[10.1130/g36476.1](https://doi.org/10.1130/g36476.1).
- 38 Lasher, G.E. and Y. Axford, 2019: Medieval warmth confirmed at the Norse Eastern Settlement in Greenland. *Geology*,  
39                   **47**(3), 267–270, doi:[10.1130/g45833.1](https://doi.org/10.1130/g45833.1).
- 40 Laskar, J., A. Fienga, M. Gastineau, and H. Manche, 2011: La2010: a new orbital solution for the long-term motion of  
41                   the Earth. *Astronomy & Astrophysics*, **532**, A89, doi:[10.1051/0004-6361/201116836](https://doi.org/10.1051/0004-6361/201116836).
- 42 Laube, J.C. et al., 2014: Newly detected ozone-depleting substances in the atmosphere. *Nature Geoscience*, **7**, 266–269,  
43                   doi:[10.1038/ngeo2109](https://doi.org/10.1038/ngeo2109).
- 44 Lauvset, S.K., N. Gruber, P. Landschützer, A. Olsen, and J. Tjiputra, 2015: Trends and drivers in global surface ocean  
45                   pH over the past 3 decades. *Biogeosciences*, **12**(5), 1285–1298, doi:[10.5194/bg-12-1285-2015](https://doi.org/10.5194/bg-12-1285-2015).
- 46 Lauvset, S.K. et al., 2020: Processes Driving Global Interior Ocean pH Distribution. *Global Biogeochemical Cycles*,  
47                   **34**(1), e2019GB006229, doi:[10.1029/2019gb006229](https://doi.org/10.1029/2019gb006229).
- 48 Lawrence, D.M. et al., 2016: The Land Use Model Intercomparison Project (LUMIP) contribution to CMIP6: Rationale  
49                   and experimental design. *Geoscientific Model Development*, **9**(9), 2973–2998, doi:[10.5194/gmd-9-2973-2016](https://doi.org/10.5194/gmd-9-2973-2016).
- 50 Leahy, T. P., F. P. Llopis, M. D. Palmer, N.H.R., 2018: Using neural networks to correct historical climate  
51                   observations. *Journal of Atmospheric and Oceanic Technology*, **35**, 2053–2059.
- 52 Lean, J.L., 2018a: Estimating Solar Irradiance Since 850 CE. *Earth and Space Science*, **5**(4), 133–149,  
53                   doi:[10.1002/2017ea000357](https://doi.org/10.1002/2017ea000357).
- 54 Lean, J.L., 2018b: Estimating Solar Irradiance Since 850 CE. *Earth and Space Science*, **5**(4), 133–149,  
55                   doi:[10.1002/2017ea000357](https://doi.org/10.1002/2017ea000357).
- 56 Lecavalier, B.S. et al., 2014: A model of Greenland ice sheet deglaciation constrained by observations of relative sea  
57                   level and ice extent. *Quaternary Science Reviews*, **102**, 54–84, doi:[10.1016/j.quascirev.2014.07.018](https://doi.org/10.1016/j.quascirev.2014.07.018).
- 58 Lechleitner, F.A. et al., 2017: Tropical rainfall over the last two millennia: Evidence for a low-latitude hydrologic  
59                   seesaw. *Scientific Reports*, **7**, 1–9, doi:[10.1038/srep45809](https://doi.org/10.1038/srep45809).
- 60 Ledru, M.-P. et al., 2013: The Medieval Climate Anomaly and the Little Ice Age in the eastern Ecuadorian Andes.  
61                   *Climate of the Past*, **9**(1), 307–321, doi:[10.5194/cp-9-307-2013](https://doi.org/10.5194/cp-9-307-2013).

- 1 Leduc, G., L. Vidal, O. Cartapanis, and E. Bard, 2009: Modes of eastern equatorial Pacific thermocline variability:  
2 Implications for ENSO dynamics over the last glacial period. *Paleoceanography*, **24**(3),  
3 doi:[10.1029/2008pa001701](https://doi.org/10.1029/2008pa001701).
- 4 Lee, J., K.R. Sperber, P.J. Gleckler, C.J.W. Bonfils, and K.E. Taylor, 2019: Quantifying the agreement between  
5 observed and simulated extratropical modes of interannual variability. *Climate Dynamics*, **52**, 4057–4089,  
6 doi:[10.1007/s00382-018-4355-4](https://doi.org/10.1007/s00382-018-4355-4).
- 7 Lee, J.-Y. and K.-J. Ha, 2015: Understanding of Interdecadal Changes in Variability and Predictability of the Northern  
8 Hemisphere Summer Tropical–Extratropical Teleconnection. *Journal of Climate*, **28**(21), 8634–8647,  
9 doi:[10.1175/jcli-d-15-0154.1](https://doi.org/10.1175/jcli-d-15-0154.1).
- 10 Lee, S.H., P.D. William, and T.A. Frame, 2019: Increased shear in the North Atlantic upper-level jet stream over the  
11 past four decades. *Nature*, **572**, 639–643, doi:[10.1038/s41586-019-1465-z](https://doi.org/10.1038/s41586-019-1465-z).
- 12 Lee, S.-K. et al., 2015: Pacific origin of the abrupt increase in Indian Ocean heat content during the warming hiatus.  
13 *Nature Geoscience*, **8**(6), 445–449, doi:[10.1038/ngeo2438](https://doi.org/10.1038/ngeo2438).
- 14 Legeais, J.-F., W. Llovel, A.M.B.M., 2020: Evidence of the TOPEX-A Altimeter Instrumental Anomaly and  
15 Acceleration of the Global Mean Sea Level. In *Copernicus Marine Service Ocean State Report Journal of*  
16 *Operational Oceanography*, S1–S172, doi:[10.1080/1755876x.2020.1785097](https://doi.org/10.1080/1755876x.2020.1785097).
- 17 LeGrande, A.N. and G.A. Schmidt, 2011: Water isotopologues as a quantitative paleosalinity proxy.  
18 *Paleoceanography*, **26**(3), doi:[10.1029/2010pa002043](https://doi.org/10.1029/2010pa002043).
- 19 Lejeune, Q. et al., 2020: Biases in the albedo sensitivity to deforestation in CMIP5 models and their impacts on the  
20 associated historical Radiative Forcing. *Earth System Dynamics*, **11**(4), 1209–1232, doi:[10.5194/esd-2019-94](https://doi.org/10.5194/esd-2019-94).
- 21 Lenoir, J. and J.C. Svenning, 2015: Climate-related range shifts – a global multidimensional synthesis and new research  
22 directions. *Ecography*, **38**(1), 15–28, doi:[10.1111/ecog.00967](https://doi.org/10.1111/ecog.00967).
- 23 Lenoir, J., J.C. Gégout, P.A. Marquet, P. De Ruffray, and H. Brisse, 2008: A significant upward shift in plant species  
24 optimum elevation during the 20th century. *Science*, doi:[10.1126/science.1156831](https://doi.org/10.1126/science.1156831).
- 25 Lenoir, J. et al., 2020: Species better track climate warming in the oceans than on land. *Nature Ecology and Evolution*,  
26 **4**(8), doi:[10.1038/s41559-020-1198-2](https://doi.org/10.1038/s41559-020-1198-2).
- 27 Lenssen, N.J.L. et al., 2019: Improvements in the GISTEMP Uncertainty Model. *Journal of Geophysical Research: Atmospheres*, **124**(12), 6307–6326, doi:[10.1029/2018jd029522](https://doi.org/10.1029/2018jd029522).
- 28 Leroy, S.S., C.O. Ao, and O.P. Verkhoglyadova, 2018: Temperature Trends and Anomalies in Modern Satellite Data:  
29 Infrared Sounding and GPS Radio Occultation. *Journal of Geophysical Research: Atmospheres*, **123**(20),  
30 11,411–431,444, doi:[10.1029/2018jd028990](https://doi.org/10.1029/2018jd028990).
- 31 Levitus, S. et al., 2012: World ocean heat content and thermosteric sea level change (0–2000 m), 1955–2010.  
32 *Geophysical Research Letters*, **39**(10), doi:[10.1029/2012gl051106](https://doi.org/10.1029/2012gl051106).
- 33 Levy, R. et al., 2016: Antarctic ice sheet sensitivity to atmospheric CO<sub>2</sub> variations in the early to mid-Miocene..  
34 *Proceedings of the National Academy of Sciences of the United States of America*, **113**(13), 3453–8,  
35 doi:[10.1073/pnas.1516030113](https://doi.org/10.1073/pnas.1516030113).
- 36 Lewis, K., G. Dijken, and K. Arrigo, 2020: Changes in phytoplankton concentration now drive increased Arctic Ocean  
37 primary production. *Science*, **369**, 198–202, doi:[10.1126/science.aay8380](https://doi.org/10.1126/science.aay8380).
- 38 Lewkowicz, A.G. and R.G. Way, 2019: Extremes of summer climate trigger thousands of thermokarst landslides in a  
39 High Arctic environment. *Nature Communications*, **10**(1), 1329, doi:[10.1038/s41467-019-109314-7](https://doi.org/10.1038/s41467-019-109314-7).
- 40 Li, F. et al., 2020: Towards quantification of Holocene anthropogenic land-cover change in temperate China: A review  
41 in the light of pollen-based REVEALS reconstructions of regional plant cover. *Earth-Science Reviews*, **203**,  
42 doi:[10.1016/j.earscirev.2020.103119](https://doi.org/10.1016/j.earscirev.2020.103119).
- 43 Li, J., B.E. Carlson, O. Dubovik, and A.A. Lacis, 2014: Recent trends in aerosol optical properties derived from  
44 AERONET measurements. *Atmospheric Chemistry and Physics*, **14**(22), 12271–12289, doi:[10.5194/acp-14-12271-2014](https://doi.org/10.5194/acp-14-12271-2014).
- 45 Li, J. et al., 2013: El Niño modulations over the past seven centuries. *Nature Climate Change*, **3**, 822,  
46 doi:[10.1038/nclimate1936](https://doi.org/10.1038/nclimate1936).
- 47 Li, M., A.L. Gordon, J. Wei, L.K. Gruenburg, and G. Jiang, 2018: Multi-decadal timeseries of the Indonesian  
48 throughflow. *Dynamics of Atmospheres and Oceans*, **81**, 84–95, doi:[10.1016/j.dynatmoce.2018.02.001](https://doi.org/10.1016/j.dynatmoce.2018.02.001).
- 49 Li, X., D. Jiang, Z. Tian, and Y. Yang, 2018: Mid-Pliocene global land monsoon from PlioMIP1 simulations.  
50 *Palaeogeography, Palaeoclimatology, Palaeoecology*, **512**, 56–70, doi:[10.1016/j.palaeo.2018.06.027](https://doi.org/10.1016/j.palaeo.2018.06.027).
- 51 Li, X. et al., 2015: Mid-Pliocene westerlies from PlioMIP simulations. *Advances in Atmospheric Sciences*, **32**(7), 909–  
52 923, doi:[10.1007/s00376-014-4171-7](https://doi.org/10.1007/s00376-014-4171-7).
- 53 Li, X. et al., 2016: Trend and seasonality of land precipitation in observations and CMIP5 model simulations.  
54 *International Journal of Climatology*, **36**(11), 3781–3793, doi:[10.1002/joc.4592](https://doi.org/10.1002/joc.4592).
- 55 Li, Y., L. Zhu, X. Zhao, S. Li, and Y. Yan, 2013: Urbanization Impact on Temperature Change in China with Emphasis  
56 on Land Cover Change and Human Activity. *Journal of Climate*, **26**(22), 8765–8780, doi:[10.1175/jcli-d-12-00698.1](https://doi.org/10.1175/jcli-d-12-00698.1).
- 57 Li, Z., S. Yang, C.-Y. Tam, and C. Hu, 2020: Strengthening western equatorial Pacific and Maritime Continent  
58 atmospheric convection and its modulation on the trade wind during spring of 1901–2010. *International*

- 1 *Journal of Climatology*, **41**(2), 1455–1464, doi:[10.1002/joc.6856](https://doi.org/10.1002/joc.6856).

2 Liang, Y.C., C.C. Chou, J.Y. Yu, and M.H. Lo, 2016: Mapping the locations of asymmetric and symmetric discharge  
3 responses in global rivers to the two types of El Niño. *Environmental Research Letters*, **11**(4),  
4 doi:[10.1088/1748-9326/11/4/044012](https://doi.org/10.1088/1748-9326/11/4/044012).

5 Liao, W., D. Wang, X. Liu, G. Wang, and J. Zhang, 2017: Estimated influence of urbanization on surface warming in  
6 Eastern China using time-varying land use data. *International Journal of Climatology*, **37**(7), 3197–3208,  
7 doi:[10.1002/joc.4908](https://doi.org/10.1002/joc.4908).

8 Liefert, D.T. and B.N. Shuman, 2020: Pervasive Desiccation of North American Lakes During the Late Quaternary.  
9 *Geophysical Research Letters*, **47**, e2019GL086412, doi:[10.1029/2019gl086412](https://doi.org/10.1029/2019gl086412).

10 Liljedahl, A.K. et al., 2016: Pan-Arctic ice-wedge degradation in warming permafrost and its influence on tundra  
11 hydrology. *Nature Geoscience*, **9**, 312–318, doi:[10.1038/ngeo2674](https://doi.org/10.1038/ngeo2674).

12 Liman, J., M. Schröder, K. Fennig, A. Andersson, and R. Hollmann, 2018: Uncertainty characterization of HOAPS 3.3  
13 latent heat-flux-related parameters. *Atmospheric Measurement Techniques*, **11**(3), 1793–1815,  
14 doi:[10.5194/amt-11-1793-2018](https://doi.org/10.5194/amt-11-1793-2018).

15 Lin, R., T. Zhou, and Y. Qian, 2014: Evaluation of global monsoon precipitation changes based on five reanalysis  
16 datasets. *Journal of Climate*, **27**(3), 1271–1289, doi:[10.1175/jcli-d-13-00215.1](https://doi.org/10.1175/jcli-d-13-00215.1).

17 Lindsay, R. and A. Schweiger, 2015: Arctic sea ice thickness loss determined using subsurface, aircraft, and satellite  
18 observations. *Cryosphere*, **9**(1), 269–283, doi:[10.5194/tc-9-269-2015](https://doi.org/10.5194/tc-9-269-2015).

19 Linsley, B.K., H.C. Wu, E.P. Dassie, and D.P. Schrag, 2015: Decadal changes in South Pacific sea surface temperatures  
20 and the relationship to the Pacific decadal oscillation and upper ocean heat content. *Geophysical Research  
21 Letters*, **42**(7), 2358–2366, doi:[10.1002/2015gl063045](https://doi.org/10.1002/2015gl063045).

22 Lippold, J. et al., 2019: Constraining the Variability of the Atlantic Meridional Overturning Circulation During the  
23 Holocene. *Geophysical Research Letters*, **46**(20), 11338–11346, doi:[10.1029/2019gl084988](https://doi.org/10.1029/2019gl084988).

24 Little, C.M. et al., 2019: The Relationship Between U.S. East Coast Sea Level and the Atlantic Meridional Overturning  
25 Circulation: A Review. *Journal of Geophysical Research: Oceans*, **124**(9), 6435–6458,  
26 doi:[10.1029/2019jc015152](https://doi.org/10.1029/2019jc015152).

27 Liu, C. and R.P. Allan, 2013: Observed and simulated precipitation responses in wet and dry regions 1850 – 2100.  
28 *Environ. Res. Lett.*, **8**(034002), 1–11, doi:[10.1088/1748-9326/8/3/034002](https://doi.org/10.1088/1748-9326/8/3/034002).

29 Liu, C., X. Liang, D.P. Chambers, and R.M. Ponte, 2020: Global Patterns of Spatial and Temporal Variability in  
30 Salinity from Multiple Gridded Argo Products. *Journal of Climate*, **33**(20), 8751–8766, doi:[10.1175/jcli-d-20-0053.1](https://doi.org/10.1175/jcli-d-20-0053.1).

31 Liu, G. et al., 2017: Permafrost Warming in the Context of Step-wise Climate Change in the Tien Shan Mountains,  
32 China. *Permafrost and Periglacial Processes*, **28**(1), 130–139, doi:[10.1002/ppp.1885](https://doi.org/10.1002/ppp.1885).

33 Liu, J., M. Song, Y. Hu, and X. Ren, 2012: Changes in the strength and width of the Hadley Circulation since 1871.  
34 *Climate of the Past*, **8**(4), 1169–1175, doi:[10.5194/cp-8-1169-2012](https://doi.org/10.5194/cp-8-1169-2012).

35 Liu, J., G.A. Milne, R.E. Kopp, P.U. Clark, and I. Shennan, 2016: Sea-level constraints on the amplitude and source  
36 distribution of Meltwater Pulse 1A. *Nature Geoscience*, **9**(2), 130–134, doi:[10.1038/ngeo2616](https://doi.org/10.1038/ngeo2616).

37 Liu, Q. et al., 2016: Delayed autumn phenology in the Northern Hemisphere is related to change in both climate and  
38 spring phenology. *Global Change Biology*, **22**(11), 3702–3711, doi:[10.1111/gcb.13311](https://doi.org/10.1111/gcb.13311).

39 Liu, Q.-Y., M. Feng, D. Wang, and S. Wijffels, 2015: Interannual variability of the Indonesian Throughflow transport:  
40 A revisit based on 30 year expendable bathythermograph data. *Journal of Geophysical Research: Oceans*,  
41 **120**(12), 8270–8282, doi:[10.1002/2015jc011351](https://doi.org/10.1002/2015jc011351).

42 Liu, W. et al., 2015: Extended Reconstructed Sea Surface Temperature Version 4 (ERSST.v4): Part II. Parametric and  
43 Structural Uncertainty Estimations. *Journal of Climate*, **28**(3), 931–951, doi:[10.1175/jcli-d-14-00007.1](https://doi.org/10.1175/jcli-d-14-00007.1).

44 Liu, Y., Y. Li, S. Li, and S. Motesharrei, 2015a: Spatial and temporal patterns of global NDVI trends: Correlations with  
45 climate and human factors. *Remote Sensing*, doi:[10.3390/rs71013233](https://doi.org/10.3390/rs71013233).

46 Liu, Y. et al., 2015b: Obliquity pacing of the western Pacific Intertropical Convergence Zone over the past 282,000  
47 years. *Nature Communications*, **6**(10018), 1–7, doi:[10.1038/ncomms10018](https://doi.org/10.1038/ncomms10018).

48 Liu, Y. et al., 2017a: Recent enhancement of central Pacific El Niño variability relative to last eight centuries. *Nature  
49 Communications*, **8**, 15386, doi:[10.1038/ncomms15386](https://doi.org/10.1038/ncomms15386).

50 Liu, Y. et al., 2017b: Recent enhancement of central Pacific El Niño variability relative to last eight centuries. *Nature  
51 Communications*, **8**, 15386, doi:[10.1038/ncomms15386](https://doi.org/10.1038/ncomms15386).

52 Liu, Z., Z. Jian, C.J. Poulsen, and L. Zhao, 2019: Isotopic evidence for twentieth-century weakening of the Pacific  
53 Walker circulation. *Earth and Planetary Science Letters*, **507**, 85–93, doi:[10.1016/j.epsl.2018.12.002](https://doi.org/10.1016/j.epsl.2018.12.002).

54 Liu, Z. et al., 2014: The Holocene temperature conundrum. *Proceedings of the National Academy of Sciences*, **111**(34),  
55 E3501–E3505, doi:[10.1073/pnas.1407229111](https://doi.org/10.1073/pnas.1407229111).

56 Liu, Z. et al., 2017: Pacific North American circulation pattern links external forcing and North American hydroclimatic  
57 change over the past millennium. *Proceedings of the National Academy of Sciences of the United States of  
58 America*, **114**(13), 3340–3345, doi:[10.1073/pnas.1618201114](https://doi.org/10.1073/pnas.1618201114).

59 Lockwood, M. and W.T. Ball, 2020: Placing limits on long-term variations in quiet-Sun irradiance and their  
60 contribution to total solar irradiance and solar radiative forcing of climate. *Proceedings of the Royal Society A:*

- Mathematical, Physical and Engineering Sciences*, **476(2238)**, 20200077, doi:[10.1098/rspa.2020.0077](https://doi.org/10.1098/rspa.2020.0077).

Loeb, N.G., T.J. Thorsen, J.R. Norris, H. Wang, and W. Su, 2018: Changes in Earth's energy budget during and after the "Pause" in global warming: An observational perspective. *Climate*, **6(3)**, doi:[10.3390/cli6030062](https://doi.org/10.3390/cli6030062).

Long, C.S., M. Fujiwara, S. Davis, D.M. Mitchell, and C.J. Wright, 2017: Climatology and interannual variability of dynamic variables in multiple reanalyses evaluated by the SPARC Reanalysis Intercomparison Project (S-RIP). *Atmospheric Chemistry and Physics*, **17(23)**, 14593–14629, doi:[10.5194/acp-17-14593-2017](https://doi.org/10.5194/acp-17-14593-2017).

Longhurst, A.R., 2007: *Ecological Geography of the Sea*. Academic Press, 560 pp., doi:[10.1016/b978-0-12-455521-1.x5000-1](https://doi.org/10.1016/b978-0-12-455521-1.x5000-1).

López, O., R. Houborg, and M.F. McCabe, 2017: Evaluating the hydrological consistency of evaporation products using satellite-based gravity and rainfall data. *Hydrology and Earth System Sciences*, **21**, 323–343, doi:[10.5194/hess-21-323-2017](https://doi.org/10.5194/hess-21-323-2017).

Lorenz, D.J., E.T. DeWeaver, and D.J. Vimont, 2010: Evaporation Change and Global Warming: The Role of Net Radiation and Relative Humidity. *Journal of Geophysical Research: Atmospheres*, **115(D20)**, doi:[10.1029/2010jd013949](https://doi.org/10.1029/2010jd013949).

Lossow, S. et al., 2018: Trend differences in lower stratospheric water vapour between Boulder and the zonal mean and their role in understanding fundamental observational discrepancies. *Atmospheric Chemistry and Physics*, **18(11)**, 8331–8351, doi:[10.5194/acp-18-8331-2018](https://doi.org/10.5194/acp-18-8331-2018).

Loulergue, L. et al., 2008: Orbital and millennial-scale features of atmospheric CH<sub>4</sub> over the past 800,000 years. *Nature*, **453**, 383, doi:[10.1038/nature06950](https://doi.org/10.1038/nature06950).

Lowell, T. et al., 2013: Late Holocene expansion of Istorvet ice cap, Liverpool Land, east Greenland. *Quaternary Science Reviews*, **63**, 128–140, doi:[10.1016/j.quascirev.2012.11.012](https://doi.org/10.1016/j.quascirev.2012.11.012).

Lowry, D.P. and C. Morrill, 2018: Is the Last Glacial Maximum a reverse analog for future hydroclimate changes in the Americas? *Climate Dynamics*, **52(8)**, 4407–4427, doi:[10.1007/s00382-018-4385-y](https://doi.org/10.1007/s00382-018-4385-y).

Lozier, M.S. et al., 2019a: A sea change in our view of overturning in the subpolar North Atlantic. *Science*, **363(6426)**, 516–521, doi:[10.1126/science.aau6592](https://doi.org/10.1126/science.aau6592).

Lozier, M.S. et al., 2019b: A sea change in our view of overturning in the subpolar North Atlantic. *Science*, **363(6426)**, 516–521, doi:[10.1126/science.aau6592](https://doi.org/10.1126/science.aau6592).

Lübbecke, J.F. and M.J. McPhaden, 2014: Assessing the Twenty-First-Century Shift in ENSO Variability in Terms of the Bjerknes Stability Index. *Journal of Climate*, **27(7)**, 2577–2587, doi:[10.1175/jcli-d-13-00438.1](https://doi.org/10.1175/jcli-d-13-00438.1).

Lübbecke, J.F. et al., 2018: Equatorial Atlantic variability – Modes, mechanisms, and global teleconnections. *Wiley Interdisciplinary Reviews: Climate Change*, **9(4)**, e527, doi:[10.1002/wcc.527](https://doi.org/10.1002/wcc.527).

Lucas, C. and H. Nguyen, 2015: Regional characteristics of tropical expansion and the role of climate variability. *Journal of Geophysical Research*, **120**, 6809–6824, doi:[10.1002/2015jd023130](https://doi.org/10.1002/2015jd023130).

Lucas, C., B. Timbal, and H. Nguyen, 2014: The expanding tropics: A critical assessment of the observational and modeling studies. *Wiley Interdisciplinary Reviews: Climate Change*, **5(1)**, 89–112, doi:[10.1002/wcc.251](https://doi.org/10.1002/wcc.251).

Lüning, S., M. Ga, I.B. Danladi, T.A. Adagunodo, and F. Vahrenholt, 2018a: Hydroclimate in Africa during the Medieval Climate Anomaly. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **495**, 309–322, doi:[10.1016/j.palaeo.2018.01.025](https://doi.org/10.1016/j.palaeo.2018.01.025).

Lüning, S., M. Ga, I.B. Danladi, T.A. Adagunodo, and F. Vahrenholt, 2018b: Hydroclimate in Africa during the Medieval Climate Anomaly. *Palaeogeography, Palaeoclimatology, Palaeoecology*, **495**, 309–322, doi:[10.1016/j.palaeo.2018.01.025](https://doi.org/10.1016/j.palaeo.2018.01.025).

Lüning, S., M. Gałka, F.P. Bamonte, F.G. Rodríguez, and F. Vahrenholt, 2019a: The Medieval Climate Anomaly in South America. *Quaternary International*, **508**, 70–87, doi:[10.1016/j.quaint.2018.10.041](https://doi.org/10.1016/j.quaint.2018.10.041).

Lüning, S., L. Schulte, S. Garcés-Pastor, I.B. Danladi, and M. Gałka, 2019b: The Medieval Climate Anomaly in the Mediterranean Region. *Paleoceanography and Paleoclimatology*, **34(10)**, 1625–1649, doi:[10.1029/2019pa003734](https://doi.org/10.1029/2019pa003734).

Lunt, D.J. et al., 2017: The DeepMIP contribution to PMIP4: experimental design for model simulations of the EECO, PETM, and pre-PETM (version 1.0). *Geosci. Model Dev.*, **10(2)**, 889–901, doi:[10.5194/gmd-10-889-2017](https://doi.org/10.5194/gmd-10-889-2017).

Lunt, D.J. et al., 2021: DeepMIP: Model intercomparison of early Eocene climatic optimum (EECO) large-scale climate features and comparison with proxy data. *Climate of the Past*, **17(1)**, 203–227, doi:[10.5194/cp-17-203-2021](https://doi.org/10.5194/cp-17-203-2021).

Luo, B., 2018: Aerosol Radiative Forcing and SAD version v4.0.0 1850–2016. Retrieved from: [ftp://iacftp.ethz.ch/pub/read/luo/cmip6\\_sad\\_radforcing\\_v4.0.0](ftp://iacftp.ethz.ch/pub/read/luo/cmip6_sad_radforcing_v4.0.0).

Luo, D. et al., 2016: Impact of Ural blocking on winter warm Arctic–cold Eurasian anomalies. Part I: Blocking-induced amplification. *Journal of Climate*, **29**, 3925–3947, doi:[10.1175/jcli-d-15-0611.1](https://doi.org/10.1175/jcli-d-15-0611.1).

Lynch-Stieglitz, J., 2017: The Atlantic Meridional Overturning Circulation and Abrupt Climate Change. *Annual Review of Marine Science*, **9**, 83–104, doi:[10.1146/annurev-marine-010816-060415](https://doi.org/10.1146/annurev-marine-010816-060415).

Lynch-Stieglitz, J., T. Ito, and E. Michel, 2016: Antarctic density stratification and the strength of the circumpolar current during the Last Glacial Maximum. *Paleoceanography*, **31(5)**, 539–552, doi:[10.1002/2015pa002915](https://doi.org/10.1002/2015pa002915).

Lynch-Stieglitz, J. et al., 2007: Atlantic Meridional Overturning Circulation During the Last Glacial Maximum. *Science*, **316(5821)**, 66, doi:[10.1126/science.1137127](https://doi.org/10.1126/science.1137127).

Ma, S. and T. Zhou, 2016: Robust Strengthening and westward shift of the tropical Pacific Walker circulation during

- 1 1979–2012: A comparison of 7 sets of reanalysis data and 26 CMIP5 models. *Journal of Climate*, **29**(9), 3097–  
2 3118, doi:[10.1175/jcli-d-15-0398.1](https://doi.org/10.1175/jcli-d-15-0398.1).
- 3 Ma, X. and Y. Zhang, 2018: Interannual variability of the North Pacific winter storm track and its relationship with  
4 extratropical atmospheric circulation. *Climate Dynamics*, **51**, 3685–3698, doi:[10.1007/s00382-018-4104-8](https://doi.org/10.1007/s00382-018-4104-8).
- 5 Ma, Z., R. Liu, Y. Liu, and J. Bi, 2019: Effects of air pollution control policies on PM2.5 pollution improvement in  
6 China from 2005 to 2017: a satellite-based perspective. *Atmospheric Chemistry and Physics*, **19**(10), 6861–  
7 6877, doi:[10.5194/acp-19-6861-2019](https://doi.org/10.5194/acp-19-6861-2019).
- 8 MacDonald, G.M., K. Kremenetski, and D.W. Beilman, 2008: Climate change and the northern Russian treeline zone.  
9 *Philosophical Transactions of the Royal Society B: Biological Sciences*, **363**(1501),  
10 doi:[10.1098/rstb.2007.2200](https://doi.org/10.1098/rstb.2007.2200).
- 11 MacDonald, G.M. et al., 2000: Holocene treeline history and climate change across northern Eurasia. *Quaternary  
12 Research*, **53**(3), 302 – 311, doi:[10.1006/qres.1999.2123](https://doi.org/10.1006/qres.1999.2123).
- 13 MacFarling Meure, C. et al., 2006: Law Dome CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O ice core records extended to 2000 years BP.  
14 *Geophysical Research Letters*, **33**(14), L14810, doi:[10.1029/2006gl026152](https://doi.org/10.1029/2006gl026152).
- 15 Machida, T., T. Nakazawa, Y. Fujii, S. Aoki, and O. Watanabe, 1995: Increase in the atmospheric nitrous oxide  
16 concentration during the last 250 years. *Geophysical Research Letters*, **22**(21), 2921–2924,  
17 doi:[10.1029/95gl02822](https://doi.org/10.1029/95gl02822).
- 18 Maksym, T., 2019: Arctic and Antarctic Sea Ice Change: Contrasts, Commonalities, and Causes. *Annual Review of  
19 Marine Science*, **11**(1), 187–213, doi:[10.1146/annurev-marine-010816-060610](https://doi.org/10.1146/annurev-marine-010816-060610).
- 20 Mann, M.E. et al., 2009: Global Signatures and Dynamical Origins of the Little Ice Age and Medieval Climate  
21 Anomaly. *Science*, **326**(5957), 1256, doi:[10.1126/science.1177303](https://doi.org/10.1126/science.1177303).
- 22 Manney, G.L. and M.I. Hegglin, 2018: Seasonal and regional variations of long-term changes in upper-tropospheric jets  
23 from reanalyses. *Journal of Climate*, **31**(1), 423–448, doi:[10.1175/jcli-d-17-0303.1](https://doi.org/10.1175/jcli-d-17-0303.1).
- 24 Manney, G.L. et al., 2011: Unprecedented Arctic ozone loss in 2011. *Nature*, **478**(7370), 469–475,  
25 doi:[10.1038/nature10556](https://doi.org/10.1038/nature10556).
- 26 Manney, G.L. et al., 2020: Record-low Arctic stratospheric ozone in 2020: MLS observations of chemical processes  
27 and comparisons with previous extreme winters. *Geophysical Research Letters*, **47**(16), e2020GL089063,  
28 doi:[10.1029/2020gl089063](https://doi.org/10.1029/2020gl089063).
- 29 Manucharyan, G.E. and A. Fedorov, 2014: Robust ENSO across a Wide Range of Climates. *Journal of Climate*, **27**(15),  
30 5836–5850, doi:[10.1175/jcli-d-13-00759.1](https://doi.org/10.1175/jcli-d-13-00759.1).
- 31 Manzanedo, R.D., J. HilleRisLambers, T.T. Rademacher, and N. Pederson, 2020: Evidence of unprecedented rise in  
32 growth synchrony from global tree ring records. *Nature Ecology and Evolution*, **4**, 1622–1629,  
33 doi:[10.1038/s41559-020-01306-x](https://doi.org/10.1038/s41559-020-01306-x).
- 34 Marcer, M. et al., 2019: Evaluating the destabilization susceptibility of active rock glaciers in the French Alps. *The  
35 Cryosphere*, **13**(1), 141–155, doi:[10.5194/tc-13-141-2019](https://doi.org/10.5194/tc-13-141-2019).
- 36 Marcott, S.A., J.D. Shakun, P.U. Clark, and A.C. Mix, 2013: A Reconstruction of Regional and Global Temperature for  
37 the Past 11,300 Years. *Science*, **339**(6124), 1198 LP – 1201, doi:[10.1126/science.1228026](https://doi.org/10.1126/science.1228026).
- 38 Marcott, S.A. et al., 2014a: Centennial-scale changes in the global carbon cycle during the last deglaciation. *Nature*,  
39 **514**(7524), 616–619, doi:[10.1038/nature13799](https://doi.org/10.1038/nature13799).
- 40 Marcott, S.A. et al., 2014b: Centennial-scale changes in the global carbon cycle during the last deglaciation. *Nature*,  
41 **514**(7524), 616–619, doi:[10.1038/nature13799](https://doi.org/10.1038/nature13799).
- 42 Margari, V. et al., 2020: Fast and slow components of interstadial warming in the North Atlantic during the last glacial.  
43 *Communications Earth & Environment*, **1**(1), 1–9, doi:[10.1038/s43247-020-0006-x](https://doi.org/10.1038/s43247-020-0006-x).
- 44 Marino, G. et al., 2013: Agulhas salt-leakage oscillations during abrupt climate changes of the Late Pleistocene.  
45 *Paleoceanography*, **28**(3), 599–606, doi:[10.1002/palo.20038](https://doi.org/10.1002/palo.20038).
- 46 Marquer, L. et al., 2017a: Quantifying the effects of land use and climate on Holocene vegetation in Europe.  
47 *Quaternary Science Reviews*, doi:[10.1016/j.quascirev.2017.07.001](https://doi.org/10.1016/j.quascirev.2017.07.001).
- 48 Marquer, L. et al., 2017b: Quantifying the effects of land use and climate on Holocene vegetation in Europe.  
49 *Quaternary Science Reviews*, **171**, 20–37, doi:[10.1016/j.quascirev.2017.07.001](https://doi.org/10.1016/j.quascirev.2017.07.001).
- 50 Marquer, L. et al., 2017c: Quantifying the effects of land use and climate on Holocene vegetation in Europe.  
51 *Quaternary Science Reviews*, **171**, 20–37, doi:[10.1016/j.quascirev.2017.07.001](https://doi.org/10.1016/j.quascirev.2017.07.001).
- 52 Martínez-Botí, M.A. et al., 2015a: Plio-Pleistocene climate sensitivity evaluated using high-resolution CO<sub>2</sub> records.  
53 *Nature*, **518**(7537), 49–54, doi:[10.1038/nature14145](https://doi.org/10.1038/nature14145).
- 54 Martínez-Botí, M.A. et al., 2015b: Boron isotope evidence for oceanic carbon dioxide leakage during the last  
55 deglaciation. *Nature*, **518**(7538), 219–222, doi:[10.1038/nature14155](https://doi.org/10.1038/nature14155).
- 56 Martinez-Garcia, A. et al., 2014: Iron Fertilization of the Subantarctic Ocean During the Last Ice Age. *Science*,  
57 **343**(6177), 1347–1350, doi:[10.1126/science.1246848](https://doi.org/10.1126/science.1246848).
- 58 Martínez-Méndez, G. et al., 2010: Contrasting multiproxy reconstructions of surface ocean hydrography in the Agulhas  
59 Corridor and implications for the Agulhas Leakage during the last 345,000 years. *Paleoceanography*, **25**(4),  
60 doi:[10.1029/2009pa001879](https://doi.org/10.1029/2009pa001879).
- 61 Martín-Rey, M., B. Rodríguez-Fonseca, I. Polo, and F. Kucharski, 2014: On the Atlantic–Pacific Niños connection: a

- multidecadal modulated mode. *Climate Dynamics*, **43**(11), 3163–3178, doi:[10.1007/s00382-014-2305-3](https://doi.org/10.1007/s00382-014-2305-3).
- Martín-Rey, M., I. Polo, B. Rodríguez-Fonseca, T. Losada, and A. Lazar, 2018: Is There Evidence of Changes in Tropical Atlantic Variability Modes under AMO Phases in the Observational Record? *Journal of Climate*, **31**(2), 515–536, doi:[10.1175/jcli-d-16-0459.1](https://doi.org/10.1175/jcli-d-16-0459.1).
- Marty, C., A.-M. Tilg, and T. Jonas, 2017: Recent Evidence of Large-Scale Receding Snow Water Equivalents in the European Alps. *Journal of Hydrometeorology*, **18**(4), 1021–1031, doi:[10.1175/jhm-d-16-0188.1](https://doi.org/10.1175/jhm-d-16-0188.1).
- Marzeion, B., P.W. Leclercq, J.G. Cogley, and A.H. Jarosch, 2015: Brief Communication: Global reconstructions of glacier mass change during the 20th century are consistent. *The Cryosphere*, **9**(6), 2399–2404, doi:[10.5194/tc-9-2399-2015](https://doi.org/10.5194/tc-9-2399-2015).
- Marzeion, B., G. Kaser, F. Maussion, and N. Champollion, 2018: Limited influence of climate change mitigation on short-term glacier mass loss. *Nature Climate Change*, **8**(4), 305–308, doi:[10.1038/s41558-018-0093-1](https://doi.org/10.1038/s41558-018-0093-1).
- Massonnet, F., V. Guemas, N.S. Fuèkar, and F.J. Doblas-Reyes, 2015: The 2014 high record of antarctic sea ice extent. *Bulletin of the American Meteorological Society*, **96**(12), S163–S167, doi:[10.1175/bams-d-15-00093.1](https://doi.org/10.1175/bams-d-15-00093.1).
- Mathew, S.S. and K.K. Kumar, 2019: On the role of precipitation latent heating in modulating the strength and width of the Hadley circulation. *Theoretical and Applied Climatology*, **136**, 661–673, doi:[10.1007/s00704-018-2515-4](https://doi.org/10.1007/s00704-018-2515-4).
- Mathew, S.S., K.K. Kumar, and K.V. Subrahmanyam, 2016: Hadley cell dynamics in Japanese Reanalysis-55 dataset: evaluation using other reanalysis datasets and global radiosonde network observations. *Climate Dynamics*, **47**(12), 3917–3930, doi:[10.1007/s00382-016-3051-5](https://doi.org/10.1007/s00382-016-3051-5).
- Matley, K.A., J.M.K. Sniderman, A.N. Drinnan, and J.C. Hellstrom, 2020: Late-Holocene environmental change on the Nullarbor Plain, southwest Australia, based on speleothem pollen records. *Holocene*, **30**(5), 672–681, doi:[10.1177/0959683619895589](https://doi.org/10.1177/0959683619895589).
- Matthes, K. et al., 2017: Solar forcing for CMIP6 (v3.2). *Geoscientific Model Development*, **10**(6), 2247–2302, doi:[10.5194/gmd-10-2247-2017](https://doi.org/10.5194/gmd-10-2247-2017).
- Maycock, A.C. et al., 2018: Revisiting the mystery of recent stratospheric temperature trends. *Geophysical Research Letters*, **45**(18), 9919–9933, doi:[10.1029/2018gl078035](https://doi.org/10.1029/2018gl078035).
- McAfee, S.A., 2017: Uncertainty in Pacific decadal oscillation indices does not contribute to teleconnection instability. *International Journal of Climatology*, **37**(8), 3509–3516, doi:[10.1002/joc.4918](https://doi.org/10.1002/joc.4918).
- McCabe, G.J., J.L. Betancourt, and S. Feng, 2015: Variability in the start, end, and length of frost-free periods across the conterminous United States during the past century. *International Journal of Climatology*, doi:[10.1002/joc.4315](https://doi.org/10.1002/joc.4315).
- McCabe-Glynn, S. et al., 2013: Variable North Pacific influence on drought in southwestern North America since AD 854. *Nature Geoscience*, **6**(8), 617–621.
- McCarthy, G.D., T.M. Joyce, and S.A. Josey, 2018: Gulf Stream variability in the context of quasi-decadal and multi-decadal Atlantic climate variability. *Geophysical Research Letters*, **45**(20), 11,257–11,264, doi:[10.1029/2018gl079336](https://doi.org/10.1029/2018gl079336).
- McCarthy, G.D., I.D. Haigh, J.J.M. Hirschi, J.P. Grist, and D.A. Smeed, 2015: Ocean impact on decadal Atlantic climate variability revealed by sea-level observations. *Nature*, **521**(7553), 508–510, doi:[10.1038/nature14491](https://doi.org/10.1038/nature14491).
- McCave, I.N., S.J. Crowhurst, G. Kuhn, C.-D. Hillenbrand, and M.P. Meredith, 2013: Minimal change in Antarctic Circumpolar Current flow speed between the last glacial and Holocene. *Nature Geoscience*, **7**, 113, doi:[10.1038/ngeo2037](https://doi.org/10.1038/ngeo2037).
- McClymont, E.L. et al., 2020: Lessons from a high CO<sub>2</sub> world: an ocean view from ~ 3 million years ago. *Climate of the Past*, **16**(4), 1599–1615, doi:[10.5194/cp-2019-161](https://doi.org/10.5194/cp-2019-161).
- McGee, D., A. Donohoe, J. Marshall, and D. Ferreira, 2014a: Changes in ITCZ location and cross-equatorial heat transport at the Last Glacial Maximum, Heinrich Stadial 1, and the mid-Holocene. *Earth and Planetary Science Letters*, **390**, 69–79, doi:[10.1016/j.epsl.2013.12.043](https://doi.org/10.1016/j.epsl.2013.12.043).
- McGee, D., A. Donohoe, J. Marshall, and D. Ferreira, 2014b: Changes in ITCZ location and cross-equatorial heat transport at the Last Glacial Maximum, Heinrich Stadial 1, and the mid-Holocene. *Earth and Planetary Science Letters*, **390**, 69–79, doi:[10.1016/j.epsl.2013.12.043](https://doi.org/10.1016/j.epsl.2013.12.043).
- McGee, D., P.B. DeMenocal, G. Winckler, J.B.W. Stuut, and L.I. Bradtmiller, 2013: The magnitude, timing and abruptness of changes in North African dust deposition over the last 20,000yr. *Earth and Planetary Science Letters*, **371–372**, 163–176, doi:[10.1016/j.epsl.2013.03.054](https://doi.org/10.1016/j.epsl.2013.03.054).
- McGee, D. et al., 2018: Hemispherically asymmetric trade wind changes as signatures of past ITCZ shifts. *Quaternary Science Reviews*, **180**, 214–228, doi:[10.1016/j.quascirev.2017.11.020](https://doi.org/10.1016/j.quascirev.2017.11.020).
- McGregor, H. et al., 2013: A weak El Niño/Southern Oscillation with delayed seasonal growth around 4,300 years ago. *Nature Geoscience*, **6**, 949, doi:[10.1038/ngeo1936](https://doi.org/10.1038/ngeo1936).
- McGregor, H. et al., 2015: Robust global ocean cooling trend for the pre-industrial Common Era. *Nature Geoscience*, **8**(9), 671–677, doi:[10.1038/ngeo2510](https://doi.org/10.1038/ngeo2510).
- McGregor, S., A. Timmermann, and O. Timm, 2010: A unified proxy for ENSO and PDO variability since 1650. *Climate of the Past*, **6**(1), 1–17, doi:[10.5194/cp-6-1-2010](https://doi.org/10.5194/cp-6-1-2010).
- McGregor, S., A. Timmermann, M.H. England, O. Elison Timm, and A.T. Wittenberg, 2013a: Inferred changes in El Niño–Southern Oscillation variance over the past six centuries. *Climate of the Past*, **9**(5), 2269–2284,

1 doi:[10.5194/cp-9-2269-2013](https://doi.org/10.5194/cp-9-2269-2013).

2 McGregor, S., A. Timmermann, M.H. England, O. Elison Timm, and A.T. Wittenberg, 2013b: Inferred changes in El  
3 Niño–Southern Oscillation variance over the past six centuries. *Climate of the Past*, **9**(5), 2269–2284,  
4 doi:[10.5194/cp-9-2269-2013](https://doi.org/10.5194/cp-9-2269-2013).

5 McGregor, S. et al., 2014: Recent Walker circulation strengthening and Pacific cooling amplified by Atlantic warming.  
6 *Nature Climate Change*, **4**(10), 888–892, doi:[10.1038/nclimate2330](https://doi.org/10.1038/nclimate2330).

7 McKay, R. et al., 2012: Pleistocene variability of Antarctic Ice Sheet extent in the Ross Embayment. *Quaternary  
8 Science Reviews*, **34**, 93–112, doi:[10.1016/j.quascirev.2011.12.012](https://doi.org/10.1016/j.quascirev.2011.12.012).

9 McKay, R. et al., 2016: Antarctic marine ice-sheet retreat in the Ross Sea during the early Holocene. *Geology*, **44**(1), 7–  
10 10, doi:[10.1130/g37315.1](https://doi.org/10.1130/g37315.1).

11 McKenney, D.W. et al., 2014: Change and evolution in the plant hardiness zones of Canada. *BioScience*,  
12 doi:[10.1093/biosci/biu016](https://doi.org/10.1093/biosci/biu016).

13 McLandress, C., T.G. Shepherd, A.I. Jonsson, T. von Clarmann, and B. Funke, 2015: A method for merging nadir-  
14 sounding climate records, with an application to the global-mean stratospheric temperature data sets from SSU  
15 and AMSU. *Atmospheric Chemistry and Physics*, **15**(16), 9271–9284, doi:[10.5194/acp-15-9271-2015](https://doi.org/10.5194/acp-15-9271-2015).

16 McManus, J.F., D.W. Oppo, and J.L. Cullen, 1999: A 0.5-Million-Year Record of Millennial-Scale Climate Variability  
17 in the North Atlantic. *Science*, **283**(5404), 971–975, doi:[10.1126/science.283.5404.971](https://doi.org/10.1126/science.283.5404.971).

18 McManus, J.F., R. Francois, J.-M. Gherardi, L.D. Keigwin, and S. Brown-Leger, 2004: Collapse and rapid resumption  
19 of Atlantic meridional circulation linked to deglacial climate changes. *Nature*, **428**(6985), 834–837,  
20 doi:[10.1038/nature02494](https://doi.org/10.1038/nature02494).

21 McVicar, T.R. et al., 2012: Global review and synthesis of trends in observed terrestrial near-surface wind speeds:  
22 Implications for evaporation. *Journal of Hydrology*, **416**–**417**, 182–205, doi:[10.1016/j.jhydrol.2011.10.024](https://doi.org/10.1016/j.jhydrol.2011.10.024).

23 Mears, C.A. and F.J. Wentz, 2017: A Satellite-Derived Lower-Tropospheric Atmospheric Temperature Dataset Using  
24 an Optimized Adjustment for Diurnal Effects. *Journal of Climate*, **30**(19), 7695–7718, doi:[10.1175/jcli-d-16-0768.1](https://doi.org/10.1175/jcli-d-16-0768.1).

25 Mears, C.A., S.P. Ho, O. Bock, X. Zhou, and J. Nicolas, 2019: Hydrological cycle: Total column water vapor [in “State  
26 of the Climate in 2018”]. *Bull. Am. Meteorol. Soc.*, **100**(9), S27–S28,  
27 doi:[10.1175/2019bamsstateoftheclimate.1](https://doi.org/10.1175/2019bamsstateoftheclimate.1).

28 Mears, C.A. et al., 2018: Construction and Uncertainty Estimation of a Satellite-Derived Total Precipitable Water Data  
29 Record Over the World’s Oceans. *Earth and Space Science*, **5**(5), 197–210, doi:[10.1002/2018ea000363](https://doi.org/10.1002/2018ea000363).

30 Medley, B. and E.R. Thomas, 2019: Increased snowfall over the Antarctic Ice Sheet mitigated twentieth-century sea-  
31 level rise. *Nature Climate Change*, **9**(1), 34–39, doi:[10.1038/s41558-018-0356-x](https://doi.org/10.1038/s41558-018-0356-x).

32 Meier, W.N. and J.S. Stewart, 2019: Assessing uncertainties in sea ice extent climate indicators. *Environmental  
33 Research Letters*, **14**(3), 35005, doi:[10.1088/1748-9326/aaf52c](https://doi.org/10.1088/1748-9326/aaf52c).

34 Meier, W.N., D. Gallaher, and G.G. Campbell, 2013: New estimates of Arctic and Antarctic sea ice extent during  
35 September 1964 from recovered Nimbus I satellite imagery. *The Cryosphere*, **7**(2), 699–705, doi:[10.5194/tc-7-699-2013](https://doi.org/10.5194/tc-7-699-2013).

36 Meinen, C.S. et al., 2018: Meridional Overturning Circulation Transport Variability at 34.5°S During 2009–2017:  
37 Baroclinic and Barotropic Flows and the Dueling Influence of the Boundaries. *Geophysical Research Letters*,  
38 **45**(9), 4180–4188, doi:[10.1029/2018gl077408](https://doi.org/10.1029/2018gl077408).

39 Meinshausen, M. et al., 2017: Historical greenhouse gas concentrations for climate modelling (CMIP6). *Geosci. Model  
40 Dev.*, **10**(5), 2057–2116, doi:[10.5194/gmd-10-2057-2017](https://doi.org/10.5194/gmd-10-2057-2017).

41 Melamed-Turkish, K., P.A. Taylor, and J. Liu, 2018: Upper-level winds over eastern North America: A regional jet  
42 stream climatology. *International Journal of Climatology*, 1–18, doi:[10.1002/joc.5693](https://doi.org/10.1002/joc.5693).

43 Mellado-Cano, J., D. Barriopedro, R. García-Herrera, R.M. Trigo, and A. Hernández, 2019: Examining the North  
44 Atlantic Oscillation, East Atlantic pattern and jet variability since 1685. *Journal of Climate*, **32**, 6285–6298,  
45 doi:[10.1175/jcli-d-18-0135.1](https://doi.org/10.1175/jcli-d-18-0135.1).

46 Menary, M.B. et al., 2020: Aerosol-Forced AMOC Changes in CMIP6 Historical Simulations. *Geophysical Research  
47 Letters*, **47**(14), e2020GL088166, doi:[10.1029/2020gl088166](https://doi.org/10.1029/2020gl088166).

48 Menne, M.J., C.N. Williams, B.E. Gleason, J.J. Rennie, and J.H. Lawrimore, 2018: The Global Historical Climatology  
49 Network Monthly Temperature Dataset, Version 4. *Journal of Climate*, **31**(24), 9835–9854, doi:[10.1175/jcli-d-18-0094.1](https://doi.org/10.1175/jcli-d-18-0094.1).

50 Menzel, L. et al., 2017: Poorly ventilated deep ocean at the Last Glacial Maximum inferred from carbon isotopes: A  
51 data-model comparison study. *Paleoceanography*, **32**(1), 2–17, doi:[10.1002/2016pa003024](https://doi.org/10.1002/2016pa003024).

52 Merchant, C.J. et al., 2012: A 20 year independent record of sea surface temperature for climate from Along-Track  
53 Scanning Radiometers. *Journal of Geophysical Research: Oceans*, **117**(C12), doi:[10.1029/2012jc008400](https://doi.org/10.1029/2012jc008400).

54 Merchant, C.J. et al., 2013: The surface temperatures of Earth: steps towards integrated understanding of variability and  
55 change. *Geoscientific Instrumentation, Methods and Data Systems*, **2**(2), 305–321, doi:[10.5194/gi-2-305-2013](https://doi.org/10.5194/gi-2-305-2013).

56 Mercier, H. et al., 2015: Variability of the meridional overturning circulation at the Greenland–Portugal OVIDE section  
57 from 1993 to 2010. *Progress in Oceanography*, **132**, 250–261, doi:[10.1016/j.pocean.2013.11.001](https://doi.org/10.1016/j.pocean.2013.11.001).

58 Meredith, M. et al., 2019: Polar Regions. In: *IPCC Special Report on the Ocean and Cryosphere in a Changing Climate*

- [Pörtner, H.-O., D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegria, M. Nicolai, A. Okem, J. Petzold, B. Rama, and N.M. Weyer (eds.)]. In Press, pp. 203–320.
- Mernild, S.H., W.H. Lipscomb, D.B. Bahr, V. Radić, and M. Zemp, 2013: Global glacier changes: a revised assessment of committed mass losses and sampling uncertainties. *The Cryosphere*, **7**(5), 1565–1577, doi:[10.5194/tc-7-1565-2013](https://doi.org/10.5194/tc-7-1565-2013).
- Meyssignac, B. et al., 2019: Measuring Global Ocean Heat Content to Estimate the Earth Energy Imbalance. *Frontiers in Marine Science*, **6**, 432, doi:[10.3389/fmars.2019.00432](https://doi.org/10.3389/fmars.2019.00432).
- Middleton, J.L., S. Mukhopadhyay, C.H. Langmuir, J.F. McManus, and P.J. Huybers, 2018: Millennial-scale variations in dustiness recorded in Mid-Atlantic sediments from 0 to 70 ka. *Earth and Planetary Science Letters*, **482**, 12–22, doi:[10.1016/j.epsl.2017.10.034](https://doi.org/10.1016/j.epsl.2017.10.034).
- Mieruch, S., M. Schröder, S. Noël, and J. Schulz, 2014: Comparison of decadal global water vapor changes derived from independent satellite time series. *Journal of Geophysical Research Atmospheres*, **119**(22), 12489–12499, doi:[10.1002/2014jd021588](https://doi.org/10.1002/2014jd021588).
- Miller, G.H., J.Y. Landvik, S.J. Lehman, and J.R. Southon, 2017: Episodic Neoglacial snowline descent and glacier expansion on Svalbard reconstructed from the 14C ages of ice-entombed plants. *Quaternary Science Reviews*, **155**, 67–78, doi:[10.1016/j.quascirev.2016.10.023](https://doi.org/10.1016/j.quascirev.2016.10.023).
- Miller, G.H., S.J. Lehman, K.A. Refsnider, J.R. Southon, and Y. Zhong, 2013: Unprecedented recent summer warmth in Arctic Canada. *Geophysical Research Letters*, **40**(21), 5745–5751, doi:[10.1002/2013gl057188](https://doi.org/10.1002/2013gl057188).
- Miller, K.G. et al., 2020: Cenozoic sea-level and cryospheric evolution from deep-sea geochemical and continental margin records. *Science Advances*, **6**(20), doi:[10.1126/sciadv.aaz1346](https://doi.org/10.1126/sciadv.aaz1346).
- Milne, G.A. and J.X. Mitrovica, 2008: Searching for eustasy in deglacial sea-level histories. *Quaternary Science Reviews*, **27**(25), 2292–2302, doi:[10.1016/j.quascirev.2008.08.018](https://doi.org/10.1016/j.quascirev.2008.08.018).
- Mitchell, D.M., L.J. Gray, J. Anstey, M.P. Baldwin, and A.J. Charlton-Perez, 2013: The influence of stratospheric vortex displacements and splits on surface climate. *Journal of Climate*, **26**(8), 2668–2682, doi:[10.1175/jcli-d-12-00030.1](https://doi.org/10.1175/jcli-d-12-00030.1).
- Mitchell, L., E. Brook, J.E. Lee, C. Buijzer, and T. Sowers, 2013a: Constraints on the late Holocene anthropogenic contribution to the atmospheric methane budget (2013b). *Science*, **342**(6161), 964–966, doi:[10.1126/science.1238920](https://doi.org/10.1126/science.1238920).
- Mitchell, L., E. Brook, J.E. Lee, C. Buijzer, and T. Sowers, 2013b: Constraints on the late Holocene anthropogenic contribution to the atmospheric methane budget (2013b). *Science*, **342**(6161), 964–966, doi:[10.1126/science.1238920](https://doi.org/10.1126/science.1238920).
- MK, T., E. Devred, T. Platt, and S. Sathyendranath, 2013: Variation in ocean colour may help predict cod and haddock recruitment. *Marine Ecology Progress Series*, **491**, 187–197, doi:[10.3354/meps10451](https://doi.org/10.3354/meps10451).
- Moat, B.I. et al., 2020: Pending recovery in the strength of the meridional overturning circulation at 26° N. *Ocean Science*, **16**(4), 863–874, doi:[10.5194/os-16-863-2020](https://doi.org/10.5194/os-16-863-2020).
- Moffa-Sánchez, P. and I.R. Hall, 2017: North Atlantic variability and its links to European climate over the last 3000 years. *Nature Communications*, **8**(1), 1726, doi:[10.1038/s41467-017-01884-8](https://doi.org/10.1038/s41467-017-01884-8).
- Moffa-Sánchez, P. et al., 2019: Variability in the Northern North Atlantic and Arctic Oceans Across the Last Two Millennia: A Review. *Paleoceanography and Paleoclimatology*, **34**(8), 1399–1436, doi:[10.1029/2018pa003508](https://doi.org/10.1029/2018pa003508).
- Moffitt, S.E. et al., 2015: Paleoceanographic Insights on Recent Oxygen Minimum Zone Expansion: Lessons for Modern Oceanography. *PLOS ONE*, **10**(1), e0115246, doi:[10.1371/journal.pone.0115246](https://doi.org/10.1371/journal.pone.0115246).
- Mohajerani, Y., I. Velicogna, and E. Rignot, 2018: Mass Loss of Totten and Moscow University Glaciers, East Antarctica, Using Regionally Optimized GRACE Mascons. *Geophysical Research Letters*, **45**(14), 7010–7018, doi:[10.1029/2018gl078173](https://doi.org/10.1029/2018gl078173).
- Mohtadi, M., M. Prange, and S. Steinke, 2016: Review Palaeoclimatic insights into forcing and response of monsoon rainfall. *Nature*, **533**(7602), 191–199, doi:[10.1038/nature17450](https://doi.org/10.1038/nature17450).
- Mokeddem, Z. and J.F. McManus, 2016: Persistent climatic and oceanographic oscillations in the subpolar North Atlantic during the MIS 6 glaciation and MIS 5 interglacial. *Paleoceanography*, **31**(6), 758–778, doi:[10.1002/2015pa002813](https://doi.org/10.1002/2015pa002813).
- Mokeddem, Z., J.F. McManus, and D.W. Oppo, 2014a: Oceanographic dynamics and the end of the last interglacial in the subpolar North Atlantic. *Proceedings of the National Academy of Sciences*, **111**(31), 11263, doi:[10.1073/pnas.1322103111](https://doi.org/10.1073/pnas.1322103111).
- Mokeddem, Z., J.F. McManus, and D.W. Oppo, 2014b: Oceanographic dynamics and the end of the last interglacial in the subpolar North Atlantic. *Proceedings of the National Academy of Sciences*, **111**(31), 11263, doi:[10.1073/pnas.1322103111](https://doi.org/10.1073/pnas.1322103111).
- Mollier-Vogel, E., G. Leduc, T. Bösch, P. Martinez, and R.R. Schneider, 2013: Rainfall response to orbital and millennial forcing in northern Peru over the last 18ka. *Quaternary Science Reviews*, **76**, 29–38, doi:[10.1016/j.quascirev.2013.06.021](https://doi.org/10.1016/j.quascirev.2013.06.021).
- Mollier-Vogel, E. et al., 2019: Mid-Holocene deepening of the Southeast Pacific oxycline. *Global and Planetary Change*, **172**, 365–373, doi:[10.1016/j.gloplacha.2018.10.020](https://doi.org/10.1016/j.gloplacha.2018.10.020).

- 1 Molnar, P. and M.A. Cane, 2002: El Niño's tropical climate and teleconnections as a blueprint for pre-Ice Age climates.  
2 *Paleoceanography*, **17**(2), 11, doi:[10.1029/2001pa000663](https://doi.org/10.1029/2001pa000663).
- 3 Monerie, P.A., J. Robson, B. Dong, D.L.R. Hodson, and N.P. Klingaman, 2019: Effect of the Atlantic Multidecadal  
4 Variability on the Global Monsoon. *Geophysical Research Letters*, **46**(3), 1765–1775,  
5 doi:[10.1029/2018gl080903](https://doi.org/10.1029/2018gl080903).
- 6 Montaggioni, L.F. and G. Faure, 2008: Response of reef coral communities to sea-level rise: a Holocene model from  
7 Mauritius (Western Indian Ocean). *Sedimentology*, **44**(6), 1053–1070, doi:[10.1111/j.1365-3091.1997.tb02178.x](https://doi.org/10.1111/j.1365-3091.1997.tb02178.x).
- 8 Montzka, S.A. et al., 2018a: An unexpected and persistent increase in global emissions of ozone-depleting CFC-11.  
9 *Nature*, **557**(7705), 413–417, doi:[10.1038/s41586-018-0106-2](https://doi.org/10.1038/s41586-018-0106-2).
- 10 Montzka, S.A. et al., 2018b: Hydrofluorocarbons (HFCs). In: *Scientific Assessment of Ozone Depletion: 2018. Global*  
11 *Ozone Research and Monitoring Project – Report No. 58*, World Meteorological Organization (WMO),  
12 Geneva, Switzerland, pp. 2.1–2.56.
- 13 Montzka, S.A. et al., 2021: A decline in global CFC-11 emissions during 2018–2019. *Nature*, **590**(7846), 428–432,  
14 doi:[10.1038/s41586-021-03260-5](https://doi.org/10.1038/s41586-021-03260-5).
- 15 Moore, G.W.K., I.A. Renfrew, and R.S. Pickart, 2013: Multidecadal mobility of the north atlantic oscillation. *Journal*  
16 *of Climate*, **26**(8), 2453–2466, doi:[10.1175/jcli-d-12-00023.1](https://doi.org/10.1175/jcli-d-12-00023.1).
- 17 Morales, M.S. et al., 2020: Six hundred years of South American tree rings reveal an increase in severe hydroclimatic  
18 events since mid-20th century. *Proceedings of the National Academy of Sciences*, **117**(29), 16816–16823,  
19 doi:[10.1073/pnas.2002411117](https://doi.org/10.1073/pnas.2002411117).
- 20 Moreno, P.I. et al., 2014: Southern Annular Mode-like changes in southwestern Patagonia at centennial timescales over  
21 the last three millennia. *Nature Communications*, **5**(1), 4375, doi:[10.1038/ncomms5375](https://doi.org/10.1038/ncomms5375).
- 22 Moreno, P.I. et al., 2018: Onset and evolution of southern annular mode-like changes at centennial timescale. *Scientific*  
23 *Reports*, **8**(1), 3458, doi:[10.1038/s41598-018-21836-6](https://doi.org/10.1038/s41598-018-21836-6).
- 24 Morice, C.P. et al., 2021: An updated assessment of near-surface temperature change from 1850: the HadCRUT5  
25 dataset. *Journal of Geophysical Research: Atmospheres*, **126**(3), doi:[10.1029/2019jd032361](https://doi.org/10.1029/2019jd032361).
- 26 Morioka, Y., T. Tozuka, and T. Yamagata, 2011: On the Growth and Decay of the Subtropical Dipole Mode in the  
27 South Atlantic. *Journal of Climate*, **24**(21), 5538–5554, doi:[10.1175/2011jcli4010.1](https://doi.org/10.1175/2011jcli4010.1).
- 28 Morley, A., Y. Rosenthal, P. DeMenocal, and P. Morley, A., Rosenthal, Y., deMenocal, 2014: Ocean-atmosphere  
29 climate shift during the mid-to-late Holocene transition. *Earth and Planetary Science Letters*, **388**, 18–26,  
30 doi:[10.1016/j.epsl.2013.11.039](https://doi.org/10.1016/j.epsl.2013.11.039).
- 31 Morlighem, M. et al., 2017: BedMachine v3: Complete Bed Topography and Ocean Bathymetry Mapping of Greenland  
32 From Multibeam Echo Sounding Combined With Mass Conservation. *Geophysical Research Letters*, **44**(21),  
33 11,11–51,61, doi:[10.1002/2017gl074954](https://doi.org/10.1002/2017gl074954).
- 34 Morlighem, M. et al., 2020: Deep glacial troughs and stabilizing ridges unveiled beneath the margins of the Antarctic  
35 ice sheet. *Nature Geoscience*, **13**(2), 132–137, doi:[10.1038/s41561-019-0510-8](https://doi.org/10.1038/s41561-019-0510-8).
- 36 Morrill, C., D.P. Lowry, and A. Hoell, 2018: Thermodynamic and Dynamic Causes of Pluvial Conditions During the  
37 Last Glacial Maximum in Western North America. *Geophysical Research Letters*, **45**, 335–345,  
38 doi:[10.1002/2017gl075807](https://doi.org/10.1002/2017gl075807).
- 39 Mortimer, C. et al., 2020: Evaluation of long-term Northern Hemisphere snow water equivalent products. *The*  
40 *Cryosphere*, **14**(5), 1579–1594, doi:[10.5194/tc-14-1579-2020](https://doi.org/10.5194/tc-14-1579-2020).
- 41 Mortin, J. et al., 2016: Melt onset over Arctic sea ice controlled by atmospheric moisture transport. *Geophysical*  
42 *Research Letters*, **43**(12), 6636–6642, doi:[10.1002/2016gl069330](https://doi.org/10.1002/2016gl069330).
- 43 Moucha, R. and G.A. Ruetenik, 2017: Interplay between dynamic topography and flexure along the U.S. Atlantic  
44 passive margin: Insights from landscape evolution modeling. *Global and Planetary Change*, **149**, 72–78,  
45 doi:[10.1016/j.gloplacha.2017.01.004](https://doi.org/10.1016/j.gloplacha.2017.01.004).
- 46 Mouginot, J. et al., 2019: Forty-six years of Greenland Ice Sheet mass balance from 1972 to 2018. *Proceedings of the*  
47 *National Academy of Sciences*, **116**(19), 9239–9244, doi:[10.1073/pnas.1904242116](https://doi.org/10.1073/pnas.1904242116).
- 48 Mudryk, L. et al., 2020: Historical Northern Hemisphere snow cover trends and projected changes in the CMIP6 multi-  
49 model ensemble. *The Cryosphere*, **14**(7), 2495–2514, doi:[10.5194/tc-14-2495-2020](https://doi.org/10.5194/tc-14-2495-2020).
- 50 Mudryk, L.R. et al., 2018: Canadian snow and sea ice: Historical trends and projections. *Cryosphere*, **12**, 1157–1176,  
51 doi:[10.5194/tc-12-1157-2018](https://doi.org/10.5194/tc-12-1157-2018).
- 52 Muglia, J., L.C. Skinner, and A. Schmittner, 2018: Weak overturning circulation and high Southern Ocean nutrient  
53 utilization maximized glacial ocean carbon. *Earth and Planetary Science Letters*, **496**, 47–56,  
54 doi:[10.1016/j.epsl.2018.05.038](https://doi.org/10.1016/j.epsl.2018.05.038).
- 55 Mühle, J. et al., 2019: Perfluorocyclobutane (PFC-318, C4F8) in the global atmosphere. *Atmospheric Chemistry and*  
56 *Physics*, **19**(15), 10335–10359, doi:[10.5194/acp-19-10335-2019](https://doi.org/10.5194/acp-19-10335-2019).
- 57 Müller, T. et al., 2020: Ocean acidification during the early Toarcian extinction event: Evidence from boron isotopes in  
58 brachiopods. *Geology*, **48**(12), 1184–1188, doi:[10.1130/g47781.1](https://doi.org/10.1130/g47781.1).
- 59 Muñoz, P. et al., 2017: Holocene climatic variations in the Western Cordillera of Colombia: A multiproxy high-  
60 resolution record unravels the dual influence of ENSO and ITCZ. *Quaternary Science Reviews*, **155**, 159–178,
- 61

- 1 doi:[10.1016/j.quascirev.2016.11.021](https://doi.org/10.1016/j.quascirev.2016.11.021).
- 2 Murphy, E.J., A. Clarke, C. Symon, and J. Priddle, 1995: Temporal Variation in Antarctic Sea-Ice - Analysis of a Long-  
3 Term Fast-Ice Record from the South-Orkney Islands. *Deep-Sea Research Part I-Oceanographic Research  
4 Papers*, doi:[10.1016/0967-0637\(95\)00057-d](https://doi.org/10.1016/0967-0637(95)00057-d).
- 5 Murphy, E.J., A. Clarke, N.J. Abram, and J. Turner, 2014: Variability of sea-ice in the northern Weddell Sea during the  
6 20th century. *Journal of Geophysical Research: Oceans*, **119**(7), 4549–4572, doi:[10.1002/2013jc009511](https://doi.org/10.1002/2013jc009511).
- 7 Myers-Smith, I.H. et al., 2020: Complexity revealed in the greening of the Arctic. *Nature Climate Change*, **10**(2),  
8 doi:[10.1038/s41558-019-0688-1](https://doi.org/10.1038/s41558-019-0688-1).
- 9 NA SEM, 2017: *Antarctic Sea Ice Variability in the Southern Ocean-Climate System: Proceedings of a Workshop*.  
10 National Academies of Sciences, Engineering, and Medicine. The National Academies Press, Washington,  
11 DC, USA, 82 pp., doi:[10.17226/24696](https://doi.org/10.17226/24696).
- 12 Naik, S.S., P. Divakar Naidu, G.L. Foster, and M.A. Martínez-Botí, 2015: Tracing the strength of the southwest  
13 monsoon using boron isotopes in the eastern Arabian Sea. *Geophysical Research Letters*, **42**(5), 1450–1458,  
14 doi:[10.1002/2015gl063089](https://doi.org/10.1002/2015gl063089).
- 15 Nair, A. et al., 2019: Southern Ocean sea ice and frontal changes during the Late Quaternary and their linkages to Asian  
16 summer monsoon. *Quaternary Science Reviews*, **213**, 93–104, doi:[10.1016/j.quascirev.2019.04.007](https://doi.org/10.1016/j.quascirev.2019.04.007).
- 17 Naqvi, A.-S.T.S.W.A., F. Al-Yamani, A. Goncharov, and L. Fernandes, 2018: High total organic carbon in surface  
18 waters of the northern Arabian Gulf: Implications for the oxygen minimum zone of the Arabian Sea. *Marine  
19 Pollution Bulletin*, **129**(1), 35–42, doi:[10.1016/j.marpolbul.2018.02.013](https://doi.org/10.1016/j.marpolbul.2018.02.013).
- 20 Nash, D.J. et al., 2016: African hydroclimatic variability during the last 2000 years. *Quaternary Science Reviews*, **154**,  
21 1–22, doi:[10.1016/j.quascirev.2016.10.012](https://doi.org/10.1016/j.quascirev.2016.10.012).
- 22 Neely III, R.R. and A. Schmidt, 2016: VolcanEESM: Global volcanic sulphur dioxide (SO<sub>2</sub>) emissions database from  
23 1850 to present - Version 1.0. Centre for Environmental Data Analysis, 04 February 2016.
- 24 Nerem, R.S. et al., 2018: Climate-change–driven accelerated sea-level rise detected in the altimeter era. *Proceedings of  
25 the National Academy of Sciences*, **115**, 201717312, doi:[10.1073/pnas.1717312115](https://doi.org/10.1073/pnas.1717312115).
- 26 Neu, U. et al., 2013: IMILAST: A Community Effort to Intercompare Extratropical Cyclone Detection and Tracking  
27 Algorithms. *Bulletin of the American Meteorological Society*, **94**, 529–547, doi:[10.1175/bams-d-11-00154.1](https://doi.org/10.1175/bams-d-11-00154.1).
- 28 Neukom, R., N. Steiger, J.J. Gómez-Navarro, J. Wang, and J.P. Werner, 2019: No evidence for globally coherent warm  
29 and cold periods over the preindustrial Common Era. *Nature*, **571**(7766), 550–554, doi:[10.1038/s41586-019-1401-2](https://doi.org/10.1038/s41586-019-<br/>30 1401-2).
- 31 Neukom, R. et al., 2014: Inter-hemispheric temperature variability over the past millennium. *Nature Climate Change*, **4**,  
32 362, doi:[10.1038/nclimate2174](https://doi.org/10.1038/nclimate2174).
- 33 Newby, P.E., B.N. Shuman, J.P. Donnelly, K.B. Karnauskas, and J. Marsicek, 2014: Centennial-to-millennial  
34 hydrologic trends and variability along the North Atlantic Coast, USA, during the Holocene. *Geophys. Res.  
35 Lett.*, **41**, 4300–4307, doi:[10.1002/2014gl060183](https://doi.org/10.1002/2014gl060183).
- 36 Newman, M. et al., 2016: The Pacific Decadal Oscillation, Revisited. *Journal of Climate*, **29**(12), 4399–4427,  
37 doi:[10.1175/jcli-d-15-0508.1](https://doi.org/10.1175/jcli-d-15-0508.1).
- 38 Newman, P.A., L. Coy, S. Pawson, and L.R. Lait, 2016: The anomalous change in the QBO in 2015–2016. *Geophysical  
39 Research Letters*, **43**(16), 8791–8797, doi:[10.1002/2016gl070373](https://doi.org/10.1002/2016gl070373).
- 40 Nguyen, H., A. Evans, C. Lucas, I. Smith, and B. Timbal, 2013: The Hadley Circulation in Reanalyses : Climatology,  
41 Variability, and Change. *Journal of Climate*, **26**, 3357–3376, doi:[10.1175/jcli-d-12-00224.1](https://doi.org/10.1175/jcli-d-12-00224.1).
- 42 Nguyen, H., C. Lucas, A. Evans, B. Timbal, and L. Hanson, 2015: Expansion of the Southern Hemisphere Hadley Cell  
43 in Response to Greenhouse Gas Forcing. *Journal of Climate*, **28**, 8067–8077, doi:[10.1175/jcli-d-15-0139.1](https://doi.org/10.1175/jcli-d-15-0139.1).
- 44 Nguyen, P. et al., 2018: Global precipitation trends across spatial scales using satellite observations. *Bulletin of the  
45 American Meteorological Society*, **99**(4), 689–697, doi:[10.1175/bams-d-17-0065.1](https://doi.org/10.1175/bams-d-17-0065.1).
- 46 Niedermeyer, E.M., A.L. Sessions, S.J. Feakins, and M. Mohtadi, 2014: Hydroclimate of the western Indo-Pacific  
47 Warm Pool during the past 24,000 years. *Proceedings of the National Academy of Sciences*, **111**(26), 9402,  
48 doi:[10.1073/pnas.1323585111](https://doi.org/10.1073/pnas.1323585111).
- 49 Nielsen, T. and A. Kuijpers, 2013: Only 5 southern Greenland shelf edge glaciations since the early Pliocene. *Scientific  
50 Reports*, **3**(1), doi:[10.1038/srep01875](https://doi.org/10.1038/srep01875).
- 51 Nitze, I. et al., 2017: Landsat-based trend analysis of lake dynamics across Northern Permafrost Regions. *Remote  
52 Sensing*, **9**(7), 640, doi:[10.3390/rs9070640](https://doi.org/10.3390/rs9070640).
- 53 Nnamchi, H.C., F. Kucharski, N.S. Keenlyside, and R. Farneti, 2017: Analogous seasonal evolution of the South  
54 Atlantic SST dipole indices. *Atmospheric Science Letters*, **18**(10), 396–402, doi:[10.1002/asl.781](https://doi.org/10.1002/asl.781).
- 55 Nnamchi, H.C. et al., 2016: An Equatorial–Extratropical Dipole Structure of the Atlantic Niño. *Journal of Climate*,  
56 **29**(20), 7295–7311, doi:[10.1175/jcli-d-15-0894.1](https://doi.org/10.1175/jcli-d-15-0894.1).
- 57 Noble, T.L. et al., 2020: The Sensitivity of the Antarctic Ice Sheet to a Changing Climate: Past, Present, and Future.  
58 *Reviews of Geophysics*, **58**(4), e2019RG000663, doi:[10.1029/2019rg000663](https://doi.org/10.1029/2019rg000663).
- 59 Noetzli J, Biskaborn B, Christiansen HH, Isaksen K, Schroeneich P, Smith S, Vieira G, Zhao L, S., 2019: Permafrost  
60 Thermal State [in “State of the Climate in 2018”]. *Bulletin of the American Meteorological Society*, **100**(9),  
61 S21–S22, doi:[10.1175/2019bamsstateoftheclimate.1](https://doi.org/10.1175/2019bamsstateoftheclimate.1).

- 1 Noetzli J, Christiansen HH, Isaksen K, Smith S, Zhao L, S., 2020: Permafrost Thermal State [in "State of the Climate in  
2 2019"]. *Bulletin of the American Meteorological Society*, **101**(8), S34–S36, doi:[10.1175/bams-d-20-0104.1](https://doi.org/10.1175/bams-d-20-0104.1).
- 3 Nogueira, M., 2020: Inter-comparison of ERA-5, ERA-interim and GPCP rainfall over the last 40 years: Process-based  
4 analysis of systematic and random differences. *Journal of Hydrology*, **583**, 124632,  
5 doi:[10.1016/j.jhydrol.2020.124632](https://doi.org/10.1016/j.jhydrol.2020.124632).
- 6 Nolan, C. et al., 2018: Past and future global transformation of terrestrial ecosystems under climate change. *Science*,  
7 **361**(6405), 920–923, doi:[10.1126/science.aan5360](https://doi.org/10.1126/science.aan5360).
- 8 Norris, J.R. et al., 2016: Evidence for climate change in the satellite cloud record. *Nature*, **536**(7614), 72–75,  
9 doi:[10.1038/nature18273](https://doi.org/10.1038/nature18273).
- 10 Notz, D., 2014: Sea-ice extent and its trend provide limited metrics of model performance. *Cryosphere*, **8**(1), 229–243,  
11 doi:[10.5194/tc-8-229-2014](https://doi.org/10.5194/tc-8-229-2014).
- 12 O'Leary, M.J. et al., 2013: Ice sheet collapse following a prolonged period of stable sea level during the last  
13 interglacial. *Nature Geoscience*, **6**(9), 796–800, doi:[10.1038/ngeo1890](https://doi.org/10.1038/ngeo1890).
- 14 O'Mara, N.A. et al., 2019: Subtropical Pacific Ocean Temperature Fluctuations in the Common Era: Multidecadal  
15 Variability and Its Relationship With Southwestern North American Megadroughts. *Geophysical Research  
16 Letters*, **46**(24), 14662–14673, doi:[10.1029/2019gl084828](https://doi.org/10.1029/2019gl084828).
- 17 O'Neill, H.B., S.L. Smith, and C. Duchesne, 2019: Long-Term Permafrost Degradation and Thermokarst Subsidence in  
18 the Mackenzie Delta Area Indicated by Thaw Tube Measurements. *Cold Regions Engineering 2019*, 643–651,  
19 doi:[10.1061/9780784482599.074](https://doi.org/10.1061/9780784482599.074).
- 20 Ohba, M., 2013: Important factors for long-term change in ENSO transitivity. *International Journal of Climatology*,  
21 **33**(6), 1495–1509, doi:[10.1002/joc.3529](https://doi.org/10.1002/joc.3529).
- 22 Okamoto, K., T. Ushio, T. Iguchi, N. Takahashi, and K. Iwanami, 2005: The Global Satellite Mapping of Precipitation ( )  
23 GSMAp ) Project. *Proceedings. 2005 IEEE International Geoscience and Remote Sensing Symposium, 2005.  
24 IGARSS '05.*, **5**(3), 3414–3416, doi:[10.1109/igarss.2005.1526575](https://doi.org/10.1109/igarss.2005.1526575).
- 25 Olden, J.D. and T.P. Rooney, 2006: On defining and quantifying biotic homogenization. *Global Ecology and  
26 Biogeography*, **15**(2), 113–120, doi:[10.1111/j.1466-822x.2006.00214.x](https://doi.org/10.1111/j.1466-822x.2006.00214.x).
- 27 Oliveira, F.N.M., L.M. Carvalho, and T. Ambrizzi, 2014: A new climatology for Southern Hemisphere blockings in the  
28 winter and the combined effect of ENSO and SAM phases. *International Journal of Climatology*, **34**, 1676–  
29 1692.
- 30 Olsen, J., N.J. Anderson, and M.F. Knudsen, 2012: Variability of the North Atlantic Oscillation over the past 5 , 200  
31 years. *Nature Geoscience*, **5**(11), 808–812, doi:[10.1038/ngeo1589](https://doi.org/10.1038/ngeo1589).
- 32 Oltmans, S.J. et al., 2013: Recent tropospheric ozone changes - A pattern dominated by slow or no growth. *Atmospheric  
33 Environment*, **67**, 331–351, doi:[10.1016/j.atmosenv.2012.10.057](https://doi.org/10.1016/j.atmosenv.2012.10.057).
- 34 Oppo, D.W., J.F. McManus, and J.L. Cullen, 2003: Deepwater variability in the Holocene epoch. *Nature*, **422**(6929),  
35 277, doi:[10.1038/422277b](https://doi.org/10.1038/422277b).
- 36 Ordonez, A., J.W. Williams, and J.C. Svensson, 2016: Mapping climatic mechanisms likely to favour the emergence of  
37 novel communities. *Nature Climate Change*, **6**, 1104–1109, doi:[10.1038/nclimate3127](https://doi.org/10.1038/nclimate3127).
- 38 Orme, L.C. et al., 2017: Past changes in the North Atlantic storm track driven by insolation and sea-ice forcing.  
39 *Geology*, **45**(4), 335–338, doi:[10.1130/g38521.1](https://doi.org/10.1130/g38521.1).
- 40 Ortega, P. et al., 2015a: A model-tested North Atlantic Oscillation reconstruction for the past millennium. *Nature*,  
41 **523**(7558), 71–74, doi:[10.1038/nature14518](https://doi.org/10.1038/nature14518).
- 42 Ortega, P. et al., 2015b: A model-tested North Atlantic Oscillation reconstruction for the past millennium. *Nature*,  
43 **523**(7558), 71–74, doi:[10.1038/nature14518](https://doi.org/10.1038/nature14518).
- 44 Ortega, P. et al., 2015c: A model-tested North Atlantic Oscillation reconstruction for the past millennium. *Nature*,  
45 **523**(7558), 71–74, doi:[10.1038/nature14518](https://doi.org/10.1038/nature14518).
- 46 Osborn, T.J. et al., 2021: Land Surface Air Temperature Variations Across the Globe Updated to 2019: The CRUTEM5  
47 Data Set. *Journal of Geophysical Research: Atmospheres*, **126**(2), e2019JD032352,  
48 doi:[10.1029/2019jd032352](https://doi.org/10.1029/2019jd032352).
- 49 Osborne, E., J. Richter-Menge, and M. Jeffries (eds.), 2018: *Arctic Report Card 2018*.
- 50 Osborne, E.B., R.C. Thunell, N. Gruber, R.A. Feely, and C.R. Benitez-Nelson, 2020: Decadal variability in twentieth-  
51 century ocean acidification in the California Current Ecosystem. *Nature Geoscience*, **13**(1), 43–49,  
52 doi:[10.1038/s41561-019-0499-z](https://doi.org/10.1038/s41561-019-0499-z).
- 53 Osterberg, E.C. et al., 2017: The 1200 year composite ice core record of Aleutian Low intensification. *Geophysical  
54 Research Letters*, **44**(14), 7447–7454, doi:[10.1002/2017gl073697](https://doi.org/10.1002/2017gl073697).
- 55 Osterhus, S. et al., 2019: Arctic Mediterranean exchanges: a consistent volume budget and trends in transports from two  
56 decades of observations. *Ocean Sci.*, **15**(2), 379–399, doi:[10.5194/os-15-379-2019](https://doi.org/10.5194/os-15-379-2019).
- 57 Otto-Bliesner, B.L. et al., 2017: Amplified North Atlantic warming in the late Pliocene by changes in Arctic gateways:  
58 Arctic Gateways and Pliocene Climate. *Geophysical Research Letters*, **44**(2), 957–964,  
59 doi:[10.1002/2016gl071805](https://doi.org/10.1002/2016gl071805).
- 60 Otto-Bliesner, B.L. et al., 2021a: Large-scale features of Last Interglacial climate: Results from evaluating the lig127k  
61 simulations for CMIP6-PMIP4. *Climate of the Past*, **17**(1), 63–94, doi:[10.5194/cp-17-63-2021](https://doi.org/10.5194/cp-17-63-2021).

- 1 Otto-Bliesner, B.L. et al., 2021b: Large-scale features of Last Interglacial climate: results from evaluating the lig127k  
2 simulations for the Coupled Model Intercomparison Project (CMIP6)--Paleoclimate Modeling Intercomparison  
3 Project (PMIP4). *Climate of the Past*, **17**(1), 63–94, doi:[10.5194/cp-17-63-2021](https://doi.org/10.5194/cp-17-63-2021).
- 4 Ouellet, P. et al., 2011: Ocean surface characteristics influence recruitment variability of populations of northern shrimp  
5 (*Pandalus borealis*) in the Northwest Atlantic. *ICES Journal of Marine Science*, **68**(4), 737–744,  
6 doi:[10.1093/icesjms/fsq174](https://doi.org/10.1093/icesjms/fsq174).
- 7 Overland, J.E. and M. Wang, 2015: Increased variability in the early winter subarctic North American atmospheric  
8 circulation. *Journal of Climate*, **28**(18), 7297–7305, doi:[10.1175/jcli-d-15-0395.1](https://doi.org/10.1175/jcli-d-15-0395.1).
- 9 Pagani, M. et al., 2011: The role of carbon dioxide during the onset of antarctic glaciation. *Science*, **334**(6060), 1261–  
10 1264, doi:[10.1126/science.1203909](https://doi.org/10.1126/science.1203909).
- 11 PAGES 2k Consortium, 2013: Continental-scale temperature variability during the past two millennia. *Nature  
12 Geoscience*, **6**(5), 339–346, doi:[10.1038/ngeo1797](https://doi.org/10.1038/ngeo1797).
- 13 PAGES 2k Consortium, 2019: Consistent multidecadal variability in global temperature reconstructions and simulations  
14 over the Common Era. *Nature Geoscience*, **12**(8), 643–649, doi:[10.1038/s41561-019-0400-0](https://doi.org/10.1038/s41561-019-0400-0).
- 15 PAGES 2k Consortium et al., 2017: A global multiproxy database for temperature reconstructions of the Common Era.  
16 *Scientific Data*, **4**, 170088, doi:[10.1038/sdata.2017.88](https://doi.org/10.1038/sdata.2017.88).
- 17 Palchan, D. and A. Torfstein, 2019: A drop in Sahara dust fluxes records the northern limits of the African Humid  
18 Period. *Nature Communications*, **10**(1), 3803, doi:[10.1038/s41467-019-11701-z](https://doi.org/10.1038/s41467-019-11701-z).
- 19 Palmeiro, F.M., D. Barriopetro, R. Garcia-Herrera, and N. Calvo, 2015: Comparing sudden stratospheric warming  
20 definitions in reanalysis data. *Journal of Climate*, **28**(17), 6823–6840, doi:[10.1175/jcli-d-15-0004.1](https://doi.org/10.1175/jcli-d-15-0004.1).
- 21 Palmer, J.G. et al., 2015: Drought variability in the eastern Australia and New Zealand summer drought atlas (ANZDA,  
22 CE 1500–2012) modulated by the Interdecadal Pacific Oscillation. *Environmental Research Letters*, **10**(12),  
23 124002, doi:[10.1088/1748-9326/10/12/124002](https://doi.org/10.1088/1748-9326/10/12/124002).
- 24 Palmer, M.D., C.M. Domingues, A.B.A. Slangen, and F. Boeira Dias, 2021: An ensemble approach to quantify global  
25 mean sea-level rise over the 20th century from tide gauge reconstructions. *Environmental Research Letters*,  
26 **16**(4), 044043, doi:[10.1088/1748-9326/abdaec](https://doi.org/10.1088/1748-9326/abdaec).
- 27 Palmer, M.D. et al., 2018: An Algorithm for Classifying Unknown Expendable Bathythermograph (XBT) Instruments  
28 Based on Existing Metadata. *Journal of Atmospheric and Oceanic Technology*, **35**(3), 429–440,  
29 doi:[10.1175/jtech-d-17-0129.1](https://doi.org/10.1175/jtech-d-17-0129.1).
- 30 Palmer, M.R. and P.N. Pearson, 2003: A 23,000-year record of surface water pH and PCO<sub>2</sub> in the western equatorial  
31 Pacific Ocean.. *Science (New York, N.Y.)*, **300**(5618), 480–482, doi:[10.1126/science.1080796](https://doi.org/10.1126/science.1080796).
- 32 Palmer, M.R. et al., 2010: Multi-proxy reconstruction of surface water pCO<sub>2</sub> in the northern Arabian Sea since 29ka.  
33 *Earth and Planetary Science Letters*, **295**(1), 49–57, doi:[10.1016/j.epsl.2010.03.023](https://doi.org/10.1016/j.epsl.2010.03.023).
- 34 Pan, N. et al., 2018: Increasing global vegetation browning hidden in overall vegetation greening: Insights from time-  
35 varying trends (2018a). *Remote Sensing of Environment*, **214**, 59–72, doi:[10.1016/j.rse.2018.05.018](https://doi.org/10.1016/j.rse.2018.05.018).
- 36 Pan, T.-Y., C. Murray-Wallace, A. Dosseto, and R.P. Bourman, 2018: The last interglacial (MIS 5e) sea level highstand  
37 from a tectonically stable far-field setting, Yorke Peninsula, southern Australia (2018b). *Marine Geology*, **398**,  
38 126–136, doi:[10.1016/j.margeo.2018.01.012](https://doi.org/10.1016/j.margeo.2018.01.012).
- 39 Park, S. et al., 2021: A decline in emissions of CFC-11 and related chemicals from eastern China. *Nature*, **590**(7846),  
40 433–437, doi:[10.1038/s41586-021-03277-w](https://doi.org/10.1038/s41586-021-03277-w).
- 41 Park, T. et al., 2016: Changes in growing season duration and productivity of northern vegetation inferred from long-  
42 term remote sensing data. *Environmental Research Letters*, **11**(084001), doi:[10.1088/1748-9326/11/8/084001](https://doi.org/10.1088/1748-9326/11/8/084001).
- 43 Parkes, D. and B. Marzeion, 2018: Twentieth-century contribution to sea-level rise from uncharted glaciers. *Nature*,  
44 **563**(7732), 551–554, doi:[10.1038/s41586-018-0687-9](https://doi.org/10.1038/s41586-018-0687-9).
- 45 Parkinson, C.L., 2014: Spatially mapped reductions in the length of the Arctic sea ice season. *Geophysical Research  
46 Letters*, **41**(12), 4316–4322, doi:[10.1002/2014gl060434](https://doi.org/10.1002/2014gl060434).
- 47 Parkinson, C.L., 2019: A 40-y record reveals gradual Antarctic sea ice increases followed by decreases at rates far  
48 exceeding the rates seen in the Arctic. *Proceedings of the National Academy of Sciences*, **116**(29), 14414–  
49 14423, doi:[10.1073/pnas.1906556116](https://doi.org/10.1073/pnas.1906556116).
- 50 Parmesan, C. and M. Hanley, 2015: Plants and climate change: complexities and surprises. *Annals of botany*, **116**, 849–  
51 864, doi:[10.1093/aob/mcv169](https://doi.org/10.1093/aob/mcv169).
- 52 Pascolini-Campbell, M. et al., 2015: Toward a record of Central Pacific El Niño events since 1880. *Theoretical and  
53 Applied Climatology*, **119**(1), 379–389, doi:[10.1007/s00704-014-1114-2](https://doi.org/10.1007/s00704-014-1114-2).
- 54 Paulot, F., D. Paynter, P. Ginoux, V. Naik, and L.W. Horowitz, 2018: Changes in the aerosol direct radiative forcing  
55 from 2001 to 2015: observational constraints and regional mechanisms. *Atmospheric Chemistry and Physics*,  
56 **18**(17), 13265–13281, doi:[10.5194/acp-18-13265-2018](https://doi.org/10.5194/acp-18-13265-2018).
- 57 Pearson, P.N., G.L. Foster, and B.S. Wade, 2009: Atmospheric carbon dioxide through the Eocene–Oligocene climate  
58 transition. *Nature*, **461**, 1110, doi:[10.1038/nature08447](https://doi.org/10.1038/nature08447).
- 59 Pecl, G.T. et al., 2017: Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being.  
60 *Science*, **355**(6332), eaai9214, doi:[10.1126/science.aai9214](https://doi.org/10.1126/science.aai9214).
- 61 Pedlar, J.H. et al., 2015: A comparison of two approaches for generating spatial models of growing-season variables for

- 1 Canada. *Journal of Applied Meteorology and Climatology*, **54**(2), 506–518, doi:[10.1175/jamc-d-14-0045.1](https://doi.org/10.1175/jamc-d-14-0045.1).
- 2 Peeters, F.J.C. et al., 2004: Vigorous exchange between the Indian and Atlantic oceans at the end of the past five glacial  
3 periods. *Nature*, **430**(7000), 661–665, doi:[10.1038/nature02785](https://doi.org/10.1038/nature02785).
- 4 Peltier, W.R., D.F. Argus, and R. Drummond, 2015: Space geodesy constrains ice age terminal deglaciation: The global  
5 ICE-6G\_C (VM5a) model. *Journal of Geophysical Research: Solid Earth*, **120**(1), 450–487,  
6 doi:[10.1002/2014jb011176](https://doi.org/10.1002/2014jb011176).
- 7 Pena-Ortiz, C., D. Gallego, P. Ribera, P. Ordóñez, and M.D.C. Alvarez-Castro, 2013: Observed trends in the global jet  
8 stream characteristics during the second half of the 20th century. *Journal of Geophysical Research  
Atmospheres*, **118**, 2702–2713, doi:[10.1002/jgrd.50305](https://doi.org/10.1002/jgrd.50305).
- 9 Pendleton, S.L. et al., 2019: Rapidly receding Arctic Canada glaciers revealing landscapes continuously ice-covered for  
10 more than 40,000 years. *Nature communications*, **10**(1), 445, doi:[10.1038/s41467-019-08307-w](https://doi.org/10.1038/s41467-019-08307-w).
- 11 Penduff, T., G. Sérazin, S. Leroux, S. Close, J.-M. Molines, B. Barnier, L. Bessières, L. Terray, G.M., 2018: Chaotic  
12 variability of ocean heat content: Climate-relevant features and observational implications. *Oceanography*,  
13 **31**(2), 63–71, doi:[10.5670/oceanog.2018.210](https://doi.org/10.5670/oceanog.2018.210).
- 14 Peng, G., M. Steele, A.C. Bliss, W.N. Meier, and S. Dickinson, 2018: Temporal means and variability of Arctic sea ice  
15 melt and freeze season climate indicators using a satellite climate data record. *Remote Sensing*, **10**(9), 1328,  
16 doi:[10.3390/rs10091328](https://doi.org/10.3390/rs10091328).
- 17 Penman, D.E., B. Hönisch, R.E. Zeebe, E. Thomas, and J.C. Zachos, 2014: Rapid and sustained surface ocean  
18 acidification during the Paleocene-Eocene Thermal Maximum. *Paleoceanography*, **29**(5), 357–369,  
19 doi:[10.1002/2014pa002621](https://doi.org/10.1002/2014pa002621).
- 20 Pepler, A.S., A. Di Luca, and J.P. Evans, 2018: Independently assessing the representation of midlatitude cyclones in  
21 high-resolution reanalyses using satellite observed winds. *International Journal of Climatology*, **38**(3), 1314–  
22 1327, doi:[10.1002/joc.5245](https://doi.org/10.1002/joc.5245).
- 23 Perez, F.F. et al., 2018: Meridional overturning circulation conveys fast acidification to the deep Atlantic Ocean.  
24 *Nature*, **554**(7693), 515–518, doi:[10.1038/nature25493](https://doi.org/10.1038/nature25493).
- 25 Petherick, L. et al., 2013: Climatic records over the past 30 ka from temperate Australia – a synthesis from the Oz-  
26 INTIMATE workgroup. *Quaternary Science Reviews*, **74**, 58–77, doi:[10.1016/j.quascirev.2012.12.012](https://doi.org/10.1016/j.quascirev.2012.12.012).
- 27 Philipona, R. et al., 2018: Radiosondes Show That After Decades of Cooling, the Lower Stratosphere Is Now Warming.  
28 *Journal of Geophysical Research: Atmospheres*, **123**(22), 12,509–12,522, doi:[10.1029/2018jd028901](https://doi.org/10.1029/2018jd028901).
- 29 Piao, S. et al., 2018: On the causes of trends in the seasonal amplitude of atmospheric CO<sub>2</sub>. *Global Change Biology*,  
30 **24**(2), 608–616, doi:[10.1111/gcb.13909](https://doi.org/10.1111/gcb.13909).
- 31 Piao, S. et al., 2020: Characteristics, drivers and feedbacks of global greening. *Nature Reviews Earth & Environment*,  
32 **1**(1), 14–27, doi:[10.1038/s43017-019-0001-x](https://doi.org/10.1038/s43017-019-0001-x).
- 33 Pico, T., 2020: Towards assessing the influence of sediment loading on Last Interglacial sea level. *Geophysical Journal  
International*, **220**(1), 384–392, doi:[10.1093/gji/gjz447](https://doi.org/10.1093/gji/gjz447).
- 34 Piecuch, C.G., 2020: Likely weakening of the Florida Current during the past century revealed by sea-level  
35 observations. *Nature Communications*, **11**(1), 3973, doi:[10.1038/s41467-020-17761-w](https://doi.org/10.1038/s41467-020-17761-w).
- 36 Piecuch, C.G. and R.M. Ponte, 2015: Inverted barometer contributions to recent sea level changes along the northeast  
37 coast of North America. *Geophysical Research Letters*, **42**(14), 5918–5925, doi:[10.1002/2015gl064580](https://doi.org/10.1002/2015gl064580).
- 38 Piecuch, C.G., S. Dangendorf, R.M. Ponte, and M. Marcos, 2016: Annual sea level changes on the North American  
39 Northeast Coast: influence of local winds and barotropic motions. *Journal of Climate*, **29**(13), 4801–4816,  
40 doi:[10.1175/jcli-d-16-0048.1](https://doi.org/10.1175/jcli-d-16-0048.1).
- 41 Pimm, S.L. et al., 2014: The biodiversity of species and their rates of extinction, distribution, and protection. *Science*,  
42 **344**(6187), 1246752, doi:[10.1126/science.1246752](https://doi.org/10.1126/science.1246752).
- 43 Pinsky, M.L., R.L. Selden, and Z.J. Kitchel, 2020: Climate-Driven Shifts in Marine Species Ranges: Scaling from  
44 Organisms to Communities. *Annual Review of Marine Science*, **12**(1), 153–179, doi:[10.1146/annurev-marine-010419-010916](https://doi.org/10.1146/annurev-marine-010419-010916).
- 45 Pinto, J.G. and C.C. Raible, 2012: Past and recent changes in the North Atlantic oscillation. *WIREs Climate Change*,  
46 **3**(1), 79–90, doi:[10.1002/wcc.150](https://doi.org/10.1002/wcc.150).
- 47 Platt, T., C. Fuentes-Yaco, and K.T. Frank, 2003: Spring algal bloom and larval fish survival. *Nature*, **423**(6938), 398–  
48 399, doi:[10.1038/423398b](https://doi.org/10.1038/423398b).
- 49 Poli, P. et al., 2016: ERA-20C: An Atmospheric Reanalysis of the Twentieth Century. *Journal of Climate*, **29**(11),  
50 4083–4097, doi:[10.1175/jcli-d-15-0556.1](https://doi.org/10.1175/jcli-d-15-0556.1).
- 51 Polo, I., B.W. Dong, and R.T. Sutton, 2013: Changes in tropical Atlantic interannual variability from a substantial  
52 weakening of the meridional overturning circulation. *Climate Dynamics*, **41**(9), 2765–2784,  
53 doi:[10.1007/s00382-013-1716-x](https://doi.org/10.1007/s00382-013-1716-x).
- 54 Polo, I., M. Martin-Rey, B. Rodriguez-Fonseca, F. Kucharski, and C.R. Mechoso, 2015: Processes in the Pacific La  
55 Niña onset triggered by the Atlantic Niño. *Climate Dynamics*, **44**(1), 115–131, doi:[10.1007/s00382-014-2354-7](https://doi.org/10.1007/s00382-014-2354-7).
- 56 Polovina, J.J., E.A. Howell, and M. Abecassis, 2008: Ocean's least productive waters are expanding. *Geophysical  
57 Research Letters*, **35**(3), doi:[10.1029/2007gl031745](https://doi.org/10.1029/2007gl031745).

- 1 Polson, D. and G.C. Hegerl, 2017: Strengthening contrast between precipitation in tropical wet and dry regions.  
2 *Geophysical Research Letters*, **44**(1), 365–373, doi:[10.1002/2016gl071194](https://doi.org/10.1002/2016gl071194).
- 3 Poluianov, S., G.A. Kovaltsov, A.L. Mishev, and I.G. Usoskin, 2016: Production of cosmogenic isotopes  $^{7}\text{Be}$ ,  $^{10}\text{Be}$ ,  
4  $^{14}\text{C}$ ,  $^{22}\text{Na}$ , and  $^{36}\text{Cl}$  in the atmosphere: Altitudinal profiles of yield functions. *Journal of Geophysical  
Research: Atmospheres*, **121**(13), 8125–8136, doi:[10.1002/2016jd025034](https://doi.org/10.1002/2016jd025034).
- 5 Polyak, V.J. et al., 2018: A highly resolved record of relative sea level in the western Mediterranean Sea during the last  
6 interglacial period. *Nature Geoscience*, **11**(11), 860–864, doi:[10.1038/s41561-018-0222-5](https://doi.org/10.1038/s41561-018-0222-5).
- 7 Polyakov, I. et al., 2005: Multidecadal Variability of North Atlantic Temperature and Salinity during the Twentieth  
8 Century. *Journal of Climate*, **18**(21), 4562–4581, doi:[10.1175/jcli3548.1](https://doi.org/10.1175/jcli3548.1).
- 9 Pontes, G.M. et al., 2020: Drier tropical and subtropical Southern Hemisphere in the mid-Pliocene Warm Period.  
10 *Scientific Reports*, **10**(1), 13458, doi:[10.1038/s41598-020-68884-5](https://doi.org/10.1038/s41598-020-68884-5).
- 11 Pottapinjara, V., M.S. Girishkumar, R. Murtugudde, K. Ashok, and M. Ravichandran, 2019: On the Relation between  
12 the Boreal Spring Position of the Atlantic Intertropical Convergence Zone and Atlantic Zonal Mode. *Journal  
13 of Climate*, **32**(15), 4767–4781, doi:[10.1175/jcli-d-18-0614.1](https://doi.org/10.1175/jcli-d-18-0614.1).
- 14 Power, S.B. and G. Kociuba, 2011: What Caused the Observed Twentieth-Century Weakening of the Walker  
15 Circulation? *Journal of Climate*, **24**(24), 6501–6514, doi:[10.1175/2011jcli4101.1](https://doi.org/10.1175/2011jcli4101.1).
- 16 Prakash, S., F. Shati, H. Norouzi, and R. Blake, 2018: Observed differences between near-surface air and skin  
17 temperatures using satellite and ground-based data. *Theoretical and Applied Climatology*, **137**(1–2), 587–600,  
18 doi:[10.1007/s00704-018-2623-1](https://doi.org/10.1007/s00704-018-2623-1).
- 19 Prentice, I.C. et al., 2000: Mid-Holocene and glacial-maximum vegetation geography of the northern continents and  
20 Africa. *Journal of Biogeography*, **27**(3), 507–519, doi:[10.1046/j.1365-2699.2000.00425.x](https://doi.org/10.1046/j.1365-2699.2000.00425.x).
- 21 Prigent, A., R.A. Imbol Koungue, J.F. Lübbeke, P. Brandt, and M. Latif, 2020a: Origin of Weakened Interannual Sea  
22 Surface Temperature Variability in the Southeastern Tropical Atlantic Ocean. *Geophysical Research Letters*,  
23 **47**(20), e2020GL089348, doi:[10.1029/2020gl089348](https://doi.org/10.1029/2020gl089348).
- 24 Prigent, A., J.F. Lübbeke, T. Bayr, M. Latif, and C. Wengel, 2020b: Weakened SST variability in the tropical Atlantic  
25 Ocean since 2000. *Climate Dynamics*, **54**(5), 2731–2744, doi:[10.1007/s00382-020-05138-0](https://doi.org/10.1007/s00382-020-05138-0).
- 26 Prytherch, J., E.C. Kent, and D.I. Berry, 2015: A comparison of SSM/I-derived global marine surface-specific  
27 humidity datasets. *International Journal of Climatology*, **35**, 2359–2381, doi:[10.1002/joc.4150](https://doi.org/10.1002/joc.4150).
- 28 Pulliainen, J. et al., 2020: Patterns and trends of Northern Hemisphere snow mass from 1980 to 2018. *Nature*,  
29 **581**(7808), 294–298, doi:[10.1038/s41586-020-2258-0](https://doi.org/10.1038/s41586-020-2258-0).
- 30 Punyu, V.R., V.K. Banakar, and A. Garg, 2014: Equatorial Indian Ocean productivity during the last 33kyr and possible  
31 linkage to Westerly Jet variability. *Marine Geology*, **348**, 44–51, doi:[10.1016/j.margeo.2013.11.010](https://doi.org/10.1016/j.margeo.2013.11.010).
- 32 Purkey, S.G. and G.C. Johnson, 2010: Warming of Global Abyssal and Deep Southern Ocean Waters between the  
33 1990s and 2000s: Contributions to Global Heat and Sea Level Rise Budgets. *Journal of Climate*, **23**(23),  
34 6336–6351, doi:[10.1175/2010jcli3682.1](https://doi.org/10.1175/2010jcli3682.1).
- 35 Putnam, A.E. and W.S. Broecker, 2017: Human-induced changes in the distribution of rainfall. *Science Advances*, **3**(5),  
36 e1600871, doi:[10.1126/sciadv.1600871](https://doi.org/10.1126/sciadv.1600871).
- 37 Qi, D. et al., 2017: Increase in acidifying water in the western Arctic Ocean. *Nature Climate Change*, 195–199,  
38 doi:[10.1038/nclimate3228](https://doi.org/10.1038/nclimate3228).
- 39 Quade, J. and M.R. Kaplan, 2017: Lake-level stratigraphy and geochronology revisited at Lago (Lake) Cardiel,  
40 Argentina, and changes in the Southern Hemispheric Westerlies over the last 25 ka. *Quaternary Science  
Reviews*, **177**, 173–188, doi:[10.1016/j.quascirev.2017.10.006](https://doi.org/10.1016/j.quascirev.2017.10.006).
- 41 Quade, J. et al., 2018: Megalakes in the Sahara ? A Review. *Quaternary Research*, **90**, 253–275,  
42 doi:[10.1017/qua.2018.46](https://doi.org/10.1017/qua.2018.46).
- 43 Queste, B.Y., C. Vic, K.J. Heywood, and S.A. Piontkovski, 2018: Physical Controls on Oxygen Distribution and  
44 Denitrification Potential in the North West Arabian Sea. *Geophysical Research Letters*, **45**(9), 4143–4152,  
doi:[10.1029/2017gl076666](https://doi.org/10.1029/2017gl076666).
- 45 Racault, M.-F., S. Sathyendranath, N. Menon, and T. Platt, 2017a: Phenological Responses to ENSO in the Global  
46 Oceans (2017a). *Surveys in Geophysics*, **38**(1), 277–293, doi:[10.1007/s10712-016-9391-1](https://doi.org/10.1007/s10712-016-9391-1).
- 47 Racault, M.-F., C. Le Quéré, E. Buitenhuis, S. Sathyendranath, and T. Platt, 2012: Phytoplankton phenology in the  
48 global ocean. *Ecological Indicators*, **14**(1), 152–163, doi:[10.1016/j.ecolind.2011.07.010](https://doi.org/10.1016/j.ecolind.2011.07.010).
- 49 Racault, M.-F. et al., 2017b: Impact of El Niño Variability on Oceanic Phytoplankton. *Frontiers in Marine Science*, **4**,  
50 133, doi:[10.3389/fmars.2017.00133](https://doi.org/10.3389/fmars.2017.00133).
- 51 Radeloff, V.C. et al., 2015: The rise of novelty in ecosystems. *Ecological Applications*, **25**(8), 2051–2068,  
52 doi:[10.1890/14-1781.1](https://doi.org/10.1890/14-1781.1).
- 53 Rae, J.W.B., Y.-G. Zhang, X. Liu, G.L. Foster, and H.M. Stoll, 2021: Atmospheric CO<sub>2</sub> over the last 66 million years  
54 from marine archives. *Annual Review of Earth and Planetary Sciences*, doi:[10.1146/annurev-earth-082420-063026](https://doi.org/10.1146/annurev-earth-082420-063026).
- 55 Rae, J.W.B. et al., 2018: CO<sub>2</sub> storage and release in the deep Southern Ocean on millennial to centennial timescales.  
56 *Nature*, **562**(7728), 569–573, doi:[10.1038/s41586-018-0614-0](https://doi.org/10.1038/s41586-018-0614-0).
- 57 Rahmstorf, S. et al., 2015: Exceptional twentieth-century slowdown in Atlantic Ocean overturning circulation. *Nature*

- 1                   *Climate Change*, **5**, 475–480, doi:[10.1038/nclimate2554](https://doi.org/10.1038/nclimate2554).
- 2 Raible, C.C., J.G. Pinto, P. Ludwig, and M. Messmer, 2021: A review of past changes in extratropical cyclones in the  
3 northern hemisphere and what can be learned for the future. *WIREs Climate Change*, **12**(1), e680,  
4 doi:[10.1002/wcc.680](https://doi.org/10.1002/wcc.680).
- 5 Raitzsch, M. et al., 2018: Boron isotope-based seasonal paleo-pH reconstruction for the Southeast Atlantic – A  
6 multispecies approach using habitat preference of planktonic foraminifera. *Earth and Planetary Science  
Letters*, **487**, 138–150, doi:[10.1016/j.epsl.2018.02.002](https://doi.org/10.1016/j.epsl.2018.02.002).
- 8 Randel, W.J., A.K. Smith, F. Wu, C.-Z. Zou, and H. Qian, 2016: Stratospheric Temperature Trends over 1979–2015  
9 Derived from Combined SSU, MLS, and SABER Satellite Observations. *Journal of Climate*, **29**(13), 4843–  
10 4859, doi:[10.1175/jcli-d-15-0629.1](https://doi.org/10.1175/jcli-d-15-0629.1).
- 11 Rao, Y., S. Liang, and Y. Yu, 2018: Land Surface Air Temperature Data Are Considerably Different Among BEST-  
12 LAND, CRU-TEM4v, NASA-GISS, and NOAA-NCEI. *Journal of Geophysical Research: Atmospheres*,  
13 **123**(11), 5881–5900, doi:[10.1029/2018jd028355](https://doi.org/10.1029/2018jd028355).
- 14 Räsänen, T.A., V. Lindgren, J.H.A. Guillaume, B.M. Buckley, and M. Kummu, 2016: On the spatial and temporal  
15 variability of ENSO precipitation and drought teleconnection in mainland Southeast Asia. *Climate of the Past*,  
16 **12**(9), 1889–1905, doi:[10.5194/cp-12-1889-2016](https://doi.org/10.5194/cp-12-1889-2016).
- 17 Ratnam, J., S.K. Behera, Y. Masumoto, and T. Yamagata, 2014: Remote Effects of El Niño and Modoki Events on the  
18 Austral Summer Precipitation of Southern Africa. *Journal of Climate*, **27**(10), 3802–3815, doi:[10.1175/jcli-d-13-00431.1](https://doi.org/10.1175/jcli-d-13-00431.1).
- 20 Ray, E.A. et al., 2017: Quantification of the SF6 lifetime based on mesospheric loss measured in the stratospheric polar  
21 vortex. *Journal of Geophysical Research*, **122**(8), 4626–4638, doi:[10.1002/2016jd026198](https://doi.org/10.1002/2016jd026198).
- 22 Ray, R.D. and B.C. Douglas, 2011: Experiments in reconstructing twentieth-century sea levels. *Progress in  
23 Oceanography*, **91**(4), 496–515, doi:[10.1016/j.pocean.2011.07.021](https://doi.org/10.1016/j.pocean.2011.07.021).
- 24 Raymo, M.E. and J.X. Mitrovica, 2012: Collapse of polar ice sheets during the stage 11 interglacial. *Nature*, **483**(7390),  
25 453–456, doi:[10.1038/nature10891](https://doi.org/10.1038/nature10891).
- 26 Rayner, N.A. et al., 2003: Global analyses of sea surface temperature, sea ice, and night marine air temperature since  
27 the late nineteenth century. *Journal of Geophysical Research: Atmospheres*, **108**(D14),  
28 doi:[10.1029/2002jd002670](https://doi.org/10.1029/2002jd002670).
- 29 Rayner, N.A. et al., 2020: The EUSTACE project: delivering global, daily information on surface air temperature.  
30 *Bulletin of the American Meteorological Society*, 1–79, doi:[10.1175/bams-d-19-0095.1](https://doi.org/10.1175/bams-d-19-0095.1).
- 31 Reboita, M.S., R.P. da Rocha, T. Ambrizzi, and C.D. Gouveia, 2015: Trend and teleconnection patterns in the  
32 climatology of extratropical cyclones over the Southern Hemisphere. *Climate Dynamics*, **45**, 1929–1944,  
33 doi:[10.1007/s00382-014-2447-3](https://doi.org/10.1007/s00382-014-2447-3).
- 34 Rehfeld, K., T. Münch, S.L. Ho, and T. Laepple, 2018: Global patterns of declining temperature variability from the  
35 Last Glacial Maximum to the Holocene. *Nature*, **554**, 356, doi:[10.1038/nature25454](https://doi.org/10.1038/nature25454).
- 36 Reid, P. and R.A. Massom, 2015: Successive Antarctic sea ice extent records during 2012, 2013 and 2014 [in “State of  
37 the Climate in 2014”]. *Bulletin of the American Meteorological Society*, **96**(7), S163–S164,  
38 doi:[10.1175/2015bamsstateoftheclimate.1](https://doi.org/10.1175/2015bamsstateoftheclimate.1).
- 39 Reid, P., S. Stammerjohn, R. Massom, T. Scambos, and J. Lieser, 2015: The record 2013 Southern Hemisphere sea-ice  
40 extent maximum. *Annals of Glaciology*, **56**(69), doi:[10.3189/2015aog69a892](https://doi.org/10.3189/2015aog69a892).
- 41 Reid, P. et al., 2020: Sea ice extent, concentration, and seasonality [in “State of the Climate in 2019”]. *Bull. Amer.  
42 Meteor. Soc.*, **101**(8), S304–S306, doi:[10.1175/bams-d-20-0090.1](https://doi.org/10.1175/bams-d-20-0090.1).
- 43 Reinhold, T. et al., 2019: The Sun is less active than other solar-type stars. *Science*, **368**(6490), 518–521,  
44 doi:[10.1126/science.aay3821](https://doi.org/10.1126/science.aay3821).
- 45 Remmelzwaal, S.R.C. et al., 2019: Investigating Ocean Deoxygenation During the PETM Through the Cr Isotopic  
46 Signature of Foraminifera. *Paleoceanography and Paleoclimatology*, **34**(6), 917–929,  
47 doi:[10.1029/2018pa003372](https://doi.org/10.1029/2018pa003372).
- 48 Renner, A.H.H. et al., 2014: Evidence of Arctic sea ice thinning from direct observations. *Geophysical Research  
49 Letters*, **41**(14), 5029–5036, doi:[10.1002/2014gl060369](https://doi.org/10.1002/2014gl060369).
- 50 Rennie, J.J. et al., 2014: The international surface temperature initiative global land surface databank: monthly  
51 temperature data release description and methods. *Geoscience Data Journal*, **1**(2), 75–102, doi:[10.1002/gdj3.8](https://doi.org/10.1002/gdj3.8).
- 52 Renwick, J.M. and M.E. Rocca, 2015: Temporal context affects the observed rate of climate-driven range shifts in tree  
53 species. *Global Ecology and Biogeography*, **24**(1), 44–51, doi:[10.1111/geb.12240](https://doi.org/10.1111/geb.12240).
- 54 Resplandy, L. et al., 2019: Quantification of ocean heat uptake from changes in atmospheric O<sub>2</sub> and CO<sub>2</sub> composition.  
55 *Scientific Reports*, **9**(1), 20244, doi:[10.1038/s41598-019-56490-z](https://doi.org/10.1038/s41598-019-56490-z).
- 56 Reuter, M. et al., 2020: Ensemble-based satellite-derived carbon dioxide and methane column-averaged dry-air mole  
57 fraction data sets (2003–2018) for carbon and climate applications. *Atmospheric Measurement Techniques*,  
58 **13**(2), 789–819, doi:[10.5194/amt-13-789-2020](https://doi.org/10.5194/amt-13-789-2020).
- 59 Reynhout, S.A. et al., 2019: Holocene glacier fluctuations in Patagonia are modulated by summer insolation intensity  
60 and paced by Southern Annular Mode-like variability. *Quaternary Science Reviews*, **220**, 178–187,  
61 doi:[10.1016/j.quascirev.2019.05.029](https://doi.org/10.1016/j.quascirev.2019.05.029).

- 1 Reynolds, D.J. et al., 2018: Isolating and Reconstructing Key Components of North Atlantic Ocean Variability From a  
2 Sclerochronological Spatial Network. *Paleoceanography and Paleoclimatology*, **33(10)**, 1086–1098,  
3 doi:[10.1029/2018pa003366](https://doi.org/10.1029/2018pa003366).
- 4 RGI Consortium, 2017: Randolph Glacier Inventory – A Dataset of Global Glacier Outlines: Version 6.0. Technical  
5 Report, Global Land Ice Measurements from Space, CO, USA.
- 6 Rhein, M., R. Steinfeldt, D. Kieke, I. Stendardo, and I. Yashayaev, 2017: Ventilation variability of Labrador Sea Water  
7 and its impact on oxygen and anthropogenic carbon: a review. *Philosophical Transactions of the Royal Society*  
8 *A: Mathematical, Physical and Engineering Sciences*, **375(2102)**, 20160321, doi:[10.1098/rsta.2016.0321](https://doi.org/10.1098/rsta.2016.0321).
- 9 Rhodes, R.H. et al., 2013: Continuous methane measurements from a late Holocene Greenland ice core: Atmospheric  
10 and in-situ signals. *Earth and Planetary Science Letters*, **368**, 9–19, doi:[10.1016/j.epsl.2013.02.034](https://doi.org/10.1016/j.epsl.2013.02.034).
- 11 Rhodes, R.H. et al., 2015: Enhanced tropical methane production in response to iceberg discharge in the North Atlantic.  
12 *Science*, **348(6238)**, 1016–1019, doi:[10.1126/science.1262005](https://doi.org/10.1126/science.1262005).
- 13 Rhodes, R.H. et al., 2017: Atmospheric methane variability: Centennial-scale signals in the Last Glacial Period. *Global*  
14 *Biogeochemical Cycles*, **31(3)**, 575–590, doi:[10.1002/2016gb005570](https://doi.org/10.1002/2016gb005570).
- 15 Ribeiro, N., M.M. Mata, J.L.L. De Azevedo, and M. Cirano, 2018: An assessment of the XBT fall-rate equation in the  
16 Southern Ocean. *Journal of Atmospheric and Oceanic Technology*, **35(4)**, 911–926, doi:[10.1175/jtech-d-17-0086.1](https://doi.org/10.1175/jtech-d-17-0086.1).
- 17 Richardson, M., K. Cowtan, and R.J. Millar, 2018: Global temperature definition affects achievement of long-term  
18 climate goals. *Environmental Research Letters*, **13(5)**, 54004, doi:[10.1088/1748-9326/aab305](https://doi.org/10.1088/1748-9326/aab305).
- 19 Richardson, M., K. Cowtan, E. Hawkins, and M.B. Stolpe, 2016: Reconciled climate response estimates from climate  
20 models and the energy budget of Earth. *Nature Climate Change*, **6(10)**, 931–935, doi:[10.1038/nclimate3066](https://doi.org/10.1038/nclimate3066).
- 21 Ricker, R., S. Hendricks, D.K. Perovich, V. Helm, and R. Gerdes, 2015: Impact of snow accumulation on CryoSat-2  
22 range retrievals over Arctic sea ice: An observational approach with buoy data. *Geophysical Research Letters*,  
23 **42(11)**, 4447–4455, doi:[10.1002/2015gl064081](https://doi.org/10.1002/2015gl064081).
- 24 Rigby, M. et al., 2019: Increase in CFC-11 emissions from eastern China based on atmospheric observations. *Nature*,  
25 **569(7757)**, 546–550, doi:[10.1038/s41586-019-1193-4](https://doi.org/10.1038/s41586-019-1193-4).
- 26 Rignot, E. et al., 2019: Four decades of Antarctic Ice Sheet mass balance from 1979–2017. *Proceedings of the National*  
27 *Academy of Sciences*, **116(4)**, 1095–1103, doi:[10.1073/pnas.1812883116](https://doi.org/10.1073/pnas.1812883116).
- 28 Ritz, S.P., T.F. Stocker, J.O. Grimalt, L. Menviel, and A. Timmermann, 2013: Estimated strength of the Atlantic  
29 overturning circulation during the last deglaciation. *Nature Geoscience*, **6(3)**, 208–212, doi:[10.1038/ngeo1723](https://doi.org/10.1038/ngeo1723).
- 30 Roberts, J.B., C.A. Clayson, and F.R. Robertson, 2019: Improving Near - Surface Retrievals of Surface Humidity Over  
31 the Global Open Oceans From Passive Microwave Observations. *Earth and Space Science*, **6**, 1220–1233,  
32 doi:[10.1029/2018ea000436](https://doi.org/10.1029/2018ea000436).
- 33 Roberts, N. et al., 2012a: Palaeolimnological evidence for an east–west climate see-saw in the Mediterranean since AD  
34 900. *Global and Planetary Change*, **84–85(s1)**, 23–34, doi:[10.1016/j.gloplacha.2011.11.002](https://doi.org/10.1016/j.gloplacha.2011.11.002).
- 35 Roberts, N. et al., 2012b: Palaeolimnological evidence for an east–west climate see-saw in the Mediterranean since AD  
36 900. *Global and Planetary Change*, **84–85(s1)**, 23–34, doi:[10.1016/j.gloplacha.2011.11.002](https://doi.org/10.1016/j.gloplacha.2011.11.002).
- 37 Robertson, F.R., M.G. Bosilovich, and J.B. Roberts, 2016: Reconciling Land – Ocean Moisture Transport Variability in  
38 Reanalyses with P - ET in Observationally Driven Land Surface Models. *Journal of Climate*, **29**, 8625–8646,  
39 doi:[10.1175/jcli-d-16-0379.1](https://doi.org/10.1175/jcli-d-16-0379.1).
- 40 Robertson, F.R. et al., 2014: Consistency of Estimated Global Water Cycle Variations over the Satellite Era. *Journal of*  
41 *Climate*, **27**, 6135–6154, doi:[10.1175/jcli-d-13-00384.1](https://doi.org/10.1175/jcli-d-13-00384.1).
- 42 Robertson, F.R. et al., 2020: Uncertainties in Ocean Latent Heat Flux Variations Over Recent Decades in Satellite-  
43 Based Estimates and Reduced Observation Reanalyses. *Journal of Climate*, **33**, 8415–8437, doi:[10.1175/jcli-d-19-0954.1](https://doi.org/10.1175/jcli-d-19-0954.1).
- 44 Robson, J., P. Ortega, and R. Sutton, 2016: A reversal of climatic trends in the North Atlantic since 2005. *Nature*  
45 *Geoscience*, **9**, 513.
- 46 Rodysill, J.R. et al., 2018: A North American Hydroclimate Synthesis (NAHS) of the Common Era. *Global and*  
47 *Planetary Change*, **162**, 175–198, doi:[10.1016/j.gloplacha.2017.12.025](https://doi.org/10.1016/j.gloplacha.2017.12.025).
- 48 Roemmich, D. et al., 2019: On the Future of Argo: A Global, Full-Depth, Multi-Disciplinary Array. *Frontiers in*  
49 *Marine Science*, **6**, 439, doi:[10.3389/fmars.2019.00439](https://doi.org/10.3389/fmars.2019.00439).
- 50 Rohde, R. et al., 2013: Berkeley Earth Temperature Averaging Process. *Geoinformatics & Geostatistics: An Overview*,  
51 **1(2)**, doi:[10.4172/gigs.1000103](https://doi.org/10.4172/gigs.1000103).
- 52 Rohde, R.A. and Z. Hausfather, 2020: The Berkeley Earth Land/Ocean Temperature Record. *Earth System Science*  
53 *Data*, **12(4)**, 3469–3479, doi:[10.5194/essd-12-3469-2020](https://doi.org/10.5194/essd-12-3469-2020).
- 54 Rohling, E.J., 2007: Progress in paleosalinity: Overview and presentation of a new approach. *Paleoceanography*, **22(3)**,  
55 doi:[10.1029/2007pa001437](https://doi.org/10.1029/2007pa001437).
- 56 Rohling, E.J. et al., 2017: Differences between the last two glacial maxima and implications for ice-sheet,  $\delta^{18}\text{O}$ , and  
57 sea-level reconstructions. *Quaternary Science Reviews*, **176**, 1–28, doi:[10.1016/j.quascirev.2017.09.009](https://doi.org/10.1016/j.quascirev.2017.09.009).
- 58 Rohling, E.J. et al., 2019: Asynchronous Antarctic and Greenland ice-volume contributions to the last interglacial sea-  
59 level highstand. *Nature Communications*, **10(1)**, 5040, doi:[10.1038/s41467-019-12874-3](https://doi.org/10.1038/s41467-019-12874-3).

- 1 Rohrer, M. et al., 2018: Representation of extratropical cyclones, blocking anticyclones, and alpine circulation types in  
2 multiple reanalyses and model simulations. *Journal of Climate*, **31**(8), 3009–3031, doi:[10.1175/jcli-d-17-0350.1](https://doi.org/10.1175/jcli-d-17-0350.1).
- 4 Romanovsky, V. et al., 2017: Changing permafrost and its impacts. In: *Snow, Water, Ice and Permafrost in the Arctic*  
5 (SWIPA) 2017. Arctic Monitoring and Assessment Program (AMAP), Oslo, Norway, pp. 65–102.
- 6 Romanovsky, V.E. et al., 2020: Terrestrial Permafrost [in "State of the Climate in 2019"]. *Bulletin of the American*  
7 *Meteorological Society*, **101**(8), 265–269, doi:[10.1175/bams-d-20-0086.1](https://doi.org/10.1175/bams-d-20-0086.1).
- 8 Romanovsky, V. E., Smith, S. L., Isaksen, K., Shiklomanov, N. I., Streletskiy, D. A., Kholodov, A. L., Christiansen, H.  
9 H., Drozdov, D. S., Malkova, G. V., Marchenko, S.S., 2017: Terrestrial Permafrost. In: Arctic Report Card  
10 2017.., doi:[10.1175/2018bamssstateoftheclimate.1](https://doi.org/10.1175/2018bamssstateoftheclimate.1).
- 11 Romanovsky, V. E., Smith, S. L., Isaksen, K., Shiklomanov, N. I., Streletskiy, D. A., Kholodov, A. L., Christiansen, H.  
12 H., Drozdov, D. S., Malkova, G. V., Marchenko, S.S., 2018: [Arctic] Terrestrial Permafrost [in "State of the  
13 Climate in 2017"]. *Bulletin of the American Meteorological Society (supplement)*, **99**(9), S161–S165,  
14 doi:[10.1175/2018bamssstateoftheclimate.1](https://doi.org/10.1175/2018bamssstateoftheclimate.1).
- 15 Rösel, A. et al., 2018: Thin Sea Ice, Thick Snow, and Widespread Negative Freeboard Observed During N-ICE2015  
16 North of Svalbard. *Journal of Geophysical Research: Oceans*, **123**(2), 1156–1176, doi:[10.1002/2017jc012865](https://doi.org/10.1002/2017jc012865).
- 17 Rosenthal, Y., B.K. Linsley, and D.W. Oppo, 2013: Pacific Ocean Heat Content During the Past 10,000 Years. *Science*,  
18 **342**(6158), 617–621, doi:[10.1126/science.1240837](https://doi.org/10.1126/science.1240837).
- 19 Rosenthal, Y., Kalansky, J., Morley, A., Linsley, B., 2017: A paleo-perspective on ocean heat content: Lessons from the  
20 Holocene and Common Era. *Quaternary Science Reviews*, **155**, 1–12, doi:[10.1016/j.quascirev.2016.10.017](https://doi.org/10.1016/j.quascirev.2016.10.017).
- 21 Ross, T., C. Du Preez, and D. Ianson, 2020: Rapid deep ocean deoxygenation and acidification threaten life on  
22 Northeast Pacific seamounts. *Global Change Biology*, **n/a(n/a)**, doi:[10.1111/gcb.15307](https://doi.org/10.1111/gcb.15307).
- 23 Rossby, T., L. Chafik, and L. Houptet, 2020: What can Hydrography Tell Us About the Strength of the Nordic Seas  
24 MOC Over the Last 70 to 100 Years? *Geophysical Research Letters*, **47**(12), e2020GL087456,  
25 doi:[10.1029/2020gl087456](https://doi.org/10.1029/2020gl087456).
- 26 Røthe, T.O., J. Bakke, E.W.N. Støren, and S.O. Dahl, 2019: Wintertime extreme events recorded by lake sediments in  
27 Arctic Norway. *The Holocene*, **29**(8), 1305–1321, doi:[10.1177/0959683619846983](https://doi.org/10.1177/0959683619846983).
- 28 Rouault, M., S. Illig, J. Lübbecke, and R.A.I. Koungue, 2018: Origin, development and demise of the 2010–2011  
29 Benguela Niño. *Journal of Marine Systems*, **188**, 39–48, doi:[10.1016/j.jmarsys.2017.07.007](https://doi.org/10.1016/j.jmarsys.2017.07.007).
- 30 Routson, C.C. et al., 2019: Mid-latitude net precipitation decreased with Arctic warming during the Holocene. *Nature*,  
31 **568**, 83–87, doi:[10.1038/s41586-019-1060-3](https://doi.org/10.1038/s41586-019-1060-3).
- 32 Roy, K. and W.R. Peltier, 2017: Space-geodetic and water level gauge constraints on continental uplift and tilting over  
33 North America: regional convergence of the ICE-6G\_C (VM5a/VM6) models. *Geophysical Journal  
34 International*, **210**(2), 1115–1142, doi:[10.1093/gji/gjx156](https://doi.org/10.1093/gji/gjx156).
- 35 Rubino, A., D. Zanchettin, F. De Rovere, and M.J. McPhaden, 2020: On the interchangeability of sea-surface and near-  
36 surface air temperature anomalies in climatologies. *Scientific Reports*, **10**(1), 7433, doi:[10.1038/s41598-020-64167-1](https://doi.org/10.1038/s41598-020-64167-1).
- 38 Rubino, M. et al., 2019: Revised records of atmospheric trace gases CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, and delta<sup>13</sup>C-CO<sub>2</sub> over the last  
39 2000 years from Law Dome, Antarctica. *Earth System Science Data*, **11**(2), 473–492, doi:[10.5194/essd-11-473-2019](https://doi.org/10.5194/essd-11-473-2019).
- 41 Rumpf, S.B., K. Hülber, N.E. Zimmermann, and S. Dullinger, 2018: Elevational rear edges shifted at least as much as  
42 leading edges over the last century. *Global Ecology and Biogeography*, **28**(4), 533–543,  
43 doi:[10.1111/geb.12865](https://doi.org/10.1111/geb.12865).
- 44 Rupp, D.E., P.W. Mote, N.L. Bindoff, P.A. Stott, and D.A. Robinson, 2013: Detection and attribution of observed  
45 changes in northern hemisphere spring snow cover. *Journal of Climate*, **26**(18), 6904–6914, doi:[10.1175/jcli-d-12-00563.1](https://doi.org/10.1175/jcli-d-12-00563.1).
- 47 Rustic, G.T., A. Koutavas, T.M. Marchitto, and B.K. Linsley, 2015: Dynamical excitation of the tropical Pacific Ocean  
48 and ENSO variability by Little Ice Age cooling. *Science*, **350**(6267), 1537–1541, doi:[10.1126/science.aac9937](https://doi.org/10.1126/science.aac9937).
- 49 Ryu, Y. et al., 2020: Ice core nitrous oxide over the past 2000 years. PANGAEA. Retrieved from:  
50 <https://doi.org/10.1594/pangaea.923434>.
- 51 Sachs, J.P. et al., 2018: Southward Shift of the Pacific ITCZ During the Holocene. *Paleoceanography and  
52 Paleoclimatology*, **33**, 1383–1395, doi:[10.1029/2018pa003469](https://doi.org/10.1029/2018pa003469).
- 53 Sadekov, A.Y. et al., 2013: Palaeoclimate reconstructions reveal a strong link between El Niño-Southern Oscillation  
54 and Tropical Pacific mean state. *Nature Communications*, **4**(1), 2692, doi:[10.1038/ncomms3692](https://doi.org/10.1038/ncomms3692).
- 55 Salamatikis, V., I. Vamvakas, C.A. Gueymard, and A. Kazantzidis, 2021: Atmospheric water vapor radiative effects on  
56 shortwave radiation under clear skies: A global spatiotemporal analysis. *Atmospheric Research*, **251**, 105418,  
57 doi:[10.1016/j.atmosres.2020.105418](https://doi.org/10.1016/j.atmosres.2020.105418).
- 58 Salt, L.A., S.M.A.C. van Heuven, M.E. Claus, E.M. Jones, and H.J.W. de Baar, 2015: Rapid acidification of mode and  
59 intermediate waters in the southwestern Atlantic Ocean. *Biogeosciences*, **12**(5), 1387–1401, doi:[10.5194/bg-12-1387-2015](https://doi.org/10.5194/bg-12-1387-2015).
- 60 Salzmann, U., A.M. Haywood, D.J. Lunt, P.J. Valdes, and D.J. Hill, 2008: A new global biome reconstruction and data-

- model comparison for the Middle Pliocene. *Global Ecology and Biogeography*, **17(3)**, 432–447, doi:[10.1111/j.1466-8238.2008.00381.x](https://doi.org/10.1111/j.1466-8238.2008.00381.x).
- Salzmann, U. et al., 2013a: Challenges in quantifying Pliocene terrestrial warming revealed by data-model discord. *Nature Climate Change*, **3**, 969–974, doi:[10.1038/nclimate2008](https://doi.org/10.1038/nclimate2008).
- Salzmann, U. et al., 2013b: Challenges in quantifying Pliocene terrestrial warming revealed by data-model discord. *Nature Climate Change*, **3**, 969–974, doi:[10.1038/nclimate2008](https://doi.org/10.1038/nclimate2008).
- Samset, B.H., M.T. Lund, M. Bollasina, G. Myhre, and L. Wilcox, 2019: Emerging Asian aerosol patterns. *Nature Geoscience*, **12(8)**, 582–584, doi:[10.1038/s41561-019-0424-5](https://doi.org/10.1038/s41561-019-0424-5).
- Sanborn, K.L. et al., 2017: New evidence of Hawaiian coral reef drowning in response to meltwater pulse-1A. *Quaternary Science Reviews*, **175**, 60–72, doi:[10.1016/j.quascirev.2017.08.022](https://doi.org/10.1016/j.quascirev.2017.08.022).
- Sánchez-Montes, M.L. et al., 2020: Late Pliocene Cordilleran Ice Sheet development with warm Northeast Pacific sea surface temperatures. *Climate of the Past*, **16(1)**, 299–313, doi:[10.5194/cp-2019-29](https://doi.org/10.5194/cp-2019-29).
- Sánchez-Velasco, L. et al., 2019: Larval Fish Habitats and Deoxygenation in the Northern Limit of the Oxygen Minimum Zone off Mexico. *Journal of Geophysical Research: Oceans*, **124(12)**, 9690–9705, doi:[10.1029/2019jc015414](https://doi.org/10.1029/2019jc015414).
- Santer, B.D. et al., 2008a: Consistency of modelled and observed temperature trends in the tropical troposphere. *International Journal of Climatology*, **28(13)**, 1703–1722, doi:[10.1002/joc.1756](https://doi.org/10.1002/joc.1756).
- Santer, B.D. et al., 2008b: Consistency of modelled and observed temperature trends in the tropical troposphere. *International Journal of Climatology*, **28(13)**, 1703–1722, doi:[10.1002/joc.1756](https://doi.org/10.1002/joc.1756).
- Santer, B.D. et al., 2008c: Consistency of modelled and observed temperature trends in the tropical troposphere. *International Journal of Climatology*, **28(13)**, 1703–1722, doi:[10.1002/joc.1756](https://doi.org/10.1002/joc.1756).
- Santer, B.D., T.M.L. Wigley, T.P. Barnett, E.A., 1996: Detection of climate change and attribution of causes. In: *Climate Change 1995: The Science of Climate Change. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change* [Houghton, J.T., L.G.M. Filho, B.A. Callander, N. Harris, A. Kattenberg, and K. Maskell (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 407–444.
- Sapart, C.J. et al., 2012: Natural and anthropogenic variations in methane sources during the past two millennia. *Nature*, **490**, 85–88, doi:[10.1038/nature11461](https://doi.org/10.1038/nature11461).
- Sapiro, M.R.P., C.W. Brown, S. Schollaert Uz, and M. Vargas, 2012: Establishing a global climatology of marine phytoplankton phenological characteristics. *Journal of Geophysical Research: Oceans*, **117(C8)**, doi:[10.1029/2012jc007958](https://doi.org/10.1029/2012jc007958).
- Sasgen, I. et al., 2020: Return to rapid ice loss in Greenland and record loss in 2019 detected by the GRACE-FO satellites. *Communications Earth & Environment*, **1(1)**, 8, doi:[10.1038/s43247-020-0010-1](https://doi.org/10.1038/s43247-020-0010-1).
- Sathyendranath, S. et al., 2019: An Ocean-Colour Time Series for Use in Climate Studies: The Experience of the Ocean-Colour Climate Change Initiative (OC-CCI). *Sensors*, **19(19)**, doi:[10.3390/s19194285](https://doi.org/10.3390/s19194285).
- Sathyendranath, S. et al., 2020: Reconciling models of primary production and photoacclimation. *Appl. Opt.*, **59(10)**, C100—C114, doi:[10.1364/ao.386252](https://doi.org/10.1364/ao.386252).
- Sato, M., J.E. Hansen, M.P. McCormick, and J.B. Pollack, 1993: Stratospheric Aerosol Optical Depths, 1850–1990. *Journal of Geophysical Research*, **98(D12)**, 22987–22994, doi:[10.1029/93jd02553](https://doi.org/10.1029/93jd02553).
- Schaefer, J.M. et al., 2016: Greenland was nearly ice-free for extended periods during the Pleistocene. *Nature*, **540(7632)**, 252–255, doi:[10.1038/nature20146](https://doi.org/10.1038/nature20146).
- Scheen, J. and T.F. Stocker, 2020: Effect of changing ocean circulation on deep ocean temperature in the last millennium. *Earth System Dynamics*, **11(4)**, 925–951, doi:[10.5194/esd-11-925-2020](https://doi.org/10.5194/esd-11-925-2020).
- Scheff, J., R. Seager, and H. Liu, 2017: Are Glacials Dry? Consequences for Paleoclimatology and for Greenhouse Warming. *Journal of Climate*, **30**, 6593–6609, doi:[10.1175/jcli-d-16-0854.1](https://doi.org/10.1175/jcli-d-16-0854.1).
- Scheffers, B.R. et al., 2016: The broad footprint of climate change from genes to biomes to people. *Science*, **354(6313)**, doi:[10.1126/science.aaf7671](https://doi.org/10.1126/science.aaf7671).
- Schefuß, E., H. Kuhlmann, G. Mollenhauer, M. Prange, and J. Pätzold, 2011: Forcing of wet phases in southeast Africa over the past 17,000 years. *Nature*, **480(7378)**, 509–512, doi:[10.1038/nature10685](https://doi.org/10.1038/nature10685).
- Schemm, S., 2018: Regional trends in weather systems help explain Antarctic sea ice trends. *Geophysical Research Letters*, **45**, 7165–7175, doi:[10.1029/2018gl079109](https://doi.org/10.1029/2018gl079109).
- Scherllin-Pirscher, B., G. Kirchengast, A.K. Steiner, Y.-H. Kuo, and U. Foelsche, 2011: Quantifying uncertainty in climatological fields from GPS radio occultation: an empirical-analytical error model. *Atmospheric Measurement Techniques*, **4(9)**, 2019–2034, doi:[10.5194/amt-4-2019-2011](https://doi.org/10.5194/amt-4-2019-2011).
- Scherllin-Pirscher, B. et al., 2012: The vertical and spatial structure of ENSO in the upper troposphere and lower stratosphere from GPS radio occultation measurements. *Geophysical Research Letters*, **39(20)**, doi:[10.1029/2012gl053071](https://doi.org/10.1029/2012gl053071).
- Scherllin-Pirscher B., A. K. Steiner, R. A. Anthes, S. Alexander, R. Biondi, T. Birner, J. Kim, W. J. Randel, S-W. Son, T. Tsuda, Z.Z., 2020: Tropical temperature variability in the UTLS: New insights from GPS radio occultation observations. *J. Climate*, **In Press**, 1–92, doi:[10.1175/jcli-d-20-0385.1](https://doi.org/10.1175/jcli-d-20-0385.1).
- Schilt, A. et al., 2010: Glacial–interglacial and millennial-scale variations in the atmospheric nitrous oxide

- concentration during the last 800,000 years. *Quaternary Science Reviews*, **29**(1), 182–192, doi:[10.1016/j.quascirev.2009.03.011](https://doi.org/10.1016/j.quascirev.2009.03.011).
- Schilt, A. et al., 2014: Isotopic constraints on marine and terrestrial N<sub>2</sub>O emissions during the last deglaciation. *Nature*, **516**, 234, doi:[10.1038/nature13971](https://doi.org/10.1038/nature13971).
- Schimpf, D. et al., 2011: The significance of chemical, isotopic, and detrital components in three coeval stalagmites from the superhumid southernmost Andes (53 S) as high-resolution palaeo-climate proxies. *Quaternary Science Reviews*, **30**(3–4), 443–459, doi:[10.1016/j.quascirev.2010.12.006](https://doi.org/10.1016/j.quascirev.2010.12.006).
- Schmidt, A. et al., 2018a: Volcanic Radiative Forcing From 1979 to 2015. *Journal of Geophysical Research: Atmospheres*, **123**(22), 12,412–491,508, doi:[10.1029/2018jd028776](https://doi.org/10.1029/2018jd028776).
- Schmidt, A. et al., 2018b: Volcanic Radiative Forcing From 1979 to 2015. *Journal of Geophysical Research: Atmospheres*, **123**(22), 12,412–491,508, doi:[10.1029/2018jd028776](https://doi.org/10.1029/2018jd028776).
- Schmidt, M.W., H.J. Spero, and D.W. Lea, 2004: Links between salinity variation in the Caribbean and North Atlantic thermohaline circulation. *Nature*, **428**(6979), 160–163, doi:[10.1038/nature02346](https://doi.org/10.1038/nature02346).
- Schmidt, M.W., M.J. Vautravers, and H.J. Spero, 2006: Rapid subtropical North Atlantic salinity oscillations across Dansgaard-Oeschger cycles. *Nature*, **443**(7111), 561–564, doi:[10.1038/nature05121](https://doi.org/10.1038/nature05121).
- Schneider, D.P. and R.L. Fogt, 2018: Artifacts in Century-Length Atmospheric and Coupled Reanalyses Over Antarctica Due To Historical Data Availability. *Geophysical Research Letters*, **45**(2), 964–973, doi:[10.1002/2017gl076226](https://doi.org/10.1002/2017gl076226).
- Schneider, L. et al., 2015: Revising midlatitude summer temperatures back to A.D. 600 based on a wood density network. *Geophysical Research Letters*, **42**(11), 4556–4562, doi:[10.1002/2015gl063956](https://doi.org/10.1002/2015gl063956).
- Schröder, M. et al., 2016: The GEWEX water vapor assessment: Results from intercomparison, trend, and homogeneity analysis of total column water vapor. *Journal of Applied Meteorology and Climatology*, **55**(7), 1633–1649, doi:[10.1175/jamc-d-15-0304.1](https://doi.org/10.1175/jamc-d-15-0304.1).
- Schröder, M. et al., 2018: The GEWEX Water Vapor Assessment archive of water vapour products from satellite observations and reanalyses. *Earth System Science Data*, **10**(2), 1093–1117, doi:[10.5194/essd-10-1093-2018](https://doi.org/10.5194/essd-10-1093-2018).
- Schröder, M. et al., 2019a: The GEWEX Water Vapor Assessment: Overview and Introduction to Results and Recommendations. *Remote Sensing*, **11**, 1–28, doi:[10.3390/rs11030251](https://doi.org/10.3390/rs11030251).
- Schröder, M. et al., 2019b: The GEWEX Water Vapor Assessment: Overview and Introduction to Results and Recommendations. *Remote Sensing*, **11**, 1–28, doi:[10.3390/rs11030251](https://doi.org/10.3390/rs11030251).
- Schubert, B.A. and A. Hope Jahren, 2013: Reconciliation of marine and terrestrial carbon isotope excursions based on changing atmospheric CO<sub>2</sub> levels. *Nature Communications*, **4**(1), 1653, doi:[10.1038/ncomms2659](https://doi.org/10.1038/ncomms2659).
- Schulte, L.A., D.J. Mladenoff, T.R. Crow, L.C. Merrick, and D.T. Cleland, 2007: Homogenization of northern U.S. Great Lakes forests due to land use. *Landscape Ecology*, **22**, 1089–1103, doi:[10.1007/s10980-007-9095-5](https://doi.org/10.1007/s10980-007-9095-5).
- Schüpbach, S. et al., 2018: Greenland records of aerosol source and atmospheric lifetime changes from the Eemian to the Holocene. *Nature Communications*, **9**(1), 1476, doi:[10.1038/s41467-018-03924-3](https://doi.org/10.1038/s41467-018-03924-3).
- Schweinsberg, A.D., J.P. Briner, G.H. Miller, O. Bennike, and E.K. Thomas, 2017: Local glaciation in West Greenland linked to North Atlantic Ocean circulation during the Holocene. *Geology*, **45**(3), 195–198, doi:[10.1130/g38114.1](https://doi.org/10.1130/g38114.1).
- Schweinsberg, A.D. et al., 2018: Holocene mountain glacier history in the Sukkertoppen Iskappe area, southwest Greenland. *Quaternary Science Reviews*, **197**, 142–161, doi:[10.1016/j.quascirev.2018.06.014](https://doi.org/10.1016/j.quascirev.2018.06.014).
- Screen, J.A. and I. Simmonds, 2013: Exploring links between Arctic amplification and mid-latitude weather. *Geophysical Research Letters*, **40**(5), 959–964, doi:[10.1002/grl.50174](https://doi.org/10.1002/grl.50174).
- Scussolini, P. et al., 2019: Agreement between reconstructed and modeled boreal precipitation of the last interglacial. *Science Advances*, **5**(11), 1–12, doi:[10.1126/sciadv.aax7047](https://doi.org/10.1126/sciadv.aax7047).
- Seidel, D.J. and W.J. Randel, 2006: Variability and trends in the global tropopause estimated from radiosonde data. *Journal of Geophysical Research: Atmospheres*, **111**(D21), doi:[10.1029/2006jd007363](https://doi.org/10.1029/2006jd007363).
- Seidel, D.J. et al., 2016: Stratospheric temperature changes during the satellite era. *Journal of Geophysical Research: Atmospheres*, **121**(2), 664–681, doi:[10.1002/2015jd024039](https://doi.org/10.1002/2015jd024039).
- Séjourné, A. et al., 2015: Evolution of the banks of thermokarst lakes in Central Yakutia (Central Siberia) due to retrogressive thaw slump activity controlled by insolation. *Geomorphology*, doi:[10.1016/j.geomorph.2015.03.033](https://doi.org/10.1016/j.geomorph.2015.03.033).
- Seneviratne, S.I. et al., 2018: The many possible climates from the Paris Agreement's aim of 1.5°C warming. *Nature*, **558**(7708), 41–49, doi:[10.1038/s41586-018-0181-4](https://doi.org/10.1038/s41586-018-0181-4).
- Serno, S. et al., 2015: Comparing dust flux records from the Subarctic North Pacific and Greenland: Implications for atmospheric transport to Greenland and for the application of dust as a chronostratigraphic tool. *Paleoceanography*, **30**(6), 583–600, doi:[10.1002/2014pa002748](https://doi.org/10.1002/2014pa002748).
- Servain, J., I. Wainer, J.P. McCreary Jr., and A. Dessier, 1999: Relationship between the equatorial and meridional modes of climatic variability in the tropical Atlantic. *Geophysical Research Letters*, **26**(4), 485–488, doi:[10.1029/1999gl000014](https://doi.org/10.1029/1999gl000014).
- Seth, A. et al., 2019: Monsoon Responses to Climate Changes - Connecting Past , Present and Future. *Current Climate Change Reports*, **5**(2), 63–79, doi:[10.1007/s40641-019-00125-y](https://doi.org/10.1007/s40641-019-00125-y).

- 1 Seviour, W.J.M., 2017: Weakening and shift of the Arctic stratospheric polar vortex: Internal variability or forced  
2 response? *Geophysical Research Letters*, **44**(7), 3365–3373, doi:[10.1002/2017gl073071](https://doi.org/10.1002/2017gl073071).
- 3 Seviour, W.J.M., S.M. Davis, K.M. Grise, and D.W. Waugh, 2018: Large Uncertainty in the Relative Rates of  
4 Dynamical and Hydrological Tropical Expansion. *Geophysical Research Letters*, **45**(2), 1106–1113,  
5 doi:[10.1002/2017gl076335](https://doi.org/10.1002/2017gl076335).
- 6 Sha, L., 2019: How Far North Did the African Monsoon Fringe Expand During the African Humid Period? Insights  
7 From Southwest Moroccan Speleothems. *Geophysical Research Letters*, **46**(23), 14093–14102,  
8 doi:[10.1029/2019gl084879](https://doi.org/10.1029/2019gl084879).
- 9 Shackleton, N.J., 1987: Oxygen isotopes, ice volume and sea level. *Quaternary Science Reviews*, **6**(3), 183–190,  
10 doi:[10.1016/0277-3791\(87\)90003-5](https://doi.org/10.1016/0277-3791(87)90003-5).
- 11 Shackleton, S. et al., 2019: Is the Noble Gas-Based Rate of Ocean Warming During the Younger Dryas Overestimated?  
12 *Geophysical Research Letters*, **46**(11), 5928–5936, doi:[10.1029/2019gl082971](https://doi.org/10.1029/2019gl082971).
- 13 Shakun, J.D., D.W. Lea, L.E. Lisiecki, and M.E. Raymo, 2015: An 800-kyr record of global surface ocean  $\delta^{18}\text{O}$  and  
14 implications for ice volume-temperature coupling. *Earth and Planetary Science Letters*, **426**, 58–68,  
15 doi:[10.1016/j.epsl.2015.05.042](https://doi.org/10.1016/j.epsl.2015.05.042).
- 16 Shakun, J.D. et al., 2012: Global warming preceded by increasing carbon dioxide concentrations during the last  
17 deglaciation. *Nature*, **484**, 49, doi:[10.1038/nature10915](https://doi.org/10.1038/nature10915).
- 18 Shakun, J.D. et al., 2018: Minimal East Antarctic Ice Sheet retreat onto land during the past eight million years. *Nature*,  
19 **558**(7709), 284–287, doi:[10.1038/s41586-018-0155-6](https://doi.org/10.1038/s41586-018-0155-6).
- 20 Shanahan, T.M. et al., 2015: The time-transgressive termination of the African Humid Period. *Nature Geoscience*, **8**(2),  
21 140–144, doi:[10.1038/ngeo2329](https://doi.org/10.1038/ngeo2329).
- 22 Shao, J. et al., 2019: Atmosphere-Ocean CO<sub>2</sub> Exchange Across the Last Deglaciation From the Boron Isotope Proxy.  
23 *Paleoceanography and Paleoclimatology*, **34**(10), 1650–1670, doi:[10.1029/2018pa003498](https://doi.org/10.1029/2018pa003498).
- 24 Sharmar, V.D., M.Y. Markina, and S.K. Gulev, 2021: Global Ocean Wind-Wave Model Hindcasts Forced by Different  
25 Reanalyses: A Comparative Assessment. *Journal of Geophysical Research: Oceans*, **126**(1), e2020JC016710,  
26 doi:[10.1029/2020jc016710](https://doi.org/10.1029/2020jc016710).
- 27 Shen, S.S.P., N. Tafolla, T.M. Smith, and P.A. Arkin, 2014: Multivariate Regression Reconstruction and Its Sampling  
28 Error for the Quasi-Global Annual Precipitation from 1900 to 2011. *Journal of the atmospheric sciences*, **71**,  
29 3250–3268, doi:[10.1175/jas-d-13-0301.1](https://doi.org/10.1175/jas-d-13-0301.1).
- 30 Shen, X., L. Wang, and S. Osprey, 2020: The Southern Hemisphere sudden stratospheric warming of September 2019.  
31 *Science Bulletin*, **65**(21), 1800–1802, doi:[10.1016/j.scib.2020.06.028](https://doi.org/10.1016/j.scib.2020.06.028).
- 32 Shepherd, T.G. et al., 2014: Reconciliation of halogen-induced ozone loss with the total-column ozone record. *Nature  
33 Geoscience*, **7**, 443–449, doi:[10.1038/ngeo2155](https://doi.org/10.1038/ngeo2155).
- 34 Shi, F. et al., 2015: A multi-proxy reconstruction of spatial and temporal variations in Asian summer temperatures over  
35 the last millennium. *Climatic Change*, **131**(4), 663–676, doi:[10.1007/s10584-015-1413-3](https://doi.org/10.1007/s10584-015-1413-3).
- 36 Shi, H. and B. Wang, 2018: How does the Asian summer precipitation-ENSO relationship change over the past 544  
37 years? *Climate Dynamics*, **52**, 4583–4598, doi:[10.1007/s00382-018-4392-z](https://doi.org/10.1007/s00382-018-4392-z).
- 38 Shi, L., C.J. Schreck, and M. Schröder, 2018: Assessing the Pattern Differences between Satellite-Observed Upper  
39 Tropospheric Humidity and Total Column Water Vapor during Major El Niño Events. *Remote Sensing*,  
40 **10**(1188), 1–15, doi:[10.3390/rs10081188](https://doi.org/10.3390/rs10081188).
- 41 Shi, X., T. Qin, H. Nie, B. Weng, and S. He, 2019: Changes in major global river discharges directed into the ocean.  
42 *International Journal of Environmental Research and Public Health*, **16**(8), doi:[10.3390/ijerph16081469](https://doi.org/10.3390/ijerph16081469).
- 43 Shi, Z., G. Jia, Y. Hu, and Y. Zhou, 2019: The contribution of intensified urbanization effects on surface warming  
44 trends in China. *Theoretical and Applied Climatology*, **138**(1), 1125–1137, doi:[10.1007/s00704-019-02892-y](https://doi.org/10.1007/s00704-019-02892-y).
- 45 Shuman, B.N. and J. Marsicek, 2016: The structure of Holocene climate change in mid-latitude North America.  
46 *Quaternary Science Reviews*, **141**, 38–51, doi:[10.1016/j.quascirev.2016.03.009](https://doi.org/10.1016/j.quascirev.2016.03.009).
- 47 Shuman, B.N., J. Marsicek, W.W. Oswald, and D.R. Foster, 2019: Predictable hydrological and ecological responses to  
48 Holocene North Atlantic variability. *Proceedings of the National Academy of Sciences of the United States of  
49 America*, **116**(13), 5985–5990, doi:[10.1073/pnas.1814307116](https://doi.org/10.1073/pnas.1814307116).
- 50 Shuman, B.N. et al., 2018: Placing the Common Era in a Holocene context: millennial to centennial patterns and trends  
51 in the hydroclimate of North America over the past 2000 years. *Climate of the Past*, **14**(5), 665–686,  
52 doi:[10.5194/cp-14-665-2018](https://doi.org/10.5194/cp-14-665-2018).
- 53 Siegenthaler, U. et al., 2005: Supporting evidence from the EPICA Dronning Maud Land ice core for atmospheric CO<sub>2</sub>  
54 changes during the past millennium. *Tellus B*, **57**(1), 51–57, doi:[10.1111/j.1600-0889.2005.00131.x](https://doi.org/10.1111/j.1600-0889.2005.00131.x).
- 55 Sigl, M. et al., 2015: Timing and climate forcing of volcanic eruptions for the past 2,500 years. *Nature*, **523**, 543–549,  
56 doi:[10.1038/nature14565](https://doi.org/10.1038/nature14565).
- 57 Siler, N., G.H. Roe, K.C. Armour, and N. Feldl, 2019: Revisiting the surface-energy-flux perspective on the sensitivity  
58 of global precipitation to climate change. *Climate Dynamics*, **52**(7), 3983–3995, doi:[10.1007/s00382-018-4359-0](https://doi.org/10.1007/s00382-018-4359-0).
- 59 Simmonds, P.G. et al., 2020: The increasing atmospheric burden of the greenhouse gas sulfur hexafluoride (SF<sub>6</sub>).  
60 *Atmospheric Chemistry and Physics*, **20**(12), 7271–7290, doi:[10.5194/acp-20-7271-2020](https://doi.org/10.5194/acp-20-7271-2020).

- 1 Simmons, A.J., K.M. Willett, P.D. Jones, P.W. Thorne, and D.P. Dee, 2010a: Low-frequency variations in surface  
2 atmospheric humidity, temperature, and precipitation: Inferences from reanalyses and monthly gridded  
3 observational data sets. *Journal of Geophysical Research*, **115**, 1–21, doi:[10.1029/2009jd012442](https://doi.org/10.1029/2009jd012442).
- 4 Simmons, A.J., K.M. Willett, P.D. Jones, P.W. Thorne, and D.P. Dee, 2010b: Low-frequency variations in surface  
5 atmospheric humidity, temperature, and precipitation: Inferences from reanalyses and monthly gridded  
6 observational data sets. *Journal of Geophysical Research*, **115**, 1–21, doi:[10.1029/2009jd012442](https://doi.org/10.1029/2009jd012442).
- 7 Simmons, A.J. et al., 2017: A reassessment of temperature variations and trends from global reanalyses and monthly  
8 surface climatological datasets. *Quarterly Journal of the Royal Meteorological Society*, **143**(702), 101–119,  
9 doi:[10.1002/qj.2949](https://doi.org/10.1002/qj.2949).
- 10 Simpson, I.J. et al., 2012: Long-term decline of global atmospheric ethane concentrations and implications for methane. *Nature*, **488**, 490–494, doi:[10.1038/nature11342](https://doi.org/10.1038/nature11342).
- 11 Simpson, M.J.R., G.A. Milne, P. Huybrechts, and A.J. Long, 2009: Calibrating a glaciological model of the Greenland  
12 ice sheet from the Last Glacial Maximum to present-day using field observations of relative sea level and ice  
13 extent. *Quaternary Science Reviews*, **28**(17), 1631–1657, doi:[10.1016/j.quascirev.2009.03.004](https://doi.org/10.1016/j.quascirev.2009.03.004).
- 14 Sinclair, G. et al., 2016: Diachronous retreat of the Greenland ice sheet during the last deglaciation. *Quaternary Science  
15 Reviews*, **145**, 243–258, doi:[10.1016/j.quascirev.2016.05.040](https://doi.org/10.1016/j.quascirev.2016.05.040).
- 16 Sinclair, K.E., N.A.N. Bertler, M.M. Bowen, and K.R. Arrigo, 2014: Twentieth century sea-ice trends in the Ross Sea  
17 from a high-resolution, coastal ice-core record. *Geophysical Research Letters*, **41**(10), 3510–3516,  
18 doi:[10.1002/2014gl059821](https://doi.org/10.1002/2014gl059821).
- 19 Singh, H.K.A., G.J. Hakim, R. Tardif, J. Emile-Geay, and D.C. Noone, 2018: Insights into Atlantic multidecadal  
20 variability using the Last Millennium Reanalysis framework. *Clim. Past*, **14**(2), 157–174, doi:[10.5194/cp-14-157-2018](https://doi.org/10.5194/cp-14-157-2018).
- 21 Sjolte, J. et al., 2018: Solar and volcanic forcing of North Atlantic climate inferred from a process-based reconstruction. *Climate of the Past*, **14**(8), 1179–1194, doi:[10.5194/cp-14-1179-2018](https://doi.org/10.5194/cp-14-1179-2018).
- 22 Skeie, R.B. et al., 2020: Historical total ozone radiative forcing derived from CMIP6 simulations. *npj Climate and  
23 Atmospheric Science*, **3**(1), 32, doi:[10.1038/s41612-020-00131-0](https://doi.org/10.1038/s41612-020-00131-0).
- 24 Skliris, N., J.D. Zika, G. Nurser, S.A. Josey, and R. Marsh, 2016: Global water cycle amplifying at less than the  
25 Clausius-Clapeyron rate. *Nature Publishing Group*, 1–9, doi:[10.1038/srep38752](https://doi.org/10.1038/srep38752).
- 26 Skliris, N. et al., 2014a: Salinity changes in the World Ocean since 1950 in relation to changing surface freshwater  
27 fluxes. *Climate Dynamics*, **43**(3–4), 709–736, doi:[10.1007/s00382-014-2131-7](https://doi.org/10.1007/s00382-014-2131-7).
- 28 Skliris, N. et al., 2014b: Salinity changes in the World Ocean since 1950 in relation to changing surface freshwater  
29 fluxes. *Climate Dynamics*, **43**(3–4), 709–736, doi:[10.1007/s00382-014-2131-7](https://doi.org/10.1007/s00382-014-2131-7).
- 30 Sloyan, B.M. and T.J. O’Kane, 2015: Drivers of decadal variability in the Tasman Sea. *Journal of Geophysical  
31 Research: Oceans*, **120**(5), 3193–3210, doi:[10.1002/2014jc010550](https://doi.org/10.1002/2014jc010550).
- 32 Ślubowska, M.A., N. Koç, T.L. Rasmussen, and D. Klitgaard-Kristensen, 2005: Changes in the flow of Atlantic water  
33 into the Arctic Ocean since the last deglaciation: Evidence from the northern Svalbard continental margin,  
34 80°N. *Paleoceanography*, **20**(4), doi:[10.1029/2005pa001141](https://doi.org/10.1029/2005pa001141).
- 35 Smeed, D.A. et al., 2014: Observed decline of the Atlantic Meridional Overturning Circulation 2004 to 2012. *Ocean  
36 Science*, **10**, 38–39.
- 37 Smeed, D.A. et al., 2018: The North Atlantic Ocean is in a state of reduced overturning. *Geophysical Research Letters*,  
38 **45**(3), 1527–1533, doi:[10.1002/2017gl076350](https://doi.org/10.1002/2017gl076350).
- 39 Smerdon, J.E. and H.N. Pollack, 2016: Reconstructing Earth’s surface temperature over the past 2000 years: the science  
40 behind the headlines. *Wiley Interdisciplinary Reviews: Climate Change*, **7**(5), 746–771, doi:[10.1002/wcc.418](https://doi.org/10.1002/wcc.418).
- 41 Smith, B. et al., 2020: Pervasive ice sheet mass loss reflects competing ocean and atmosphere processes. *Science*,  
42 **368**(6496), 1239–1242, doi:[10.1126/science.aaz5845](https://doi.org/10.1126/science.aaz5845).
- 43 Smith, C.J. et al., 2020: Effective radiative forcing and adjustments in CMIP6 models. *Atmospheric Chemistry and  
44 Physics*, **20**(16), doi:[10.5194/acp-20-9591-2020](https://doi.org/10.5194/acp-20-9591-2020).
- 45 Smith, T.M. and P.A. Arkin, 2015: Improved historical analysis of oceanic total precipitable water. *Journal of Climate*,  
46 **28**(8), 3099–3121, doi:[10.1175/jcli-d-14-00601.1](https://doi.org/10.1175/jcli-d-14-00601.1).
- 47 Sniderman, J.M.K. et al., 2019: Vegetation and Climate Change in Southwestern Australia During the Last Glacial  
48 Maximum. *Geophysical Research Letters*, **46**(3), 1709–1720, doi:[10.1029/2018gl080832](https://doi.org/10.1029/2018gl080832).
- 49 Snyder, C.W., 2016: Evolution of global temperature over the past two million years. *Nature*, **538**, 226,  
50 doi:[10.1038/nature19798](https://doi.org/10.1038/nature19798).
- 51 Sogacheva, L. et al., 2018: Spatial and seasonal variations of aerosols over China from two decades of multi-satellite  
52 observations – Part 1: ATSR (1995–2011) and MODIS C6.1 (2000–2017). *Atmospheric Chemistry and  
53 Physics*, **18**(15), 11389–11407, doi:[10.5194/acp-18-11389-2018](https://doi.org/10.5194/acp-18-11389-2018).
- 54 Sohn, B.J., S. Lee, E.S. Chung, and H.J. Song, 2016: The role of the dry static stability for the recent change in the  
55 Pacific Walker circulation. *Journal of Climate*, **29**(8), 2765–2779, doi:[10.1175/jcli-d-15-0374.1](https://doi.org/10.1175/jcli-d-15-0374.1).
- 56 Solomina, O.N. et al., 2015: Holocene glacier fluctuations. *Quaternary Science Reviews*, **111**, 9–34,  
57 doi:[10.1016/j.quascirev.2014.11.018](https://doi.org/10.1016/j.quascirev.2014.11.018).
- 58 Solomina, O.N. et al., 2016: Glacier fluctuations during the past 2000 years. *Quaternary Science Reviews*, **149**, 61–90,

- 1                   doi:[10.1016/j.quascirev.2016.04.008](https://doi.org/10.1016/j.quascirev.2016.04.008).
- 2 Solomon, S. et al., 2011: The Persistently Variable "Background" Stratospheric Aerosol Layer and Global Climate  
3 Change. *Science (New York, N.Y.)*, **333**(6044), 866–70, doi:[10.1126/science.1206027](https://doi.org/10.1126/science.1206027).
- 4 Son, K.H. and D.H. Bae, 2015: Drought analysis according to shifting of climate zones to arid climate zone over Asia  
5 monsoon region. *Journal of Hydrology*, **529**, doi:[10.1016/j.jhydrol.2015.09.010](https://doi.org/10.1016/j.jhydrol.2015.09.010).
- 6 Song, X.-P. et al., 2018: Global land change from 1982 to 2016. *Nature*, **560**, 639–643, doi:[10.1038/s41586-018-0411-9](https://doi.org/10.1038/s41586-018-0411-9).
- 7 Sosdian, S.M. et al., 2018: Constraining the evolution of Neogene ocean carbonate chemistry using the boron isotope  
8 pH proxy (2018a). *Earth and Planetary Science Letters*, **248**, 362–376, doi:[10.1016/j.epsl.2018.06.017](https://doi.org/10.1016/j.epsl.2018.06.017).
- 9 Sowers, T., 2001: N<sub>2</sub>O record spanning the penultimate deglaciation from the Vostok ice core. *Journal of Geophysical  
10 Research: Atmospheres*, **106**(D23), 31903–31914, doi:[10.1029/2000jd900707](https://doi.org/10.1029/2000jd900707).
- 11 Ko, M.K.W., P.A. Newman, S. Reimann, and S.E. Strahan (eds.), 2013: *SPARC Report on the Lifetimes of  
12 Stratospheric Ozone-Depleting Substances, Their Replacements, and Related Species*. SPARC Report No. 6,  
13 WCRP-15/2013, 255 pp.
- 14 Petropavlovskikh, I., S. Godin-Beekmann, D. Hubert, R. Damadeo, B. Hassler, and V. Sofieva (eds.), 2019:  
15 *SPARC/I03C/GAW Report on Long-term Ozone Trends and Uncertainties in the Stratosphere*. SPARC Report  
16 No. 9, GAW Report No. 241, WCRP-17/2018, 78 pp., doi:[10.17874/f899e57a20b](https://doi.org/10.17874/f899e57a20b).
- 17 Spector, P. et al., 2017: Rapid early-Holocene deglaciation in the Ross Sea, Antarctica. *Geophysical Research Letters*,  
18 doi:[10.1002/2017gl074216](https://doi.org/10.1002/2017gl074216).
- 19 Spencer, R.W., J.R. Christy, and W.D. Braswell, 2017: UAH Version 6 Global Satellite Temperature Products:  
20 Methodology and Results. *Asia-Pacific Journal of Atmospheric Science*, **53**(1), 121–130,  
21 doi:[10.1007/s13143-017-0010-y](https://doi.org/10.1007/s13143-017-0010-y).
- 22 Spielhagen, R.F. et al., 2011: Enhanced Modern Heat Transfer to the Arctic by Warm Atlantic Water. *Science*,  
23 **331**(6016), 450–453, doi:[10.1126/science.1197397](https://doi.org/10.1126/science.1197397).
- 24 Spinoni, J., J. Vogt, G. Naumann, H. Carrao, and P. Barbosa, 2015: Towards identifying areas at climatological risk of  
25 desertification using the Köppen-Geiger classification and FAO aridity index. *International Journal of  
26 Climatology*, **35**(9), doi:[10.1002/joc.4124](https://doi.org/10.1002/joc.4124).
- 27 Spolaor, A. et al., 2016: Canadian Arctic sea ice reconstructed from bromine in the Greenland NEEM ice core.  
28 *Scientific Reports*, **6**(1), 33925, doi:[10.1038/srep33925](https://doi.org/10.1038/srep33925).
- 29 Spratt, R.M. and L.E. Lisiecki, 2016: A Late Pleistocene sea level stack. *Climate of the Past*, **12**(4), 1079–1092,  
30 doi:[10.5194/cp-12-1079-2016](https://doi.org/10.5194/cp-12-1079-2016).
- 31 Spreen, G., R. Kwok, and D. Menemenlis, 2011: Trends in Arctic sea ice drift and role of wind forcing: 1992–2009.  
32 *Geophysical Research Letters*, **38**(19), doi:[10.1029/2011gl048970](https://doi.org/10.1029/2011gl048970).
- 33 Spreen, G. et al., 2020: Arctic Sea Ice Volume Export Through Fram Strait From 1992 to 2014. *Journal of Geophysical  
34 Research: Oceans*, **125**(6), doi:[10.1029/2019jc016039](https://doi.org/10.1029/2019jc016039).
- 35 Sprintall, J. et al., 2014: The Indonesian seas and their role in the coupled ocean–climate system. *Nature Geoscience*,  
36 **7**(7), 487–492, doi:[10.1038/ngeo2188](https://doi.org/10.1038/ngeo2188).
- 37 Sprintall, J. et al., 2019: Detecting Change in the Indonesian Seas. *Frontiers in Marine Science*, **6**, 257,  
38 doi:[10.3389/fmars.2019.00257](https://doi.org/10.3389/fmars.2019.00257).
- 39 Staehelin, J., P. Viatte, R. Stübi, F. Tummon, and T. Peter, 2018: Stratospheric ozone measurements at Arosa  
40 (Switzerland): History and scientific relevance. *Atmospheric Chemistry and Physics*, **18**(9), 6567–6584,  
41 doi:[10.5194/acp-18-6567-2018](https://doi.org/10.5194/acp-18-6567-2018).
- 42 Stahle, D.W. et al., 2016: The Mexican Drought Atlas: Tree-ring reconstructions of the soil moisture balance during the  
43 late pre-Hispanic, colonial, and modern eras. *Quaternary Science Reviews*, **149**, 34–60,  
44 doi:[10.1016/j.quascirev.2016.06.018](https://doi.org/10.1016/j.quascirev.2016.06.018).
- 45 Staten, P.W., J. Lu, K.M. Grise, S.M. Davis, and T. Birner, 2018: Re-examining tropical expansion. *Nature Climate  
46 Change*, **8**(9), 768–775, doi:[10.1038/s41558-018-0246-2](https://doi.org/10.1038/s41558-018-0246-2).
- 47 Staten, P.W. et al., 2020: Tropical Widening: From Global Variations to Regional Impacts. *Bulletin of the American  
48 Meteorological Society*, **101**(6), E897–E904, doi:[10.1175/bams-d-19-0047.1](https://doi.org/10.1175/bams-d-19-0047.1).
- 49 Steiger, N.J., J.E. Smerdon, E.R. Cook, and B.I. Cook, 2018: A reconstruction of global hydroclimate and dynamical  
50 variables over the Common Era. *Scientific Data*, **5**, 1–15, doi:[10.1038/sdata.2018.86](https://doi.org/10.1038/sdata.2018.86).
- 51 Stein, R., K. Fahl, P. Gierz, F. Niessen, and G. Lohmann, 2017: Arctic Ocean sea ice cover during the penultimate  
52 glacial and the last interglacial. *Nature Communications*, **8**(1), 373, doi:[10.1038/s41467-017-00552-1](https://doi.org/10.1038/s41467-017-00552-1).
- 53 Steiner, A.K. and Co-Authors, 2020: Observed temperature changes in the troposphere and stratosphere from 1979 to  
54 2018. *Journal of Climate*, **33**, 8165–8194, doi:[10.1175/jcli-d-19-0998.1](https://doi.org/10.1175/jcli-d-19-0998.1).
- 55 Steiner, A.K. et al., 2013: Quantification of structural uncertainty in climate data records from GPS radio occultation.  
56 *Atmospheric Chemistry and Physics*, **13**(3), 1469–1484, doi:[10.5194/acp-13-1469-2013](https://doi.org/10.5194/acp-13-1469-2013).
- 57 Steiner, A.K. et al., 2020: Consistency and structural uncertainty of multi-mission GPS radio occultation records.  
58 *Atmospheric Measurement Techniques*, **13**(5), 2547–2575, doi:[10.5194/amt-13-2547-2020](https://doi.org/10.5194/amt-13-2547-2020).
- 59 Steinman, B.A. et al., 2014: Ocean-atmosphere forcing of centennial hydroclimate variability in the Pacific Northwest.  
60 *Geophysical Research Letters*, **41**(7), 2553–2560, doi:[10.1002/2014gl059499](https://doi.org/10.1002/2014gl059499).

- Steinthersdottir, M. et al., 2020: The Miocene: the Future of the Past. *Paleoceanography and Paleoclimatology*, **35(n/a)**, e2020PA004037, doi:[10.1029/2020pa004037](https://doi.org/10.1029/2020pa004037).
- Stenni, B. et al., 2017: Antarctic climate variability on regional and continental scales over the last 2000 years. *Climate of the Past*, **13(11)**, 1609–1634, doi:[10.5194/cp-13-1609-2017](https://doi.org/10.5194/cp-13-1609-2017).
- Stephens, L. et al., 2019: Archaeological assessment reveals Earth's early transformation through land use. *Science*, **365(6456)**, doi:[10.1126/science.aax1192](https://doi.org/10.1126/science.aax1192).
- Stephenson, S.N., N.J. White, T. Li, and L.F. Robinson, 2019: Disentangling interglacial sea level and global dynamic topography: Analysis of Madagascar. *Earth and Planetary Science Letters*, **519**, 61–69, doi:[10.1016/j.epsl.2019.04.029](https://doi.org/10.1016/j.epsl.2019.04.029).
- Stevens, T. et al., 2018: Ice-volume-forced erosion of the Chinese Loess Plateau global Quaternary stratotype site. *Nature Communications*, doi:[10.1038/s41467-018-03329-2](https://doi.org/10.1038/s41467-018-03329-2).
- Stevens T, Buylaert J-P, Lu H, Thiel C, Murray A, Frechen M, 2016: Mass accumulation rate and monsoon records from Xifeng, Chinese Loess Plateau, based on a luminescence age model. *J Quat Sci*, **31(4)**, 391–405, doi:[10.1002/jqs.2848](https://doi.org/10.1002/jqs.2848).
- Stjern, C.W., A. Stohl, and J.E. Kristjánsson, 2011: Have aerosols affected trends in visibility and precipitation in Europe? *Journal of Geophysical Research*, **116(D2)**, D02212, doi:[10.1029/2010jd014603](https://doi.org/10.1029/2010jd014603).
- Stocker, M., F. Ladstädter, H. Wilhelmsen, and A.K. Steiner, 2019: Quantifying Stratospheric Temperature Signals and Climate Imprints From Post-2000 Volcanic Eruptions. *Geophysical Research Letters*, **46(21)**, 12486–12494, doi:[10.1029/2019gl084396](https://doi.org/10.1029/2019gl084396).
- Stokes, C.R. et al., 2015: On the reconstruction of palaeo-ice sheets: Recent advances and future challenges. *Quaternary Science Reviews*, **125**, 15–49, doi:[10.1016/j.quascirev.2015.07.016](https://doi.org/10.1016/j.quascirev.2015.07.016).
- Stoll, H.M. et al., 2019: Uptregulation of phytoplankton carbon concentrating mechanisms during low CO<sub>2</sub> glacial periods and implications for the phytoplankton pCO<sub>2</sub> proxy. *Quaternary Science Reviews*, **208**, 1–20, doi:[10.1016/j.quascirev.2019.01.012](https://doi.org/10.1016/j.quascirev.2019.01.012).
- Stone, E.J., D.J. Lunt, J.D. Annan, and J.C. Hargreaves, 2013: Quantification of the Greenland ice sheet contribution to Last Interglacial sea level rise. *Clim. Past*, **9(2)**, 621–639, doi:[10.5194/cp-9-621-2013](https://doi.org/10.5194/cp-9-621-2013).
- Storto, A. et al., 2017: Steric sea level variability (1993–2010) in an ensemble of ocean reanalyses and objective analyses. *Climate Dynamics*, **49(3)**, 709–729, doi:[10.1007/s00382-015-2554-9](https://doi.org/10.1007/s00382-015-2554-9).
- Stothers, R.B., 1997: Stratospheric aerosol clouds due to very large volcanic eruptions of the early twentieth century: Effective particle sizes and conversion from pyrheliometric to visual optical depth. *Journal of Geophysical Research*, **102(D5)**, 6143, doi:[10.1029/96jd03985](https://doi.org/10.1029/96jd03985).
- Stramma, L. et al., 2020: Trends and decadal oscillations of oxygen and nutrients at 50 to 300m depth in the equatorial and North Pacific. *Biogeosciences*, **17(3)**, 813–831, doi:[10.5194/bg-17-813-2020](https://doi.org/10.5194/bg-17-813-2020).
- Streltskiy, D.A., A.B. Sherstiukov, O.W. Frauenfeld, and F.E. Nelson, 2015: Changes in the 1963–2013 shallow ground thermal regime in Russian permafrost regions. *Environmental Research Letters*, **10(12)**, 125005, doi:[10.1088/1748-9326/10/12/125005](https://doi.org/10.1088/1748-9326/10/12/125005).
- Streltskiy, D.A. et al., 2017: Thaw Subsidence in Undisturbed Tundra Landscapes, Barrow, Alaska, 1962–2015. *Permafrost and Periglacial Processes*, **28(3)**, 566–572, doi:[10.1002/ppp.1918](https://doi.org/10.1002/ppp.1918).
- Stríkis, N.M. et al., 2018: South American monsoon response to iceberg discharge in the North Atlantic. *Proceedings of the National Academy of Sciences of the United States of America*, **115(15)**, 3788–3793, doi:[10.1073/pnas.1717784115](https://doi.org/10.1073/pnas.1717784115).
- Studholme, J. and S. Gulev, 2018: Concurrent changes to hadley circulation and the meridional distribution of tropical cyclones. *Journal of Climate*, **31(11)**, 4367–4389, doi:[10.1175/jcli-d-17-0852.1](https://doi.org/10.1175/jcli-d-17-0852.1).
- Su, H. et al., 2020: OPEN: A New Estimation of Global Ocean Heat Content for Upper 2000 Meters from Remote Sensing Data. *Remote Sensing*, **12(14)**, 2294, doi:[10.3390/rs12142294](https://doi.org/10.3390/rs12142294).
- Su, L. et al., 2018: Long-term trends in global river flow and the causal relationships between river flow and ocean signals. *Journal of Hydrology*, **563**, 818–833, doi:[10.1016/j.jhydrol.2018.06.058](https://doi.org/10.1016/j.jhydrol.2018.06.058).
- Sun, Q. et al., 2018: A Review of Global Precipitation Data Sets: Data Sources, Estimation, and Intercomparisons. *Reviews of Geophysics*, **56(1)**, 79–107, doi:[10.1002/2017rg000574](https://doi.org/10.1002/2017rg000574).
- Sun, S., J. Lan, Y. Fang, Tana, and X. Gao, 2015: A Triggering Mechanism for the Indian Ocean Dipoles Independent of ENSO. *Journal of Climate*, **28(13)**, 5063–5076, doi:[10.1175/jcli-d-14-00580.1](https://doi.org/10.1175/jcli-d-14-00580.1).
- Sun, W. et al., 2021: The Assessment of Global Surface Temperature Change from 1850s: The C-LSAT2.0 Ensemble and the CMST-Interim Datasets. *Advances in Atmospheric Sciences*, doi:[10.1007/s00376-021-1012-3](https://doi.org/10.1007/s00376-021-1012-3).
- Sun, X. et al., 2018: Global diurnal temperature range (DTR) changes since 1901. *Climate Dynamics*, **52**, 3343–3356, doi:[10.1007/s00382-018-4329-6](https://doi.org/10.1007/s00382-018-4329-6).
- Susanto, R.D. and Y.T. Song, 2015: Indonesian throughflow proxy from satellite altimeters and gravimeters. *Journal of Geophysical Research: Oceans*, **120(4)**, 2844–2855, doi:[10.1002/2014jc010382](https://doi.org/10.1002/2014jc010382).
- Susskind, J., G.A. Schmidt, J.N. Lee, and L. Iredell, 2019: Recent global warming as confirmed by AIRS. *Environmental Research Letters*, **14(4)**, 044030, doi:[10.1088/1748-9326/aaf4e](https://doi.org/10.1088/1748-9326/aaf4e).
- Suzuki, T. et al., 2018: A dataset of continental river discharge based on JRA-55 for use in a global ocean circulation model. *Journal of Oceanography*, **74(4)**, 421–429, doi:[10.1007/s10872-017-0458-5](https://doi.org/10.1007/s10872-017-0458-5).

- 1 Svendsen, L., N.G. Kvamstø, and N. Keenlyside, 2014a: Weakening AMOC connects Equatorial Atlantic and Pacific  
2 interannual variability. *Climate Dynamics*, **43**(11), 2931–2941, doi:[10.1007/s00382-013-1904-8](https://doi.org/10.1007/s00382-013-1904-8).
- 3 Svendsen, L., S. Hetzinger, N. Keenlyside, and Y. Gao, 2014b: Marine-based multiproxy reconstruction of Atlantic  
4 multidecadal variability. *Geophysical Research Letters*, **41**(4), 1295–1300, doi:[10.1002/2013gl059076](https://doi.org/10.1002/2013gl059076).
- 5 Swart, N.C. and J.C. Fyfe, 2012: Observed and simulated changes in the Southern Hemisphere surface westerly wind-  
6 stress. *Geophysical Research Letters*, **39**(16), 6–11, doi:[10.1029/2012gl052810](https://doi.org/10.1029/2012gl052810).
- 7 Swart, S. et al., 2019: Constraining Southern Ocean Air-Sea-Ice Fluxes Through Enhanced Observations. *Frontiers in*  
8 *Marine Science*, **6**, 421, doi:[10.3389/fmars.2019.00421](https://doi.org/10.3389/fmars.2019.00421).
- 9 Sydeman, W.J., E. Poloczanska, T.E. Reed, and S.A. Thompson, 2015: Climate change and marine vertebrates. *Science*,  
10 **350**(6262), 772–777, doi:[10.1126/science.aac9874](https://doi.org/10.1126/science.aac9874).
- 11 Tan, X., Y. Wu, B. Liu, and S. Chen, 2020: Inconsistent changes in global precipitation seasonality in seven  
12 precipitation datasets. *Climate Dynamics*, **54**(5–6), 3091–3108, doi:[10.1007/s00382-020-05158-w](https://doi.org/10.1007/s00382-020-05158-w).
- 13 Tang, C. et al., 2017: Distribution and trends of the cold-point tropopause over China from 1979 to 2014 based on  
14 radiosonde dataset. *Atmospheric Research*, **193**, 1–9, doi:[10.1016/j.atmosres.2017.04.008](https://doi.org/10.1016/j.atmosres.2017.04.008).
- 15 Tao, M. et al., 2015: Impact of the 2009 major sudden stratospheric warming on the composition of the stratosphere.  
16 *Atmospheric Chemistry and Physics*, **15**(15), 8695–8715, doi:[10.5194/acp-15-8695-2015](https://doi.org/10.5194/acp-15-8695-2015).
- 17 Tarasick, D. et al., 2019: Tropospheric Ozone Assessment Report: Tropospheric ozone from 1877 to 2016, observed  
18 levels, trends and uncertainties.. *Elem Sci Anth*, **7**(1), 39, doi:[10.1525/elementa.376](https://doi.org/10.1525/elementa.376).
- 19 Tardif, R. et al., 2019: Last Millennium Reanalysis with an expanded proxy database and seasonal proxy modeling.  
20 *Climate of the Past*, **15**(4), 1251–1273, doi:[10.5194/cp-15-1251-2019](https://doi.org/10.5194/cp-15-1251-2019).
- 21 Taylor-Silva, B.I. and C.R. Riesselman, 2018: Polar Frontal Migration in the Warm Late Pliocene: Diatom Evidence  
22 From the Wilkes Land Margin, East Antarctica. *Paleoceanography and Paleoclimatology*, **33**(1), 76–92,  
23 doi:[10.1002/2017pa003225](https://doi.org/10.1002/2017pa003225).
- 24 Tesi, T. et al., 2020: Resolving sea ice dynamics in the north-western Ross Sea during the last 2.6 ka: From seasonal to  
25 millennial timescales. *Quaternary Science Reviews*, **237**, 106299, doi:[10.1016/j.quascirev.2020.106299](https://doi.org/10.1016/j.quascirev.2020.106299).
- 26 Thackeray, C.W., C.G. Fletcher, L.R. Mudryk, and C. Derksen, 2016: Quantifying the Uncertainty in Historical and  
27 Future Simulations of Northern Hemisphere Spring Snow Cover. *Journal of Climate*, **29**(23), 8647–8663,  
28 doi:[10.1175/jcli-d-16-0341.1](https://doi.org/10.1175/jcli-d-16-0341.1).
- 29 Thatcher, D.L. et al., 2020: Hydroclimate variability from western Iberia (Portugal) during the Holocene: Insights from  
30 a composite stalagmite isotope record. *Holocene*, **30**(7), 966–981, doi:[10.1177/0959683620908648](https://doi.org/10.1177/0959683620908648).
- 31 Thibodeau, B. et al., 2018: Last Century Warming Over the Canadian Atlantic Shelves Linked to Weak Atlantic  
32 Meridional Overturning Circulation. *Geophysical Research Letters*, **45**(22), 12, 312–376, 385,  
33 doi:[10.1029/2018gl080083](https://doi.org/10.1029/2018gl080083).
- 34 Thirumalai, K., P.N. DiNezio, J.E. Tierney, M. Puy, and M. Mohtadi, 2019: An El Niño Mode in the Glacial Indian  
35 Ocean? *Paleoceanography and Paleoclimatology*, **34**(8), 1316–1327, doi:[10.1029/2019pa003669](https://doi.org/10.1029/2019pa003669).
- 36 Thomas, E.R. and N.J. Abram, 2016: Ice core reconstruction of sea ice change in the Amundsen-Ross Seas since 1702  
37 A.D.. *Geophysical Research Letters*, **43**(10), 5309–5317, doi:[10.1002/2016gl068130](https://doi.org/10.1002/2016gl068130).
- 38 Thomas, E.R. et al., 2017: Regional Antarctic snow accumulation over the past 1000 years. *Climate of the Past*, **13**(11),  
39 1491–1513, doi:[10.5194/cp-13-1491-2017](https://doi.org/10.5194/cp-13-1491-2017).
- 40 Thomas, E.R. et al., 2019: Antarctic Sea Ice Proxies from Marine and Ice Core Archives Suitable for Reconstructing  
41 Sea Ice over the Past 2000 Years. *Geosciences*, **9**(12), doi:[10.3390/geosciences9120506](https://doi.org/10.3390/geosciences9120506).
- 42 Thomason, L.W. et al., 2018: A global space-based stratospheric aerosol climatology: 1979–2016. *Earth System  
43 Science Data*, **10**(1), 469–492, doi:[10.5194/essd-10-469-2018](https://doi.org/10.5194/essd-10-469-2018).
- 44 Thompson, D.M. et al., 2017: Tropical Pacific climate variability over the last 6000 years as recorded in Bainbridge  
45 Crater Lake, Galápagos. *Paleoceanography*, **32**(8), 903–922, doi:[10.1002/2017pa003089](https://doi.org/10.1002/2017pa003089).
- 46 Thompson, D.W.J., J.J. Kennedy, J.M. Wallace, and P.D. Jones, 2008: A large discontinuity in the mid-twentieth  
47 century in observed global-mean surface temperature. *Nature*, **453**, 646, doi:[10.1038/nature06982](https://doi.org/10.1038/nature06982).
- 48 Thompson, J.R., D.N. Carpenter, C. Cogbill, and D.R. Foster, 2013: Four Centuries of Change in Northeastern United  
49 States Forests. *PLoS ONE*, doi:[10.1371/journal.pone.0072540](https://doi.org/10.1371/journal.pone.0072540).
- 50 Thornalley, D.J.R., H. Elderfield, and I.N. McCave, 2011: Reconstructing North Atlantic deglacial surface hydrography  
51 and its link to the Atlantic overturning circulation. *Global and Planetary Change*, **79**(3–4), 163–175,  
52 doi:[10.1016/j.gloplacha.2010.06.003](https://doi.org/10.1016/j.gloplacha.2010.06.003).
- 53 Thornalley, D.J.R., S. Barker, J. Becker, I.R. Hall, and G. Knorr, 2013: Abrupt changes in deep Atlantic circulation  
54 during the transition to full glacial conditions. *Paleoceanography*, **28**(2), 253–262, doi:[10.1002/palo.20025](https://doi.org/10.1002/palo.20025).
- 55 Thornalley, D.J.R. et al., 2018: Anomalously weak Labrador Sea convection and Atlantic overturning during the past  
56 150 years. *Nature*, **556**, 227–230, doi:[10.1038/s41586-018-0007-4](https://doi.org/10.1038/s41586-018-0007-4).
- 57 Thorne, P.W. et al., 2016a: Reassessing changes in diurnal temperature range: Intercomparison and evaluation of  
58 existing global data set estimates (2016b). *Journal of Geophysical Research: Atmospheres*, **121**(10), 5138–  
59 5158, doi:[10.1002/2015jd024584](https://doi.org/10.1002/2015jd024584).
- 60 Thorne, P.W. et al., 2016b: Reassessing changes in diurnal temperature range: A new data set and characterization of  
61 data biases (2016a). *Journal of Geophysical Research: Atmospheres*, **121**(10), 5115–5137,

- 1 doi:[10.1002/2015jd024583](https://doi.org/10.1002/2015jd024583).
- 2 Tian, Z., T. Li, D. Jiang, and L. Chen, 2017: Causes of ENSO weakening during the mid-Holocene. *Journal of Climate*,  
3 **30**(17), 7049–7070, doi:[10.1175/jcli-d-16-0899.1](https://doi.org/10.1175/jcli-d-16-0899.1).
- 4 Tierney, J.E., C.C. Ummenhofer, and P.B. DeMenocal, 2015: Past and future rainfall in the Horn of Africa. *Science  
5 Advances*, **1**(9), e1500682, doi:[10.1126/sciadv.1500682](https://doi.org/10.1126/sciadv.1500682).
- 6 Tierney, J.E. et al., 2020: Glacial cooling and climate sensitivity revisited. *Nature*, **584**, 569–573, doi:[10.1038/s41586-020-2617-x](https://doi.org/10.1038/s41586-<br/>7 020-2617-x).
- 8 Tilinina, N., S.K. Gulev, I. Rudeva, and P. Koltermann, 2013: Comparing Cyclone Life Cycle Characteristics and Their  
9 Interannual Variability in Different Reanalyses. *Journal of Climate*, **26**, 6419–6438, doi:[10.1175/jcli-d-12-00777.1](https://doi.org/10.1175/jcli-d-12-<br/>10 00777.1).
- 11 Timmermann, A. et al., 2018: El Niño–Southern Oscillation complexity. *Nature*, **559**(7715), 535–545,  
12 doi:[10.1038/s41586-018-0252-6](https://doi.org/10.1038/s41586-018-0252-6).
- 13 Tokarska, K.B. et al., 2019: Recommended temperature metrics for carbon budget estimates, model evaluation and  
14 climate policy. *Nature Geoscience*, **12**(12), 964–971, doi:[10.1038/s41561-019-0493-5](https://doi.org/10.1038/s41561-019-0493-5).
- 15 Tokinaga, H. and S.-P. Xie, 2011: Weakening of the equatorial Atlantic cold tongue over the past six decades. *Nature  
16 Geoscience*, **4**(4), 222–226, doi:[10.1038/ngeo1078](https://doi.org/10.1038/ngeo1078).
- 17 Tomita, H., T. Hihara, S. Kako, M. Kubota, and K. Kutsuwada, 2019: An introduction to J-OFURO3, a third-generation  
18 Japanese ocean flux data set using remote-sensing observations. *Journal of Oceanography*, **75**(2), 171–194,  
19 doi:[10.1007/s10872-018-0493-x](https://doi.org/10.1007/s10872-018-0493-x).
- 20 Toohey, M. and M. Sigl, 2017: Volcanic stratospheric sulfur injections and aerosol optical depth from 500 BCE to 1900  
21 CE. *Earth System Science Data*, **9**(2), 809–831, doi:[10.5194/essd-9-809-2017](https://doi.org/10.5194/essd-9-809-2017).
- 22 Toucanne, S. et al., 2015: Tracking rainfall in the northern Mediterranean borderlands during sapropel deposition.  
23 *Quaternary Science Reviews*, **129**, 178–195, doi:[10.1016/j.quascirev.2015.10.016](https://doi.org/10.1016/j.quascirev.2015.10.016).
- 24 Toyos, M.H. et al., 2020: Antarctic Circumpolar Current Dynamics at the Pacific Entrance to the Drake Passage Over  
25 the Past 1.3 Million Years. *Paleoceanography and Paleoclimatology*, **35**(7), e2019PA003773,  
26 doi:[10.1029/2019pa003773](https://doi.org/10.1029/2019pa003773).
- 27 Tradowsky, J.S., C.P. Burrows, S.B. Healy, and J.R. Eyre, 2017: A New Method to Correct Radiosonde Temperature  
28 Biases Using Radio Occultation Data. *Journal of Applied Meteorology and Climatology*, **56**(6), 1643–1661,  
29 doi:[10.1175/jamc-d-16-0136.1](https://doi.org/10.1175/jamc-d-16-0136.1).
- 30 Trammell, J.H. et al., 2015: Investigation of Precipitation Variations over Wet and Dry Areas from Observation and  
31 Model. *Advances in Meteorology*, **2015**(981092), 1–9, doi:[10.1155/2015/981092](https://doi.org/10.1155/2015/981092).
- 32 Treat, C.C. and M.C. Jones, 2018a: Near-surface permafrost aggradation in Northern Hemisphere peatlands shows  
33 regional and global trends during the past 6000 years. *Holocene*, **28**(6), doi:[10.1177/0959683617752858](https://doi.org/10.1177/0959683617752858).
- 34 Treat, C.C. and M.C. Jones, 2018b: Near-surface permafrost aggradation in Northern Hemisphere peatlands shows  
35 regional and global trends during the past 6000 years. *Holocene*, **28**(6), doi:[10.1177/0959683617752858](https://doi.org/10.1177/0959683617752858).
- 36 Trenberth, K.E. and J.T. Fasullo, 2017: Atlantic meridional heat transports computed from balancing Earth's energy  
37 locally. *Geophysical Research Letters*, **44**(4), 1919–1927, doi:[10.1002/2016gl072475](https://doi.org/10.1002/2016gl072475).
- 38 Trouet, V., F. Babst, and M. Meko, 2018: Recent enhanced high-summer North Atlantic jet variability emerges from  
39 three-century context. *Nature Communications*, **9**:180, doi:[10.1038/s41467-017-02699-3](https://doi.org/10.1038/s41467-017-02699-3).
- 40 Tschudi, M.A., J.C. Stroeve, and J.S. Stewart, 2016: Relating the age of Arctic sea ice to its thickness, as measured  
41 during nasa's ICESat and IceBridge campaigns. *Remote Sensing*, **8**(6), 457, doi:[10.3390/rs8060457](https://doi.org/10.3390/rs8060457).
- 42 Tseng, W.L., S.Y. Simon Wang, H.H. Hsu, and J.D.D. Meyer, 2019: Intensification of the decadal activity in Equatorial  
43 Rossby Waves and linkage to changing tropical circulation. *Terrestrial, Atmospheric and Oceanic Sciences*,  
44 **30**(4), 563–574, doi:[10.3319/tao.2019.01.18.02](https://doi.org/10.3319/tao.2019.01.18.02).
- 45 Tsubouchi, T. et al., 2021: Increased ocean heat transport into the Nordic Seas and Arctic Ocean over the period 1993–  
46 2016. *Nature Climate Change*, **11**(1), 21–26, doi:[10.1038/s41558-020-00941-3](https://doi.org/10.1038/s41558-020-00941-3).
- 47 Turner, J., J.S. Hosking, T.J. Bracegirdle, G.J. Marshall, and T. Phillips, 2015: Recent changes in Antarctic Sea Ice.  
48 *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*,  
49 **373**(2045), doi:[10.1098/rsta.2014.0163](https://doi.org/10.1098/rsta.2014.0163).
- 50 Turner, S.K., 2018: Constraints on the onset duration of the Paleocene-Eocene Thermal Maximum. *Philosophical  
51 Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, **376**(2130),  
52 doi:[10.1098/rsta.2017.0082](https://doi.org/10.1098/rsta.2017.0082).
- 53 Turney, C.S.M. et al., 2016a: A 250-year periodicity in Southern Hemisphere westerly winds over the last 2600 years  
54 (2016a). *Climate of the Past*, **12**, 189–200, doi:[10.5194/cp-12-189-2016](https://doi.org/10.5194/cp-12-189-2016).
- 55 Turney, C.S.M. et al., 2016b: Intensification of Southern Hemisphere westerly winds 2000-1000 years ago: evidence  
56 from the subantarctic Campbell and Auckland Islands (52–50°S). *Journal of Quaternary Science*, **31**(1), 12–19,  
57 doi:[10.1002/jqs.2828](https://doi.org/10.1002/jqs.2828).
- 58 Turney, C.S.M. et al., 2017: Reconstructing atmospheric circulation over southern New Zealand: Establishment of  
59 modern westerly airflow 5500 years ago and implications for Southern Hemisphere Holocene climate change.  
60 *Quaternary Science Reviews*, **159**, 77–87, doi:[10.1016/j.quascirev.2016.12.017](https://doi.org/10.1016/j.quascirev.2016.12.017).
- 61 Turney, C.S.M. et al., 2020: A global mean sea-surface temperature dataset for the Last Interglacial (129–116 kyr) and

- 1 contributin of thermal expansin to sea-level change. *Earth System Science Data*, **12(4)**, 3341–3356,  
2 doi:[10.5194/essd-12-3341-2020](https://doi.org/10.5194/essd-12-3341-2020).
- 3 Tweedy, O. et al., 2017: Response of trace gases to the disrupted 2015–2016 quasi-biennial oscillation. *Atmospheric*  
4 *Chemistry and Physics*, **17(11)**, 6813–6823, doi:[10.5194/acp-17-6813-2017](https://doi.org/10.5194/acp-17-6813-2017).
- 5 Tyrlis, E. et al., 2020: On the role of Ural Blocking in driving the Warm Arctic–Cold Siberia pattern. *Quarterly Journal*  
6 *of the Royal Meteorological Society*, **145**, 2138–2153, doi:[10.1002/qj.3784](https://doi.org/10.1002/qj.3784).
- 7 Újvári, G. et al., 2017: Coupled European and Greenland last glacial dust activity driven by North Atlantic climate.  
8 *Proceedings of the National Academy of Sciences of the United States of America*, **114(50)**, E10632–E10638,  
9 doi:[10.1073/pnas.1712651114](https://doi.org/10.1073/pnas.1712651114).
- 10 Ummenhofer, C.C., A. Biastoch, and C.W. Böning, 2016: Multidecadal Indian Ocean Variability Linked to the Pacific  
11 and Implications for Preconditioning Indian Ocean Dipole Events. *Journal of Climate*, **30(5)**, 1739–1751,  
12 doi:[10.1175/jcli-d-16-0200.1](https://doi.org/10.1175/jcli-d-16-0200.1).
- 13 UNESCO/ICES/SCOR/IAPSO, 1981: *Background papers and supporting data on the Practical Salinity Scale 1978*.  
14 UNESCO Technical Papers in Marine Science No. 37. United Nations Educational, Scientific and Cultural  
15 Organization (UNESCO), Paris, France, 144 pp.
- 16 Usoskin, I.G., Y. Gallet, F. Lopes, G.A. Kovaltsov, and G. Hulot, 2016: Solar activity during the Holocene: the  
17 Hallstatt cycle and its consequence for grand minima and maxima. *A&A*, **587**, A150, doi:[10.1051/0004-6361/201527295](https://doi.org/10.1051/0004-6361/201527295).
- 18 Vaccaro, A. et al., 2021: Climate field completion via Markov random fields – Application to the HadCRUT4.6  
19 temperature dataset. *Journal of Climate*, 1–66, doi:[10.1175/jcli-d-19-0814.1](https://doi.org/10.1175/jcli-d-19-0814.1).
- 20 Vacchi, M. et al., 2016: Multiproxy assessment of Holocene relative sea-level changes in the western Mediterranean:  
21 Sea-level variability and improvements in the definition of the isostatic signal. *Earth-Science Reviews*, **155**,  
22 172–197, doi:[10.1016/j.earscirev.2016.02.002](https://doi.org/10.1016/j.earscirev.2016.02.002).
- 23 Vaks, A. et al., 2013: Speleothems Reveal 500,000-Year History of Siberian Permafrost. *Science*, **340(6129)**,  
24 doi:[10.1126/science.1228729](https://doi.org/10.1126/science.1228729).
- 25 Vaks, A. et al., 2020: Palaeoclimate evidence of vulnerable permafrost during times of low sea ice. *Nature*, **577(7789)**,  
26 doi:[10.1038/s41586-019-1880-1](https://doi.org/10.1038/s41586-019-1880-1).
- 27 van den Bos, V. et al., 2018: Holocene temperature , humidity and seasonality in northern New Zealand linked to  
28 Southern Hemisphere summer insolation. *Quaternary Science Reviews*, **201**, 77–88,  
29 doi:[10.1016/j.quascirev.2018.10.008](https://doi.org/10.1016/j.quascirev.2018.10.008).
- 30 van den Broeke, M. et al., 2017: Greenland Ice Sheet Surface Mass Loss: Recent Developments in Observation and  
31 Modeling. *Current Climate Change Reports*, **3**, 345–356, doi:[10.1007/s40641-017-0084-8](https://doi.org/10.1007/s40641-017-0084-8).
- 32 van Dijk, J. et al., 2020: Spatial pattern of super-greenhouse warmth controlled by elevated specific humidity. *Nature*  
33 *Geoscience*, **13(11)**, 739–744, doi:[10.1038/s41561-020-00648-2](https://doi.org/10.1038/s41561-020-00648-2).
- 34 Vandenberghe, J. et al., 2014: The Last Permafrost Maximum (LPM) map of the Northern Hemisphere: permafrost  
35 extent and mean annual air temperatures, 25–17 ka BP. *Boreas*, **43(3)**, doi:[10.1111/bor.12070](https://doi.org/10.1111/bor.12070).
- 36 Vanderwal, J. et al., 2013: Focus on poleward shifts in species' distribution underestimates the fingerprint of climate  
37 change. *Nature Climate Change*, **3**, 239–243, doi:[10.1038/nclimate1688](https://doi.org/10.1038/nclimate1688).
- 38 Vasskog, K., P.M. Langbroek, J.T. Andrews, J.E. Nilsen, and A. Nesje, 2015: The Greenland Ice Sheet during the last  
39 glacial cycle: Current ice loss and contribution to sea-level rise from a palaeoclimatic perspective. *Earth-*  
40 *Science Reviews*, **150**, 45–67, doi:[10.1016/j.earscirev.2015.07.006](https://doi.org/10.1016/j.earscirev.2015.07.006).
- 41 Vautard, R., T.R. McVicar, J.N. Thepaut, and M.L. Roderic, 2012: Land surface winds and atmospheric evaporative  
42 demand [in “State of the Climate in 2011”]. *Bulletin of the American Meteorological Society*, **93(7)**, S36–S38,  
43 doi:[10.1175/2012bamsstateoftheclimate.1](https://doi.org/10.1175/2012bamsstateoftheclimate.1).
- 44 Velicogna, I. et al., 2020: Continuity of Ice Sheet Mass Loss in Greenland and Antarctica From the GRACE and  
45 GRACE Follow-On Missions. *Geophysical Research Letters*, **47(8)**, doi:[10.1029/2020gl087291](https://doi.org/10.1029/2020gl087291).
- 46 Venegas, S.A., L.A. Mysak, and D.N. Straub, 1996: Evidence for interannual and interdecadal climate variability in the  
47 South Atlantic. *Geophysical Research Letters*, **23(19)**, 2673–2676, doi:[10.1029/96gl02373](https://doi.org/10.1029/96gl02373).
- 48 Venter, O. et al., 2016: Sixteen years of change in the global terrestrial human footprint and implications for  
49 biodiversity conservation. *Nature Communications*, **7**, doi:[10.1038/ncomms12558](https://doi.org/10.1038/ncomms12558).
- 50 Venturelli, R.A. et al., 2020: Mid-Holocene Grounding Line Retreat and Readvance at Whillans Ice Stream, West  
51 Antarctica. *Geophysical Research Letters*, **47(15)**, e2020GL088476, doi:[10.1029/2020gl088476](https://doi.org/10.1029/2020gl088476).
- 52 Vernier, J.-P. et al., 2011: Major influence of tropical volcanic eruptions on the stratospheric aerosol layer during the  
53 last decade. *Geophysical Research Letters*, **38(12)**, doi:[10.1029/2011gl047563](https://doi.org/10.1029/2011gl047563).
- 54 Vicente-Serrano, S.M. et al., 2018: Recent changes of relative humidity: regional connections with land and ocean  
55 processes. *Earth System Dynamics*, **9(2)**, 915–937, doi:[10.5194/esd-9-915-2018](https://doi.org/10.5194/esd-9-915-2018).
- 56 Vihma, T., P. Tisler, and P. Uotila, 2012: Atmospheric forcing on the drift of Arctic sea ice in 1989–2009. *Geophysical*  
57 *Research Letters*, **39(2)**, doi:[10.1029/2011gl050118](https://doi.org/10.1029/2011gl050118).
- 58 Villalba, R. et al., 2012: Unusual Southern Hemisphere tree growth patterns induced by changes in the Southern  
59 Annular Mode. *Nature Geoscience*, **5**, 793–798, doi:[10.1038/ngeo1613](https://doi.org/10.1038/ngeo1613).
- 60 Vinogradova, N.T. and R.M. Ponte, 2017: In Search of Fingerprints of the Recent Intensification of the Ocean Water

- 1 Cycle. *Journal of Climate*, **30**(14), 5513–5528, doi:[10.1175/jcli-d-16-0626.1](https://doi.org/10.1175/jcli-d-16-0626.1).
- 2 Voigt, I. et al., 2015: Holocene shifts of the southern westerlies across the South Atlantic. *Paleoceanography*, **30**(2),  
3 39–51, doi:[10.1002/2014pa002677](https://doi.org/10.1002/2014pa002677).
- 4 von Schuckmann, K. et al., 2018: Copernicus Marine Service Ocean State Report. *Journal of Operational*  
5 *Oceanography*, **11**(sup1), S1–S142, doi:[10.1080/1755876x.2018.1489208](https://doi.org/10.1080/1755876x.2018.1489208).
- 6 von Schuckmann, K. et al., 2019: Copernicus Marine Service Ocean State Report, Issue 3. *Journal of Operational*  
7 *Oceanography*, **12**(sup1), S1–S123, doi:[10.1080/1755876x.2019.1633075](https://doi.org/10.1080/1755876x.2019.1633075).
- 8 von Schuckmann, K. et al., 2020: Heat stored in the Earth system: where does the energy go? *Earth System Science*  
9 *Data*, **12**(3), 2013–2041, doi:[10.5194/essd-12-2013-2020](https://doi.org/10.5194/essd-12-2013-2020).
- 10 Vose, R.S., D.R. Easterling, and B. Gleason, 2005: Maximum and minimum temperature trends for the globe: An  
11 update through 2004. *Geophysical Research Letters*, **32**(23), doi:[10.1029/2005gl024379](https://doi.org/10.1029/2005gl024379).
- 12 Vose, R.S. et al., 2021: Implementing Full Spatial Coverage in NOAA's Global Temperature Analysis. *Geophysical*  
13 *Research Letters*, **48**(4), e2020GL090873, doi:[10.1029/2020gl090873](https://doi.org/10.1029/2020gl090873).
- 14 Vrieling, A., J. De Leeuw, and M.Y. Said, 2013: Length of growing period over Africa: Variability and trends from 30  
15 years of NDVI time series. *Remote Sensing*, **5**(2), 982–1000, doi:[10.3390/rs5020982](https://doi.org/10.3390/rs5020982).
- 16 Vyverberg, K. et al., 2018: Episodic reef growth in the granitic Seychelles during the Last Interglacial: Implications for  
17 polar ice sheet dynamics. *Marine Geology*, **399**, 170–187, doi:[10.1016/j.margeo.2018.02.010](https://doi.org/10.1016/j.margeo.2018.02.010).
- 18 Wachowicz, L.J., J.R. Preece, T.L. Mote, B.S. Barrett, and G.R. Henderson, 2021: Historical trends of seasonal  
19 Greenland blocking under different blocking metrics. *International Journal of Climatology*, **41**(S1), joc.6923,  
20 doi:[10.1002/joc.6923](https://doi.org/10.1002/joc.6923).
- 21 Waelbroeck, C. et al., 2002: Sea-level and deep water temperature changes derived from benthic foraminifera isotopic  
22 records. *Quaternary Science Reviews*, **21**(1), 295–305, doi:[10.1016/s0277-3791\(01\)00101-9](https://doi.org/10.1016/s0277-3791(01)00101-9).
- 23 Wagner, B. et al., 2019: Mediterranean winter rainfall in phase with African monsoons during the past 1.36 million  
24 years. *Nature*, **573**, 256–260, doi:[10.1038/s41586-019-1529-0](https://doi.org/10.1038/s41586-019-1529-0).
- 25 Wainer, I., L.F. Prado, M. Khodri, and B. Otto-Bliesner, 2014: Reconstruction of the South Atlantic Subtropical Dipole  
26 index for the past 12,000 years from surface temperature proxy. *Scientific Reports*, **4**(1), 5291,  
27 doi:[10.1038/srep05291](https://doi.org/10.1038/srep05291).
- 28 WAIS Divide Project Members. et al., 2015: Precise interpolar phasing of abrupt climate change during the last ice age.  
29 *Nature*, **520**(7549), 661, doi:[10.1038/nature14401](https://doi.org/10.1038/nature14401).
- 30 Walsh, J.E., F. Fetterer, J. Scott Stewart, and W.L. Chapman, 2017: A database for depicting Arctic sea ice variations  
31 back to 1850. *Geographical Review*, **107**(1), 89–107, doi:[10.1111/j.1931-0846.2016.12195.x](https://doi.org/10.1111/j.1931-0846.2016.12195.x).
- 32 Walsh, J.E., W.L. Chapman, F. Fetterer, and J.S. Stewart, 2019: Gridded Monthly Sea Ice Extent and Concentration,  
33 1850 Onward, Version 2. National Snow and Ice Data Center (NSIDC), Boulder, CO, USA. Retrieved from:  
34 <https://nsidc.org/data/g10010>.
- 35 Wang, B. et al., 2013: Northern Hemisphere summer monsoon intensity fed by mega-El Niño / southern oscillation and  
36 Atlantic multidecadal oscillation. *Proceedings of the National Academy of Sciences of the United States of*  
37 *America*, **110**(14), 5347–5352, doi:[10.1073/pnas.1219405110](https://doi.org/10.1073/pnas.1219405110).
- 38 Wang, B. et al., 2018: Toward predicting changes in the land monsoon rainfall a decade in advance. *Journal of Climate*,  
39 **31**(7), 2699–2714, doi:[10.1175/jcli-d-17-0521.1](https://doi.org/10.1175/jcli-d-17-0521.1).
- 40 Wang, B. et al., 2021: Monsoons Climate Change Assessment. *Bulletin of the American Meteorological Society*,  
41 **102**(1), E1–E19, doi:[10.1175/bams-d-19-0335.1](https://doi.org/10.1175/bams-d-19-0335.1).
- 42 Wang, C., Y. Hu, X. Wen, C. Zhou, and J. Liu, 2020: Inter-model spread of the climatological annual mean Hadley  
43 circulation and its relationship with the double ITCZ bias in CMIP5. *Climate Dynamics*, **55**(9),  
44 doi:[10.1007/s00382-020-05414-z](https://doi.org/10.1007/s00382-020-05414-z).
- 45 Wang, J., A. Dai, and C. Mears, 2016: Global water vapor trend from 1988 to 2011 and its diurnal asymmetry based on  
46 GPS, radiosonde, and microwave satellite measurements. *Journal of Climate*, **29**(14), 5205–5222,  
47 doi:[10.1175/jcli-d-15-0485.1](https://doi.org/10.1175/jcli-d-15-0485.1).
- 48 Wang, J., H.-M. Kim, and E.K.M. Chang, 2017a: Changes in Northern Hemisphere Winter Storm Tracks under the  
49 Background of Arctic Amplification. *Journal of Climate*, **30**(10), 3705–3724, doi:[10.1175/jcli-d-16-0650.1](https://doi.org/10.1175/jcli-d-16-0650.1).
- 50 Wang, J. et al., 2017b: Internal and external forcing of multidecadal Atlantic climate variability over the past  
51 1,200 years. *Nature Geoscience*, **10**(7), 512–517, doi:[10.1038/ngeo2962](https://doi.org/10.1038/ngeo2962).
- 52 Wang, P.X. et al., 2014: The global monsoon across timescales: Coherent variability of regional monsoons. *Climate of*  
53 *the Past*, **10**(6), 2007–2052, doi:[10.5194/cp-10-2007-2014](https://doi.org/10.5194/cp-10-2007-2014).
- 54 Wang, P.X. et al., 2017: The global monsoon across time scales: Mechanisms and outstanding issues. *Earth-Science*  
55 *Reviews*, **174**, 84–121, doi:[10.1016/j.earscirev.2017.07.006](https://doi.org/10.1016/j.earscirev.2017.07.006).
- 56 Wang, Q. et al., 2019: Response of Southern China Winter Rainfall to El Niño Diversity and Its Relevance to Projected  
57 Southern China Rainfall Change. *Journal of Climate*, **32**(11), 3343–3356, doi:[10.1175/jcli-d-18-0571.1](https://doi.org/10.1175/jcli-d-18-0571.1).
- 58 Wang, R. and Y. Liu, 2020: Recent declines in global water vapor from MODIS products: Artifact or real trend?  
59 *Remote Sensing of Environment*, **247**, 111896, doi:[10.1016/j.rse.2020.111896](https://doi.org/10.1016/j.rse.2020.111896).
- 60 Wang, S., J. Huang, Y. He, and Y. Guan, 2014: Combined effects of the Pacific Decadal Oscillation and El Niño–  
61 Southern Oscillation on Global Land Dry–Wet Changes. *Scientific Reports*, **4**, 6651.

- 1 Wang, S. et al., 2016: Temporal trends and spatial variability of vegetation phenology over the Northern Hemisphere  
2 during 1982–2012. *PLoS ONE*, doi:[10.1371/journal.pone.0157134](https://doi.org/10.1371/journal.pone.0157134).
- 3 Wang, W. and C.-Z. Zou, 2014: AMSU-A-Only Atmospheric Temperature Data Records from the Lower Troposphere  
4 to the Top of the Stratosphere. *Journal of Atmospheric and Oceanic Technology*, **31**(4), 808–825,  
5 doi:[10.1175/jtech-d-13-00134.1](https://doi.org/10.1175/jtech-d-13-00134.1).
- 6 Wang, W., K. Matthes, N.E. Omrani, and M. Latif, 2016: Decadal variability of tropical tropopause temperature and its  
7 relationship to the Pacific Decadal Oscillation. *Scientific Reports*, **6**(29537), doi:[10.1038/srep29537](https://doi.org/10.1038/srep29537).
- 8 Wang, X., N.J. Planavsky, C.T. Reinhard, J.R. Hein, and T.M. Johnson, 2016: A cenozoic seawater redox record  
9 derived from  $^{238}\text{U}/^{235}\text{U}$  in ferromanganese crusts. *American Journal of Science*, **315**(11), 64–83,  
10 doi:[10.2475/01.2016.02](https://doi.org/10.2475/01.2016.02).
- 11 Wang, X.L., Y. Feng, R. Chan, and V. Isaac, 2016: Inter-comparison of extra-tropical cyclone activity in nine  
12 reanalysis datasets. *Atmospheric Research*, **181**, 133–153, doi:[10.1016/j.atmosres.2016.06.010](https://doi.org/10.1016/j.atmosres.2016.06.010).
- 13 Wang, Y.L., C.R. Wu, and S.Y. Chao, 2016: Warming and weakening trends of the Kuroshio during 1993–2013.  
14 *Geophysical Research Letters*, doi:[10.1002/2016gl069432](https://doi.org/10.1002/2016gl069432).
- 15 Wang, Y.-L. and C.-R. Wu, 2018: Discordant multi-decadal trend in the intensity of the Kuroshio along its path during  
16 1993–2013. *Scientific Reports*, **8**(1), 14633, doi:[10.1038/s41598-018-32843-y](https://doi.org/10.1038/s41598-018-32843-y).
- 17 Wang, Y., Brandt, M., Zhao, M., Tong, X., Xing, K., Xue, F., Kang, M., Wang, L., Jiang, Y., Fensholt, R. and Wang,  
18 Y., 2018: Major forest increase on the Loess Plateau, China (2001–2016). *Land Degradation and  
19 Development*, **29**(11), 4080–4091, doi:[10.1002/lrd.3174](https://doi.org/10.1002/lrd.3174).
- 20 Ward, D.S. and N.M. Mahowald, 2015: Local sources of global climate forcing from different categories of land use  
21 activities. *Earth System Dynamics*, **6**(1), 175–194, doi:[10.5194/esd-6-175-2015](https://doi.org/10.5194/esd-6-175-2015).
- 22 Ward, D.S., N.M. Mahowald, and S. Kloster, 2014: Potential climate forcing of land use and land cover change.  
23 *Atmospheric Chemistry and Physics*, **14**(23), 12701–12724, doi:[10.5194/acp-14-12701-2014](https://doi.org/10.5194/acp-14-12701-2014).
- 24 Warren, S.G. et al., 1999: Snow depth on Arctic sea ice. *Journal of Climate*, **12**(6), 1814–1829, doi:[10.1175/1520-0442\(1999\)012<1814:sdoasi>2.0.co;2](https://doi.org/10.1175/1520-0442(1999)012<1814:sdoasi>2.0.co;2).
- 25 Watanabe, T. et al., 2011: Permanent El Niño during the Pliocene warm period not supported by coral evidence. *Nature*,  
26 **471**, 209–211, doi:[10.1038/nature09777](https://doi.org/10.1038/nature09777).
- 27 Watson, C.S. et al., 2015: Unabated global mean sea-level rise over the satellite altimeter era. *Nature Climate Change*,  
28 **5**(6), 565–568, doi:[10.1038/nclimate2635](https://doi.org/10.1038/nclimate2635).
- 29 Waugh, D.W., A.H. Sobel, and L.M. Polvani, 2017: What is the polar vortex and how does it influence weather?  
30 *Bulletin of the American Meteorological Society*, **98**(1), 37–44, doi:[10.1175/bams-d-15-00212.1](https://doi.org/10.1175/bams-d-15-00212.1).
- 31 WCRP Global Sea Level Budget Group, 2018: AA Global sea-level budget 1993–present. *Earth System Science Data*,  
32 **10**(3), 1551–1590, doi:[10.5194/essd-10-1551-2018](https://doi.org/10.5194/essd-10-1551-2018).
- 33 Wearing, M.G. and J. Kingslake, 2019: Holocene Formation of Henry Ice Rise, West Antarctica, Inferred From Ice-  
34 Penetrating Radar. *Journal of Geophysical Research: Earth Surface*, **124**(8), 2224–2240,  
35 doi:[10.1029/2018jf004988](https://doi.org/10.1029/2018jf004988).
- 36 Webster, M. et al., 2018a: Snow in the changing sea-ice systems. *Nature Climate Change*, **8**, 946–953,  
37 doi:[10.1038/s41558-018-0286-7](https://doi.org/10.1038/s41558-018-0286-7).
- 38 Webster, M. et al., 2018b: Snow in the changing sea-ice systems. *Nature Climate Change*, **8**, 946–953,  
39 doi:[10.1038/s41558-018-0286-7](https://doi.org/10.1038/s41558-018-0286-7).
- 40 Webster, M.A. et al., 2014: Interdecadal changes in snow depth on Arctic sea ice. *Journal of Geophysical Research: Oceans*, **119**(8), 5395–5406, doi:[10.1002/2014jc009985](https://doi.org/10.1002/2014jc009985).
- 41 Wei, J., Y. Peng, R. Mahmood, L. Sun, and J. Guo, 2019: Intercomparison in spatial distributions and temporal trends  
42 derived from multi-source satellite aerosol products. *Atmospheric Chemistry and Physics*, **19**(10), 7183–7207,  
43 doi:[10.5194/acp-19-7183-2019](https://doi.org/10.5194/acp-19-7183-2019).
- 44 Wei, Z. et al., 2020: Identification of uncertainty sources in quasi-global discharge and inundation simulations using  
45 satellite-based precipitation products. *Journal of Hydrology*, **589**, doi:[10.1016/j.jhydrol.2020.125180](https://doi.org/10.1016/j.jhydrol.2020.125180).
- 46 Wen, C., A. Kumar, and Y. Xue, 2014: Factors contributing to uncertainty in Pacific Decadal Oscillation index.  
47 *Geophysical Research Letters*, **41**(22), 7980–7986, doi:[10.1002/2014gl061992](https://doi.org/10.1002/2014gl061992).
- 48 Wendt, K.A. et al., 2019: Three-phased Heinrich Stadial 4 recorded in NE Brazil stalagmites. *Earth and Planetary  
49 Science Letters*, **510**, 94–102, doi:[10.1016/j.epsl.2018.12.025](https://doi.org/10.1016/j.epsl.2018.12.025).
- 50 Werner, J.P., D. Divine, F. Charpentier Ljungqvist, T. Nilsen, and P. Francus, 2018: Spatio-temporal variability of  
51 Arctic summer temperatures over the past 2 millennia. *Climate of the Past*, **14**(4), 527–557, doi:[10.5194/cp-14-527-2018](https://doi.org/10.5194/cp-14-527-2018).
- 52 West, C.K. et al., 2020: Paleobotanical proxies for early Eocene climates and ecosystems in northern North America  
53 from middle to high latitudes. *Climate of the Past*, **16**(4), 1387–1410, doi:[10.5194/cp-16-1387-2020](https://doi.org/10.5194/cp-16-1387-2020).
- 54 Westerhold, T. et al., 2020: An astronomically dated record of Earth’s climate and its predictability over the last 66  
55 million years. *Science*, **369**(6509), 1383–1387, doi:[10.1126/science.aba6853](https://doi.org/10.1126/science.aba6853).
- 56 White, S.M., A.C. Ravelo, and P.J. Polissar, 2018a: Dampened El Niño in the Early and Mid-Holocene Due To  
57 Insolation-Forced Warming/Deepening of the Thermocline. *Geophysical Research Letters*, **45**(1), 316–326,  
58 doi:[10.1002/2017gl075433](https://doi.org/10.1002/2017gl075433).

- 1 White, S.M., A.C. Ravelo, and P.J. Polissar, 2018b: Dampened El Niño in the Early and Mid-Holocene Due To  
2 Insolation-Forced Warming/Deepening of the Thermocline. *Geophysical Research Letters*, **45**(1), 316–326,  
3 doi:[10.1002/2017gl075433](https://doi.org/10.1002/2017gl075433).
- 4 Wilhelmsen, H., F. Ladstädter, B. Scherllin-Pirscher, and A.K. Steiner, 2018: Atmospheric QBO and ENSO indices  
5 with high vertical resolution from GNSS radio occultation temperature measurements. *Atmospheric*  
6 *Measurement Techniques*, **11**(3), 1333–1346, doi:[10.5194/amt-11-1333-2018](https://doi.org/10.5194/amt-11-1333-2018).
- 7 Willett, K.M., R.J.H. Dunn, J.J. Kennedy, and D.I. Berry, 2020: Development of the HadISDH.marine humidity climate  
8 monitoring dataset. *Earth System Science Data*, **12**(4), 2853–2880, doi:[10.5194/essd-12-2853-2020](https://doi.org/10.5194/essd-12-2853-2020).
- 9 Willett, K.M. et al., 2014: HadISDH land surface multi-variable humidity and temperature record for climate  
10 monitoring. *Climate of the Past*, **10**, 1983–2006, doi:[10.5194/cp-10-1983-2014](https://doi.org/10.5194/cp-10-1983-2014).
- 11 Williams, B. et al., 2017: North Pacific twentieth century decadal-scale variability is unique for the past 342 years.  
12 *Geophys. Res. Lett.*, **44**, 3761–3769, doi:[10.1002/2017gl073138](https://doi.org/10.1002/2017gl073138).
- 13 Williams, C.N., M.J. Menne, and P.W. Thorne, 2012: Benchmarking the performance of pairwise homogenization of  
14 surface temperatures in the United States. *Journal of Geophysical Research: Atmospheres*, **117**(D5),  
15 doi:[10.1029/2011jd016761](https://doi.org/10.1029/2011jd016761).
- 16 Williams, J.W., P. Tarasov, S. Brewer, and M. Notaro, 2011: Late Quaternary variations in tree cover at the northern  
17 forest-tundra ecotone. *Journal of Geophysical Research: Biogeosciences*, **116**(G1),  
18 doi:[10.1029/2010jg001458](https://doi.org/10.1029/2010jg001458).
- 19 Wilson, R. et al., 2018: Glacial lakes of the Central and Patagonian Andes. *Global and Planetary Change*, **162**, 275–  
20 291, doi:[10.1016/j.gloplacha.2018.01.004](https://doi.org/10.1016/j.gloplacha.2018.01.004).
- 21 Windler, G., J.E. Tierney, P.N. DiNezio, K. Gibson, and R. Thunell, 2019: Shelf exposure influence on Indo-Pacific  
22 Warm Pool climate for the last 450,000 years. *Earth and Planetary Science Letters*, **516**, 66–76,  
23 doi:[10.1016/j.epsl.2019.03.038](https://doi.org/10.1016/j.epsl.2019.03.038).
- 24 Winguth, A.M.E., E. Thomas, and C. Winguth, 2012: Global decline in ocean ventilation, oxygenation, and  
25 productivity during the Paleocene-Eocene Thermal Maximum: Implications for the benthic extinction.  
26 *Geology*, **40**(3), 263–266, doi:[10.1130/g32529.1](https://doi.org/10.1130/g32529.1).
- 27 Winnick, M.J., J.K. Caves, and C.P. Chamberlain, 2015: A mechanistic analysis of early Eocene latitudinal gradients of  
28 isotopes in precipitation. *Geophysical Research Letters*, **42**(19), 8216–8224, doi:[10.1002/2015gl064829](https://doi.org/10.1002/2015gl064829).
- 29 Winski, D. et al., 2017: Industrial-age doubling of snow accumulation in the Alaska Range linked to tropical ocean  
30 warming. *Scientific Reports*, **7**(1), 1–12, doi:[10.1038/s41598-017-18022-5](https://doi.org/10.1038/s41598-017-18022-5).
- 31 Wirth, S.B., L. Glur, A. Gilli, and F.S. Anselmetti, 2013a: Holocene flood frequency across the Central Alps – solar  
32 forcing and evidence for variations in North Atlantic atmospheric circulation. *Quaternary Science Reviews*, **80**,  
33 112–128, doi:[10.1016/j.quascirev.2013.09.002](https://doi.org/10.1016/j.quascirev.2013.09.002).
- 34 Wirth, S.B., L. Glur, A. Gilli, and F.S. Anselmetti, 2013b: Holocene flood frequency across the Central Alps – solar  
35 forcing and evidence for variations in North Atlantic atmospheric circulation. *Quaternary Science Reviews*, **80**,  
36 112–128, doi:[10.1016/j.quascirev.2013.09.002](https://doi.org/10.1016/j.quascirev.2013.09.002).
- 37 Witkowski, C.R., J.W.H. Weijers, B. Blais, S. Schouten, and J.S. Sinninghe Damsté, 2018a: Molecular fossils from  
38 phytoplankton reveal secular PCO<sub>2</sub> trend over the phanerozoic. *Science Advances*, **4**(11), eaat4556,  
39 doi:[10.1126/sciadv.aat4556](https://doi.org/10.1126/sciadv.aat4556).
- 40 Witkowski, C.R., J.W.H. Weijers, B. Blais, S. Schouten, and J.S. Sinninghe Damsté, 2018b: Molecular fossils from  
41 phytoplankton reveal secular PCO<sub>2</sub> trend over the phanerozoic. *Science Advances*, **4**(11), eaat4556,  
42 doi:[10.1126/sciadv.aat4556](https://doi.org/10.1126/sciadv.aat4556).
- 43 WMO, 2018: *Scientific Assessment of Ozone Depletion: 2018*. Global Ozone Research and Monitoring Project – Report  
44 No. 58, World Meteorological Organization (WMO), Geneva, Switzerland, 588 pp.
- 45 Woodborne, S. et al., 2015: A 1000-year carbon isotope rainfall proxy record from South African baobab trees  
46 (*Adansonia digitata* L.). *PLOS ONE*, **10**(5), 1–18, doi:[10.1371/journal.pone.0124202](https://doi.org/10.1371/journal.pone.0124202).
- 47 Woodgate, R.A., 2018: Increases in the Pacific inflow to the Arctic from 1990 to 2015, and insights into seasonal trends  
48 and driving mechanisms from year-round Bering Strait mooring data. *Progress in Oceanography*, **160**, 124–  
49 154, doi:[10.1016/j.pocean.2017.12.007](https://doi.org/10.1016/j.pocean.2017.12.007).
- 50 Woodruff, S.D. et al., 2011: ICOADS Release 2.5: extensions and enhancements to the surface marine meteorological  
51 archive. *International Journal of Climatology*, **31**(7), 951–967, doi:[10.1002/joc.2103](https://doi.org/10.1002/joc.2103).
- 52 Woodworth, P.L., M.M. Maqueda, V.M. Roussenov, R.G. Williams, and C.W. Hughes, 2014: Mean sea-level  
53 variability along the northeast American Atlantic coast and the roles of the wind and the overturning  
54 circulation. *Journal of Geophysical Research C: Oceans*, **119**(12), 8916–8935, doi:[10.1002/2014jc010520](https://doi.org/10.1002/2014jc010520).
- 55 Woollings, T., C. Czuchnicki, and C. Franzke, 2014: Twentieth century North Atlantic jet variability. *Quarterly Journal*  
56 *of the Royal Meteorological Society*, **140**(680), 783–791, doi:[10.1002/qj.2197](https://doi.org/10.1002/qj.2197).
- 57 Woollings, T. et al., 2018a: Daily to Decadal Modulation of Jet Variability (2018a). *Journal of Climate*, **31**, 1297–1314,  
58 doi:[10.1175/jcli-d-17-0286.1](https://doi.org/10.1175/jcli-d-17-0286.1).
- 59 Woollings, T. et al., 2018b: Blocking and its Response to Climate Change (2018b). *Current Climate Change Reports*,  
60 **4**(3), 287–300, doi:[10.1007/s40641-018-0003](https://doi.org/10.1007/s40641-018-0003).
- 61 Woosley, R.J., F.J. Millero, and R. Wanninkhof, 2016: Rapid anthropogenic changes in CO<sub>2</sub> and pH in the Atlantic

- 1 Ocean: 2003–2014. *Global Biogeochemical Cycles*, **30**(1), 70–90, doi:[10.1002/2015gb005248](https://doi.org/10.1002/2015gb005248).
- 2 Worthington, E.L. et al., 2020: A 30-year reconstruction of the Atlantic meridional overturning circulation shows no  
3 decline. *Ocean Sci. Discuss.*, **17**(1), 285–299, doi:[10.5194/os-2020-71](https://doi.org/10.5194/os-2020-71).
- 4 Wright, N.M., M. Seton, S.E. Williams, J.M. Whittaker, and R.D. Müller, 2020: Sea-level fluctuations driven by  
5 changes in global ocean basin volume following supercontinent break-up. *Earth-Science Reviews*, **208**,  
6 103293, doi:[10.1016/j.earscirev.2020.103293](https://doi.org/10.1016/j.earscirev.2020.103293).
- 7 Wu, J., J. Zha, D. Zhao, and Q. Yang, 2018: Changes in terrestrial near-surface wind speed and their possible causes: an  
8 overview. *Climate Dynamics*, **51**, 2039–2078, doi:[10.1007/s00382-017-3997-y](https://doi.org/10.1007/s00382-017-3997-y).
- 9 Wu, L. et al., 2012: Enhanced warming over the global subtropical western boundary currents. *Nature Climate Change*,  
10 **2**(3), 161–166, doi:[10.1038/nclimate1353](https://doi.org/10.1038/nclimate1353).
- 11 Wu, P., N. Christidis, and P. Stott, 2013: Anthropogenic impact on Earth's hydrological cycle. *Nature Climate Change*,  
12 **3**(9), 807–810, doi:[10.1038/nclimate1932](https://doi.org/10.1038/nclimate1932).
- 13 Wu, C.-J., Krivova, N. A., Solanki, S. K., and Usoskin, I. G., 2018: Solar total and spectral irradiance reconstruction  
14 over the last 9000 years. *A&A*, **620**, A120, doi:[10.1051/0004-6361/201832956](https://doi.org/10.1051/0004-6361/201832956).
- 15 Wunsch, C., 2018: Towards determining uncertainties in global oceanic mean values of heat, salt, and surface elevation.  
16 *Tellus A: Dynamic Meteorology and Oceanography*, **70**(1), 1–14, doi:[10.1080/16000870.2018.1471911](https://doi.org/10.1080/16000870.2018.1471911).
- 17 Wurtzel, J.B. et al., 2018: Tropical Indo-Pacific hydroclimate response to North Atlantic forcing during the last  
18 deglaciation as recorded by a speleothem from Sumatra, Indonesia. *Earth and Planetary Science Letters*, **492**,  
19 264–278, doi:[10.1016/j.epsl.2018.04.001](https://doi.org/10.1016/j.epsl.2018.04.001).
- 20 Xia, J. et al., 2018: Shifts in timing of local growing season in China during 1961–2012. *Theoretical and Applied  
21 Climatology*, **137**, 1637–1642, doi:[10.1007/s00704-018-2698-8](https://doi.org/10.1007/s00704-018-2698-8).
- 22 Xian, T. and C.R. Homeyer, 2019: Global Tropopause Altitudes in Radiosondes and Reanalyses. *Atmospheric  
23 Chemistry and Physics*, **19**(8), 5661–5678, doi:[10.5194/acp-19-5661-2019](https://doi.org/10.5194/acp-19-5661-2019).
- 24 Xiao, Z., S. Liang, and B. Jiang, 2017: Evaluation of four long time-series global leaf area index products. *Agricultural  
25 and Forest Meteorology*, **246**, 218–230, doi:[10.1016/j.agrformet.2017.06.016](https://doi.org/10.1016/j.agrformet.2017.06.016).
- 26 Xie, P. and P.A. Arkin, 1997: Global Precipitation : A 17-Year Monthly Analysis Based on Gauge Observations ,  
27 Satellite Estimates , and Numerical Model Outputs. *Bull. Amer. Meteor. Soc.*, **78**(11), 2539–2558,  
28 doi:[10.1175/1520-0477\(1997\)078<2539:gpmaya>2.0.co;2](https://doi.org/10.1175/1520-0477(1997)078<2539:gpmaya>2.0.co;2).
- 29 Xie, T., R. Newton, P. Schlosser, C. Du, and M. Dai, 2019: Long-Term Mean Mass, Heat and Nutrient Flux Through  
30 the Indonesian Seas, Based on the Tritium Inventory in the Pacific and Indian Oceans. *Journal of Geophysical  
31 Research: Oceans*, **124**(6), 3859–3875, doi:[10.1029/2018jc014863](https://doi.org/10.1029/2018jc014863).
- 32 Xu, H. et al., 2016: Hydroclimatic contrasts over Asian monsoon areas and linkages to tropical Pacific SSTs. *Scientific  
33 Reports*, **6**(1), 33177, doi:[10.1038/srep33177](https://doi.org/10.1038/srep33177).
- 34 Xu, W. et al., 2018a: A new integrated and homogenized global monthly land surface air temperature dataset for the  
35 period since 1900. *Climate Dynamics*, **50**(7), 2513–2536, doi:[10.1007/s00382-017-3755-1](https://doi.org/10.1007/s00382-017-3755-1).
- 36 Xu, W. et al., 2018b: A new integrated and homogenized global monthly land surface air temperature dataset for the  
37 period since 1900. *Climate Dynamics*, **50**(7), 2513–2536, doi:[10.1007/s00382-017-3755-1](https://doi.org/10.1007/s00382-017-3755-1).
- 38 Xue, D.K. and Y.C. Zhang, 2018: Concurrent variations in the location and intensity of the Asian winter jet streams and  
39 the possible mechanism. *Climate Dynamics*, 37–52, doi:[10.1007/s00382-016-3325-y](https://doi.org/10.1007/s00382-016-3325-y).
- 40 Yan, Q. et al., 2016: Enhanced intensity of global tropical cyclones during the mid-{Pliocene} warm period.  
41 *Proceedings of the National Academy of Sciences*, **113**(46), 12963–12967, doi:[10.1073/pnas.1608950113](https://doi.org/10.1073/pnas.1608950113).
- 42 Yan, Y. et al., 2019: Two-million-year-old snapshots of atmospheric gases from Antarctic ice. *Nature*, **574**(7780), 663–  
43 666, doi:[10.1038/s41586-019-1692-3](https://doi.org/10.1038/s41586-019-1692-3).
- 44 Yang, H. et al., 2016: Intensification and poleward shift of subtropical western boundary currents in a warming climate.  
45 *Journal of Geophysical Research: Oceans*, **121**(7), 4928–4945, doi:[10.1002/2015jc011513](https://doi.org/10.1002/2015jc011513).
- 46 Yang, H. et al., 2020: Poleward Shift of the Major Ocean Gyres Detected in a Warming Climate. *Geophysical Research  
47 Letters*, **47**(5), e2019GL085868, doi:[10.1029/2019gl085868](https://doi.org/10.1029/2019gl085868).
- 48 Yang, J. and C. Xiao, 2018: The evolution and volcanic forcing of the southern annular mode during the past 300 years.  
49 *International Journal of Climatology*, **38**(4), 1706–1717, doi:[10.1002/joc.5290](https://doi.org/10.1002/joc.5290).
- 50 Yang, J.-W., J. Ahn, E.J. Brook, and Y. Ryu, 2017: Atmospheric methane control mechanisms during the early  
51 Holocene. *Climate of the Past*, **13**(9), 1227–1242, doi:[10.5194/cp-13-1227-2017](https://doi.org/10.5194/cp-13-1227-2017).
- 52 Yang, S. et al., 2018: A strengthened East Asian Summer Monsoon during Pliocene warmth: Evidence from 'red clay'  
53 sediments at Pianguan, northern China. *Journal of Asian Earth Sciences*, **155**, 124–133,  
54 doi:[10.1016/j.jseas.2017.10.020](https://doi.org/10.1016/j.jseas.2017.10.020).
- 55 Yao, W., A. Paytan, and U.G. Wortmann, 2018: Large-scale ocean deoxygenation during the Paleocene-Eocene  
56 Thermal Maximum. *Science*, **361**(6404), 804–806, doi:[10.1126/science.aar8658](https://doi.org/10.1126/science.aar8658).
- 57 Yashayaev, I. and J.W. Loder, 2016: Recurrent replenishment of Labrador Sea Water and associated decadal-scale  
58 variability. *Journal of Geophysical Research: Oceans*, **121**(11), 8095–8114, doi:[10.1002/2016jc012046](https://doi.org/10.1002/2016jc012046).
- 59 Yau, A.M., M.L. Bender, A. Robinson, and E.J. Brook, 2016: Reconstructing the last interglacial at Summit,  
60 Greenland: Insights from GISP2. *Proceedings of the National Academy of Sciences*, **113**(35), 9710–9715,  
61 doi:[10.1073/pnas.1524766113](https://doi.org/10.1073/pnas.1524766113).

- 1 Yeh, S.-W. et al., 2018: ENSO Atmospheric Teleconnections and Their Response to Greenhouse Gas Forcing. *Reviews*  
2 *of Geophysics*, **56(1)**, 185–206, doi:[10.1002/2017rg000568](https://doi.org/10.1002/2017rg000568).
- 3 Yeo, K.L., N.A. Krivova, and S.K. Solanki, 2017: EMPIRE: A robust empirical reconstruction of solar irradiance  
4 variability. *Journal of Geophysical Research: Space Physics*, **122(4)**, 3888–3914, doi:[10.1002/2016ja023733](https://doi.org/10.1002/2016ja023733).
- 5 Yeo, K.L. et al., 2015: UV solar irradiance in observations and the NRLSSI and SATIRE-S models. *Journal of*  
6 *Geophysical Research: Space Physics*, **120(8)**, 6055–6070, doi:[10.1002/2015ja021277](https://doi.org/10.1002/2015ja021277).
- 7 Yeo, K.L. et al., 2020: The Dimmest State of the Sun. *Geophysical Research Letters*, **47(19)**,  
8 doi:[10.1029/2020gl090243](https://doi.org/10.1029/2020gl090243).
- 9 Yeung, L.Y. et al., 2019: Isotopic constraint on the twentieth-century increase in tropospheric ozone. *Nature*,  
10 **570(7760)**, 224–227, doi:[10.1038/s41586-019-1277-1](https://doi.org/10.1038/s41586-019-1277-1).
- 11 Yim, B.Y., S.W. Yeh, H.J. Song, D. Dommenget, and B.J. Sohn, 2017: Land-sea thermal contrast determines the trend  
12 of Walker circulation simulated in atmospheric general circulation models. *Geophysical Research Letters*,  
13 **44(11)**, 5854–5862, doi:[10.1002/2017gl073778](https://doi.org/10.1002/2017gl073778).
- 14 Yokoyama, Y. et al., 2018: Rapid glaciation and a two-step sea level plunge into the Last Glacial Maximum. *Nature*,  
15 **559(7715)**, 603–607, doi:[10.1038/s41586-018-0335-4](https://doi.org/10.1038/s41586-018-0335-4).
- 16 You, Y., M. Huber, R.D. Müller, C.J. Poulsen, and J. Ribbe, 2009: Simulation of the Middle Miocene Climate  
17 Optimum. *Geophysical Research Letters*, **36(4)**, doi:[10.1029/2008gl036571](https://doi.org/10.1029/2008gl036571).
- 18 Young, I.R. and A. Ribal, 2019: Multiplatform evaluation of global trends in wind speed and wave height. *Science*,  
19 **364(6440)**, 548–552, doi:[10.1126/science.aav9527](https://doi.org/10.1126/science.aav9527).
- 20 Young, N.E. and J.P. Briner, 2015: Holocene evolution of the western Greenland Ice Sheet: Assessing geophysical ice-  
21 sheet models with geological reconstructions of ice-margin change. *Quaternary Science Reviews*, **114**, 1–17,  
22 doi:[10.1016/j.quascirev.2015.01.018](https://doi.org/10.1016/j.quascirev.2015.01.018).
- 23 Young, N.E. et al., 2020: Deglaciation of the Greenland and Laurentide ice sheets interrupted by glacier advance during  
24 abrupt coolings. *Quaternary Science Reviews*, **229**, 106091, doi:[10.1016/j.quascirev.2019.106091](https://doi.org/10.1016/j.quascirev.2019.106091).
- 25 Yu, H. et al., 2020: Interannual variability and trends of combustion aerosol and dust in major continental outflows  
26 revealed by MODIS retrievals and CAM5 simulations during 2003–2017. *Atmospheric Chemistry and Physics*,  
27 **20(1)**, 139–161, doi:[10.5194/acp-20-139-2020](https://doi.org/10.5194/acp-20-139-2020).
- 28 Yu, J.-Y. and S.T. Kim, 2013: Identifying the types of major El Niño events since 1870. *International Journal of*  
29 *Climatology*, **33(8)**, 2105–2112, doi:[10.1002/joc.3575](https://doi.org/10.1002/joc.3575).
- 30 Yu, L., S.A. Josey, F.M. Bingham, and T. Lee, 2020: Intensification of the global water cycle and evidence from ocean  
31 salinity: a synthesis review. *Annals of the New York Academy of Sciences*, **1472(1)**, 76–94,  
32 doi:[10.1111/nyas.14354](https://doi.org/10.1111/nyas.14354).
- 33 Yu, S. and J. Sun, 2018: Revisiting the relationship between El Niño–Southern Oscillation and the East Asian winter  
34 monsoon. *International Journal of Climatology*, **38(13)**, 4846–4859, doi:[10.1002/joc.5702](https://doi.org/10.1002/joc.5702).
- 35 Yun, K.-S. and A. Timmermann, 2018: Decadal Monsoon-ENSO Relationships Reexamined. *Geophysical Research  
36 Letters*, **45(4)**, 2014–2021, doi:[10.1002/2017gl076912](https://doi.org/10.1002/2017gl076912).
- 37 Zachos, J.C., G.R. Dickens, and R.E. Zeebe, 2008: An early Cenozoic perspective on greenhouse warming and carbon-  
38 cycle dynamics. *Nature*, **451(7176)**, 279–283, doi:[10.1038/nature06588](https://doi.org/10.1038/nature06588).
- 39 Zanna, L., S. Khatiwala, J.M. Gregory, J. Ison, and P. Heimbach, 2019: Global reconstruction of historical ocean heat  
40 storage and transport. *Proceedings of the National Academy of Sciences*, **116(4)**, 1126–1131,  
41 doi:[10.1073/pnas.1808838115](https://doi.org/10.1073/pnas.1808838115).
- 42 Zantopp, R., J. Fischer, M. Visbeck, and J. Karstensen, 2017: From interannual to decadal: 17 years of boundary current  
43 transports at the exit of the Labrador Sea. *Journal of Geophysical Research: Oceans*, **122(3)**, 1724–1748,  
44 doi:[10.1002/2016jc012271](https://doi.org/10.1002/2016jc012271).
- 45 Zeebe, R.E., A. Ridgwell, and J.C. Zachos, 2016: Anthropogenic carbon release rate unprecedented during the past 66  
46 million years. *Nature Geoscience*, **9(4)**, 325–329, doi:[10.1038/ngeo2681](https://doi.org/10.1038/ngeo2681).
- 47 Zekollari, H., M. Huss, and D. Farinotti, 2020: On the Imbalance and Response Time of Glaciers in the European Alps.  
48 *Geophysical Research Letters*, **47(2)**, e2019GL085578, doi:[10.1029/2019gl085578](https://doi.org/10.1029/2019gl085578).
- 49 Zemp, M. et al., 2019: Global glacier mass changes and their contributions to sea-level rise from 1961 to 2016. *Nature*,  
50 **568(7752)**, 382–386, doi:[10.1038/s41586-019-1071-0](https://doi.org/10.1038/s41586-019-1071-0).
- 51 Zemp, M. et al., 2020: Brief communication: Ad hoc estimation of glacier contributions to sea-level rise from the latest  
52 glaciological observations. *Cryosphere*, **14(3)**, doi:[10.5194/tc-14-1043-2020](https://doi.org/10.5194/tc-14-1043-2020).
- 53 Zeng, Z., S. Sokolovskiy, W.S. Schreiner, and D. Hunt, 2019a: Representation of vertical atmospheric structures by  
54 radio occultation observations in the UTLS: comparison to high resolution radiosonde profiles. *Journal of*  
55 *Atmospheric and Oceanic Technology*, **58(2)**, 199–211, doi:[10.1175/jtech-d-18-0105.1](https://doi.org/10.1175/jtech-d-18-0105.1).
- 56 Zeng, Z. et al., 2019b: A reversal in global terrestrial stilling and its implications for wind energy production. *Nature  
57 Climate Change*, **9**, 979–985, doi:[10.1038/s41558-019-0622-6](https://doi.org/10.1038/s41558-019-0622-6).
- 58 Zhang, H. et al., 2018: East Asian hydroclimate modulated by the position of the westerlies during Termination I.  
59 *Science*, **362**, 580–583, doi:[10.1126/science.aat9393](https://doi.org/10.1126/science.aat9393).
- 60 Zhang, J., W. Tian, M.P. Chipperfield, F. Xie, and J. Huang, 2016: Persistent shift of the Arctic polar vortex towards  
61 the Eurasian continent in recent decades. *Nature Climate Change*, **6(12)**, 1094–1099,

- 1                   doi:[10.1038/nclimate3136](https://doi.org/10.1038/nclimate3136).
- 2 Zhang, J. et al., 2018: Stratospheric ozone loss over the Eurasian continent induced by the polar vortex shift. *Nature Communications*, **9**(1), 1–8, doi:[10.1038/s41467-017-02565-2](https://doi.org/10.1038/s41467-017-02565-2).
- 3 Zhang, L., L. Wu, and B. Gan, 2013: Modes and mechanisms of global water vapor variability over the twentieth  
4 century. *Journal of Climate*, **26**(15), 5578–5593, doi:[10.1175/jcli-d-12-00585.1](https://doi.org/10.1175/jcli-d-12-00585.1).
- 5 Zhang, L., G. Kuczera, A.S. Kiem, and G. Willgoose, 2018: Using paleoclimate reconstructions to analyse hydrological  
6 epochs associated with Pacific decadal variability. *Hydrology and Earth System Sciences*, **22**(12), 6399–6414,  
7 doi:[10.5194/hess-22-6399-2018](https://doi.org/10.5194/hess-22-6399-2018).
- 8 Zhang, R. and D. Jiang, 2014: Impact of vegetation feedback on the mid-Pliocene warm climate. *Advances in  
9 Atmospheric Sciences*, **31**(6), 1407–1416, doi:[10.1007/s00376-014-4015-5](https://doi.org/10.1007/s00376-014-4015-5).
- 10 Zhang, R., D. Jiang, Z. Zhang, Q. Yan, and X. Li, 2019: Modeling the late Pliocene global monsoon response to  
11 individual boundary conditions. *Climate Dynamics*, **53**(7), 4871–4886, doi:[10.1007/s00382-019-04834-w](https://doi.org/10.1007/s00382-019-04834-w).
- 12 Zhang, W., Y. Wang, F.-F. Jin, M.F. Stuecker, and A.G. Turner, 2015: Impact of different El Niño types on the El  
13 Niño/IOD relationship. *Geophysical Research Letters*, **42**(20), 8570–8576, doi:[10.1002/2015gl065703](https://doi.org/10.1002/2015gl065703).
- 14 Zhang, Y., J. Xu, N. Yang, and P. Lan, 2018: Variability and Trends in Global Precipitable Water Vapor Retrieved  
15 from COSMIC Radio Occultation and Radiosonde Observations. *Atmosphere*, **9**(5), 174,  
16 doi:[10.3390/atmos9050174](https://doi.org/10.3390/atmos9050174).
- 17 Zhang, Y., C. Song, L.E. Band, and G. Sun, 2019: No Proportional Increase of Terrestrial Gross Carbon Sequestration  
18 From the Greening Earth. *Journal of Geophysical Research: Biogeosciences*, **124**(8),  
19 doi:[10.1029/2018jg004917](https://doi.org/10.1029/2018jg004917).
- 20 Zhang, Y.G., J. Henderiks, and X. Liu, 2020: Refining the alkenone-pCO<sub>2</sub> method II: Towards resolving the  
21 physiological parameter ‘b’. *Geochimica et Cosmochimica Acta*, **281**, 118–134,  
22 doi:[10.1016/j.gca.2020.05.002](https://doi.org/10.1016/j.gca.2020.05.002).
- 23 Zhang, Z., G. Leduc, and J.P. Sachs, 2014: El Niño evolution during the Holocene revealed by a biomarker rain gauge  
24 in the Galápagos Islands. *Earth and Planetary Science Letters*, **404**, 420–434, doi:[10.1016/j.epsl.2014.07.013](https://doi.org/10.1016/j.epsl.2014.07.013).
- 25 Zhao, B. et al., 2017: Decadal-scale trends in regional aerosol particle properties and their linkage to emission changes.  
26 *Environmental Research Letters*, **12**(5), 054021, doi:[10.1088/1748-9326/aa6cb2](https://doi.org/10.1088/1748-9326/aa6cb2).
- 27 Zhao, H. and C. Wang, 2019: On the relationship between ENSO and tropical cyclones in the western North Pacific  
28 during the boreal summer. *Climate Dynamics*, **52**(1–2), 275–288, doi:[10.1007/s00382-018-4136-0](https://doi.org/10.1007/s00382-018-4136-0).
- 29 Zhao, J. et al., 2015: Spatial and temporal changes in vegetation phenology at middle and high latitudes of the northern  
30 hemisphere over the past three decades. *Remote Sensing*, **7**(8), 10973–10995, doi:[10.3390/rs70810973](https://doi.org/10.3390/rs70810973).
- 31 Zhao, L. et al., 2020: Changing climate and the permafrost environment on the Qinghai–Tibet (Xizang) plateau.  
32 *Permafrost and Periglacial Processes*, **31**(3), 396–405, doi:[10.1002/ppp.2056](https://doi.org/10.1002/ppp.2056).
- 33 Zhao, S.-P., Z.-T. Nan, Y.-B. Huang, and L. Zhao, 2017: The Application and Evaluation of Simple Permafrost  
34 Distribution Models on the Qinghai-Tibet Plateau. *Permafrost and Periglacial Processes*, **28**(2), 391–404,  
35 doi:[10.1002/ppp.1939](https://doi.org/10.1002/ppp.1939).
- 36 Zhao, X. and R.J. Allen, 2019: Strengthening of the Walker Circulation in recent decades and the role of natural sea  
37 surface temperature variability. *Environmental Research Communications*, **1**(2), 021003, doi:[10.1088/2515-7620/ab0dab](https://doi.org/10.1088/2515-7620/ab0dab).
- 38 Zheng, B. et al., 2018: Trends in China’s anthropogenic emissions since 2010 as the consequence of clean air actions.  
39 *Atmospheric Chemistry and Physics*, **18**(19), 14095–14111, doi:[10.5194/acp-18-14095-2018](https://doi.org/10.5194/acp-18-14095-2018).
- 40 Zhou, X., P. Ray, B.S. Barrett, and P.-C. Hsu, 2020a: Understanding the bias in surface latent and sensible heat fluxes  
41 in contemporary AGCMs over tropical oceans. *Climate Dynamics*, **55**(11), 2957–2978, doi:[10.1007/s00382-020-05431-y](https://doi.org/10.1007/s00382-020-05431-y).
- 42 Zhou, X., P. Ray, B.S. Barrett, and P.-C. Hsu, 2020b: Understanding the bias in surface latent and sensible heat fluxes  
43 in contemporary AGCMs over tropical oceans. *Climate Dynamics*, **55**(11), 2957–2978, doi:[10.1007/s00382-020-05431-y](https://doi.org/10.1007/s00382-020-05431-y).
- 44 Zhou, X., O. Alves, S.J. Marsland, D. Bi, and A.C. Hirst, 2017: Multi-decadal variations of the South Indian Ocean  
45 subsurface temperature influenced by Pacific Decadal Oscillation. *Tellus A: Dynamic Meteorology and  
46 Oceanography*, **69**(1), 1308055, doi:[10.1080/16000870.2017.1308055](https://doi.org/10.1080/16000870.2017.1308055).
- 47 Zhu, J., C.J. Poulsen, and J.E. Tierney, 2019: Simulation of Eocene extreme warmth and high climate sensitivity  
48 through cloud feedbacks. *Science Advances*, **5**(9), doi:[10.1126/sciadv.aax1874](https://doi.org/10.1126/sciadv.aax1874).
- 49 Zhu, J. et al., 2017: Reduced ENSO variability at the LGM revealed by an isotope-enabled Earth system model.  
50 *Geophysical Research Letters*, **44**(13), 6984–6992, doi:[10.1002/2017gl073406](https://doi.org/10.1002/2017gl073406).
- 51 Zhu, Z. et al., 2016: Greening of the Earth and its drivers. *Nature Climate Change*, **6**, 791–795,  
52 doi:[10.1038/nclimate3004](https://doi.org/10.1038/nclimate3004).
- 53 Zhuang, W., M. Feng, Y. Du, A. Schiller, and D. Wang, 2013: Low-frequency sea level variability in the southern  
54 Indian Ocean and its impacts on the oceanic meridional transports. *Journal of Geophysical Research: Oceans*,  
55 **118**(3), 1302–1315, doi:[10.1002/jgrc.20129](https://doi.org/10.1002/jgrc.20129).
- 56 Zika, J.D. et al., 2018: Improved estimates of water cycle change from ocean salinity: the key role of ocean warming.  
57 *Environmental Research Letters*, **13**(7), 074036, doi:[10.1088/1748-9326/aace42](https://doi.org/10.1088/1748-9326/aace42).

- 1 Zinke, J. et al., 2014: Corals record long-term Leeuwin current variability including Ningaloo Niño/Niña since 1795.  
2 *Nature Communications*, **5**, 3607, doi:[10.1038/ncomms4607](https://doi.org/10.1038/ncomms4607).
- 3 Zou, C.-Z. and H. Qian, 2016: Stratospheric Temperature Climate Data Record from Merged SSU and AMSU-A  
4 Observations. *Journal of Atmospheric and Oceanic Technology*, **33**(9), 1967–1984, doi:[10.1175/jtech-d-16-0018.1](https://doi.org/10.1175/jtech-d-16-0018.1).
- 5 Zou, C.-Z., H. Qian, W. Wang, L. Wang, and C. Long, 2014: Recalibration and merging of SSU observations for  
6 stratospheric temperature trend studies. *Journal of Geophysical Research: Atmospheres*, **119**(23), 13,113–  
7 180,205, doi:[10.1002/2014jd021603](https://doi.org/10.1002/2014jd021603).
- 8 Zuo, J., H.-L. Ren, W. Li, and L. Wang, 2016: Interdecadal Variations in the Relationship between the Winter North  
9 Atlantic Oscillation and Temperature in South-Central China. *Journal of Climate*, **29**, 7477–7493,  
10 doi:[10.1175/jcli-d-15-0873.1](https://doi.org/10.1175/jcli-d-15-0873.1).
- 11
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