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Sources of Holocene variability of oxygen isotopes in paleoclimate archives

A. N. LeGrande and G. A. Schmidt

NASA Goddard Institute for Space Studies and Center for Climate Systems
Research, Columbia University, 2880 Broadway, New York, NY 10025, USA

Abstract. Variability in water isotopes has been captured in numerous archives and used to infer past climate changes. Here we examine water isotope variability over the course of the Holocene using the water-isotope enabled, coupled atmosphere-ocean general circulation model, GISS ModelE-R. Eight Holocene time slices, ~1000 years apart are simulated and driven by estimated changes in orbital configuration, greenhouse gases, and ice sheet extent. We find that simulated water isotope archives match well with those seen in ice cores, ocean sediment cores, and speleothems. The climate changes associated with the water isotope changes, however, are more complex than simple modern spatial slope interpretations might suggest. In particular, water isotope variability in Asian speleothems is linked to alterations in landward water vapor transport, not local precipitation, and ice sheet changes over North America lead to the masking of temperature signals in Summit, Greenland. Salinity-seawater isotope variability is complicated by inter-ocean basin exchanges of water vapor. Water isotopes do reflect variability in the hydrology, but are better interpreted in terms of regional hydrological cycle changes rather than as indicators of local climate.

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