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Stable isotope depletion in Northern Oman during the mid-to-late Holocene and the Eemian: Evidence from climate model simulations

G. Lohmann (1,2), M. Herold (1,2), D. Fleitmann (3,4)

(1) Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany , (2) Marum, Bremen, Germany, (3) Institute of Geological Sciences, University of Bern, Switzerland, (4) Oeschger Centre for Climate Change Research, University of Bern, Switzerland.

Speleothems from Hoti cave in northern Oman provide a record of continental pluvial records showing, that and δ^{18}O values of water extracted from the speleothem fluid inclusions are depleted compared to modern conditions. Here, we provide a dynamical explanation of isotope depletion linked to atmospheric circulation over northern Africa. The climate anomalies are examined with a General Circulation Model that is equipped with a module for the direct simulation of ^{18}O and in the atmospheric water cycle. Differential surface heating due to anomalies in orbital insolation forcing induce a zonal flow which results in enhanced moisture advection and precipitation. The depletion in D and ^{18}O in the region of Oman originates from increased zonal water vapour transport in conjunction with the continental and amount effects. It is argued that the Atlantic route of water vapour transport is more likely than a northward movement of the Indian monsoon rainfall. Time slice experiments indicate a similar pattern for the Eemian and mid-to-late Holocene climate evolution and related isotopic signature.