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Millennial δ^{18}O oscillations from a replicated Holocene speleothem record from Iberian Peninsula and hemispherical teleconecctions affecting the water cycle

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We present a speleothem δ^{18}O record from Kaite Cave in northern Iberian Peninsula covering the last 9.7 ka BP. The record is constructed from four different stalagmites that replicate each other. The age model is based on 63 U-Th dates and over 4500 laminae providing a robust time frame for the record. The δ^{18}O record has characteristic millennial oscillations through the Holocene with periodicity around 2 ka during the Late Holocene and around 1 ka during the Early Holocene. Causes of the millennial δ^{18}O variability are not dominated by the amount of rainfall or atmospheric temperature and other controls of the water cycle are more relevant. The aquifer at this site filters any seasonal bias and speleothems records the inter-annual δ^{18}O variability in precipitation. On the other hand, moisture source analysis at this site shows that significant amount of precipitation is from recycled moisture (continental origin). A variable proportion of this parameter is capable to impact significantly past values of δ^{18}O in precipitation. Thus, we interpret the millennial oscillations of the δ^{18}O record as changes in the hydrological cycle resulting from variable percentages of the recycled precipitation over the Iberian Peninsula. We found that variable amount of recycled precipitation in Iberian Peninsula is related to the location of the Iceland Low pressure cell, although does not correlate with NAO index. Correlation of Kaite δ^{18}O record during the Holocene with other representative records suggests that millennial oscillations are caused by variability of the Gulf Stream/North Atlantic Current that affects atmospheric pressure fields in the North Atlantic. Further correlation of Kaite δ^{18}O record along the world supports that the recorded millennial oscillations of the water cycle are related to persistent variability on the tropical North Atlantic. Only during periods of major sea-ice variability in high-latitudes of the North Atlantic, the later region replaces tropical North Atlantic as source of variability for wide planetary regions, including regions affected by the ITCZ. The duration of the millennial oscillations differs depending on the region that triggers the anomaly since mechanisms involved also differ. Thus, we propose that these two regions (tropical North Atlantic and high-latitudes of the North Atlantic) alternate as dominant sources of climate variability for wide regions of the planet.

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