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Hydrological evolution of the North-West African monsoon system: Comparison of model simulations with observational and proxy data

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The aim of our project is to improve the understanding of the hydrological evolution of the North-West African monsoon system during the Holocene. Based on climate model simulations as well as proxy data we try to identify the most significant mechanisms, which force variations in the monsoon system. Special focus will be given to detailed analyses of coupled atmospheric-vegetation feedback processes. To reach this goal we use the coupled atmosphere land surface model ECHAM5-JSBACH-wiso, which is enhanced by the simulation of the stable water isotopes H218O and HDO.

To evaluate the simulated isotope values we first use a set of present-day simulations and compare these results with both observational data and proxy data over the last century from Africa. Furthermore, to get a more realistic performance we also perform an ERA40 nudged ECHAM5-JSBACH-wiso simulation over 50 years. This simulation mode allows the detection of realistic climate variability, such as the Sahel drought, in e. g. the amount and the isotopic composition of precipitation.

In order to investigate the hydrological evolution during the Holocene, we use a transient model simulation from 6ka BP to present, performed with the fully-coupled model COSMOS-aso (Fischer and Jungclaus, 2011). Modeling results are compared with the biomarker-based proxy data of GeoB7920-2 of this period. Both, the simulations as well as the proxy data show a shift from wetter conditions during the Mid-Holocene (6 ka BP) to drier conditions at present day. In addition we carry out different time-slice simulations with the ECHAM5-JSBACH-wiso model for a direct comparison of the δD signal to improve our understanding of past hydrological changes in this region.

References:
Fischer, N. and Jungclaus, J. H., 2011. Evolution of the seasonal temperature cycle in a transient Holocene simulation:orbital forcing and sea-ice. Clim. Past, v. 7, p. 1139-1148.