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Stable Water Isotopes in a Coupled Atmosphere-Vegetation Model: Studies for a Improved Understanding of North-West African Monsoon Changes

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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 land surface model ECHAM5-JSBACH enhanced by the stable water isotopes H218O and HDO (ECHAM5-JSBACH-wiso).

To evaluate the simulated isotope values we use a first set of present-day simulations and compare these results with both observational data and proxy data over the last century from Africa. The model resolutions varies between T31 (3.8° x 3.8°) and T63 (1.9° x 1.9°) at the spatial grid and vertically between 19 and 31 pressure levels. Furthermore, to get a more realistic performance we also perform an ERA40 nudged ECHAM5-JSBACH-wiso simulation over 50 years. These model results give us a simulation-based quantitative calibration of isotope variations of the observational data.

In order to investigate the North-West African monsoon system during the Holocene we use a transient model simulation (8,000 B.P. to present) with the coupled atmosphere-vegetation-ocean model COSMOS-aso at spatial resolution T31. In addition we carry out different paleoclimate simulations with varying boundary conditions over interesting time-slices of the Holocene with ECHAM5-JSBACH-wiso to improve our understanding of hydrological changes in this region during the past.