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Global modelling of delta-18O and delta-D: First results of the ECHAM5 AGCM

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During the last decade, several state-of-the-art atmospheric and oceanic general circulation models (GCM) models have been enhanced by the capability to explicitly simulate the hydrological cycle of HDO and H218O. In a closed model system all relevant parameters determining the strength and evolution of isotopic fractionation are know. Global modelling of the isotopic composition of water therefore may help to interpret observed isotopic changes in various archives. A number of studies have already clearly demonstrated this possibility of an improved interpretation of observed water isotope variability in terms of climate and environmental change by appropriate GCM simulation results.

In this study, we report first results of the recently developed atmosphere model ECHAM5, which now has been enhanced by explicit water isotope diagnosis. Compared to the previous version, ECHAM4, a number of substantial general changes have been introduced in both the numerics and physics of the model. These include a flux-form semi-Lagrangian transport scheme for positive definite variables like water components and chemical tracers, a new longwave radiation scheme, separate prognostic equations for cloud liquid water and cloud ice, a new cloud microphysical scheme and a prognostic-statistical cloud cover parameterization. In our presentation, we will show first global isotope modelling results (both HDO and H218O) comparing present-climate simulations to various observed isotope datasets (model-data intercomparison). In addition, we will compare the new model setup to older isotope modelling results achieved with the previous model version, ECHAM4 (model-model intercomparison).