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# Stable water isotopes in the coupled atmosphere–land surface model ECHAM5-JSBACH

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Abstract. In this study we present first results of a new model development, ECHAM5-JSBACH-wiso, where we have incorporated the stable water isotopes $H_2^{18}O$ and HDO as tracers in the hydrological cycle of the coupled atmosphere–land surface model ECHAM5-JSBACH. The ECHAM5-JSBACH-wiso model was run under present-day climate conditions at two different resolutions (T31L19, T63L31). A comparison between ECHAM5-JSBACH-wiso and ECHAM5-wiso shows that the

coupling has a strong impact on the simulated temperature and soil wetness. Caused by these changes of temperature and the hydrological cycle, the $\delta^{18}O$ in precipitation also shows variations from −4 ‰ up to 4 ‰. One of the strongest anomalies is shown over northeast Asia where, due to an increase of temperature, the $\delta^{18}O$ in precipitation increases as well. In order to analyze the sensitivity of the fractionation processes over land, we compare a set of simulations with various implementations of these processes over the land surface. The simulations allow us to distinguish between no fractionation, fractionation included in the evaporation flux (from bare soil) and also fractionation included in both evaporation and transpiration (from water transport through plants) fluxes. While the isotopic composition of the soil water may change for $\delta^{18}O$ by up to +8&permil:, the simulated $\delta^{18}O$ in precipitation shows only slight differences on the order of ±1 ‰. The simulated isotopic composition of precipitation fits well with the available observations from the GNIP (Global Network of Isotopes in Precipitation) database.

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