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## Changes in the Earth's water cycle and its isotopes over the past two millennia

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Stable water isotopes are widely used to reconstruct past temperature and precipitation variations in many regions of the over Earth. While the general physical processes of how isotope variations are controlled by temperature and water amounts is well understood, quantifying past isotope changes as a proxy for temperature and precipitation is much more difficult. An explicit simulation of water isotopes in current Earth system models is one possibility to approach this problem.

In this talk we present recent simulation results of Earth System Models with explicit water isotope diagnostics, focusing on the climate of the past two millennia. We analyze long-term trends, variability and extremes of the simulated isotope changes in precipitation and quantify the relations with associated temperature and hydrological changes. Our analyses clearly show that for many regions of the Earth, the surface warming starting with the beginning of the industrialization period is clearly imprinted in the isotope signal of precipitation, e.g., over Greenland, North America, and the Atlantic Ocean. However, in some regions recent temperature, precipitation and isotope changes seem to be decoupled, e.g., over West Antarctica, Oceania, and the Indian Ocean. We will examine this regional varying imprint of the Anthropocene on the water isotope signal in detail and discuss the relevance of our findings for the general estimation of Earth's climate sensitivity and potential future climate changes from isotope-based past temperature reconstructions.