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# Water isotope modeling and observations toward reconstruction for Asian hydroclimatology

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Kei Yoshimura[1*]

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[1]Atmosphere and Ocean Research Institute, University of Tokyo

Asian hydroclimatology in the past has very important to understand the climate system and likely for the evolution of the historical civilizations. However direct measurement data is quite limited, so some proxy data for example water isotope information conserved in tree cellulose, speleothem, and/or coral shell, etc. would be highly useful. As a very preliminary step, this study presents idealized tests of a newly-developed data assimilation system for assimilating high-frequency vapor isotope observations from satellites, using an ensemble Kalman filter with the isotope-incorporated general circulation model. An LETKF-based four dimensional data assimilation system was newly developed for the first time to obtain dynamically and physically consistent analysis of both water isotope and meteorological variables. Moreover, we also aim at assessing the isotope observation impact on the dynamical fields (wind, temperature, humidity, pressure). Several numerical experiments have been performed with various synthetic observations using a model simulation as the "nature run". The control experiment assimilates conventional rawinsonde-like observations, and the test experiments with additional isotope observations showed general improvement in both isotopic fields and dynamical fields. The positive impact on the dynamical fields was surprisingly larger when the number of conventional observations was decreased. These results are promising, so that the satellite isotopic data could be very useful to analyze the atmospheric states, particularly for the past (before 19th century) when isotopic measurement data were a major source of observations.

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