

## Investigation on water cycles and past climate changes by using water isotopic information

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Recent advancements of measurement and modeling technologies for heavy stable water isotopes (i.e., H<sub>2</sub><sup>18</sup>O and HDO), namely in-situ and remote sensing spectroscopic vapor isotope measurements and isotope-incorporated general circulation models and regional models, have rapidly improved our understanding of the water isotopic behavior in the Earth System. This fact has greatly increased recognition about the usefulness of stable water isotopic information in the geoscience community. In this presentation, such recent advancements are reviewed, and some of new applications of isotopes for hydrological, meteorological, and climatological sciences, including mechanism of seasonal cycle of deuterium excess in precipitation over East Asia and global contribution of vegetation transpiration on total evapotranspiration, are described. Furthermore, as an extension of previous dataset, 20th Century Isotope Reanalysis dataset covering from AD1871 to AD2008 is introduced. First validation exercises with multiple independent isotopic proxy data, i.e., ice core  $\delta^{18}\text{O}$ , tree cellulose  $\delta^{18}\text{O}$ , and coral  $\delta^{18}\text{O}$  are made, and the results show reasonable agreement for not only the latest period but also the early 20th century and even the late 19th century. Finally, as future direction of the community, the way towards data assimilation of isotopic proxy data, in which the water isotopic information is used as constraint of various hydrological, meteorological, and climatological processes, is introduced. The ideal experiment with vapor isotope data gives us promising results.

Keywords: stable water isotope, data assimilation