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Preliminary results of atmospheric water vapor isotopic observation in Nanjing, China

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Stable isotope (δ^{18}O or δD) is an important component of natural water, and it is assigned to the two substances or phases at different ratio which occurs in every part of the nature water cycle (isotope fractionation effect). Water vapor stable isotopes can be used as important techniques in inversing atmospheric transport processes, tracing vapor sources, and reflecting the local weather and climate conditions. However, there are still less observations of δ^{18}O and δD in atmospheric water vapor. As a result, in-situ continuous measurement techniques of atmospheric water vapor isotopes are needed.

Nanjing is located in China's eastern coastal areas, where is a typical East Asian monsoon region. A long-term integrated observation of atmospheric water vapor isotopes in this region will definitely improve the current understanding of the monsoon climate and regional processes.

In November 2012, we installed an autonomous continuous isotopic water analyzer (Picarro L2120-i) at Station for Observing Regional Processes in the Earth System of Nanjing University (SORPES-NJU) (32.12 N 118.95 E) for a long-term observations of atmospheric vapor stable isotopes. The Picarro water vapor isotope analyzer offers data with high precision and temporal resolution, and the drift of the equipment can be automatically corrected by calibration system. Relevant meteorological elements are also observed at SORPES-NJU.

In order to investigate the impact of atmospheric processes on variations of atmospheric water vapor isotope ratios, different time scales have been analyzed. On seasonal time-scale, from the correlation with meteorological data, we found that the water vapor isotope values are log-linear functions of water vapor concentrations with a correlation coefficient of 0.84, which is an important indicator for variation of atmospheric water vapor. On time-scales of a few days, especially in the event of rainfall, the isotopic ratio in vapor varies significantly inside very short time. The variation is caused by advection in whole rainfall process, and the maximum amplitude of δ^{18}O is 16‰ in December. On a diurnal time-scale, a cyclical change exists in fair weather which is controlled by entrainment at the top of the boundary layer at nighttime and advection within the boundary layer at daytime. In the following work, we hope to combine isotope simulation models with observations, which can make a quantitative analysis of the short-term variability.