

The Relations between Summer Droughts/Floods and Oxygen Isotope Composition of Precipitation in Dongting Lake Basin

Zhongli Liu¹, Xinping Zhang¹, Zhuoyong Xiao¹, Xinguang He¹, Zhiguo Rao¹, and Huade Guan²

¹College of Geographic Science Hunan Normal University Changsha 410081 China

²Flinders University College of Science and Engineering

April 30, 2022

Abstract

Stable isotopes respond sensitively to environmental evolution and record it in different geological archives due to fractionation. The stable isotope composition of water ($\delta^{18}\text{O}$ and $\delta^2\text{D}$) has been widely applied in fields including hydrometeorology, weather diagnosis, and palaeoclimate reconstruction. In recent years, the stable oxygen isotope of precipitation ($\delta^{18}\text{O}_p$) in southern China are valuable proxies of environmental variables, however, their interpretations of them have been controversial. Considering that the summer monsoon circulation brings about a large amount of precipitation, the temporal variation and range of the annual $\delta^{18}\text{O}_p$ are consistent with those of the summer $\delta^{18}\text{O}_p$. Based on the observed and simulated data on oxygen isotope composition of precipitation, the linkage between summer precipitation (P) and $\delta^{18}\text{O}_p$ in the Dongting Lake Basin and their possible influencing factors are demonstrated. Meanwhile, the contribution of different factors is analyzed by using multiple linear stepwise regression. The results indicate that the temporal variation of summer $\delta^{18}\text{O}_p$ is consistent with that of annual $\delta^{18}\text{O}_p$ and the amount effect is identified in summer in the basin. Besides, the annual $\delta^{18}\text{O}_p$ shows a significantly negative correlation with summer precipitation. It demonstrates that the value of stable isotopes in precipitation may be considered a proxy of summer precipitation in Dongting Lake Basin. Statistically, on an interannual timescale, the more south-westerly the Western Pacific Subtropical High (WPSH) extended, the higher the $\delta^{18}\text{O}_p$ was and *vice versa*, indicating that there appeared circulation effect in the basin. In regression models based on the observed data in Changsha and the simulated data for the entire basin, the local summer precipitation always served as an important factor. It can be exemplified by comparing the local and upstream rainout along with water vapor flux transporting pathways in dry and wet summers. These results can potentially improve the reconstruction of paleoclimate in the East Asian monsoon region. Further study is needed to determine the contribution of local and large-scale factors to the oxygen isotope composition of precipitation.

Hosted file

The relations between summer droughts/floods and oxygen isotope composition of precipitation in Dongting available at <https://authorea.com/users/479692/articles/567405-the-relations-between-summer-droughts-floods-and-oxygen-isotope-composition-of-precipitation-in-dongting-lake-basin>