Quantitative reconstruction of the humidity in the moisture source region based on the ^{17}O-excess in precipitation on a subtropical island

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A high-precision analysis of the triple oxygen isotope composition of water provides a new tracer denoted as ^{17}O-excess. In theory, the ^{17}O-excess can be interpreted as variations in the relative humidity in moisture source regions for precipitation. However, recent studies on ^{17}O-excess in the precipitation in polar and dry regions suggest the importance of snow formation and raindrop re-evaporation processes. To date, whether humidity in the moisture source region can be quantified based on observations of ^{17}O-excess in precipitation has not been proven. Here, we show a 2 year record of the ^{17}O-excess in precipitation on a maritime island in the East Asian monsoon region, Okinawa, Japan. We demonstrate that the reconstructed relative humidity is quantitatively consistent with observations in the oceanic moisture source region. This result suggests that the ^{17}O-excess in precipitation on the subtropical island is determined largely by diffusional fractionation during evaporation in the ocean. These results suggest that the ^{17}O-excess in precipitation in tropical and subtropical regions is a unique quantitative tracer for the relative humidity in oceanic moisture source regions and thus will be a useful tracer and proxy for hydrological and paleoclimate studies.

Reference:
Uechi, Y. and R. Uemura, Dominant influence of the humidity in the moisture source region on the ^{17}O-excess in precipitation on a subtropical island, Earth and Planetary Science Letters, in press.

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