

$^{17}\text{O}_{\text{excess}}$ in water as a new tracer for hydrological cycle: application to tropical and polar regions.

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Stable isotopes of water (δD and $\delta^{18}\text{O}$) have been performed for more than 50 years with the aim to understand the links between water cycle and climate. On the one hand, records of δD and $\delta^{18}\text{O}$ provide information on temperature changes at high latitudes (e.g. ice core records) and on precipitation intensity along the trajectory at low latitudes. On the other hand, combination of $\delta^{18}\text{O}$ and δD in the so-called d-excess constrains the climatic conditions (temperature, relative humidity) over the oceanic evaporative regions albeit in a complex manner (difficulty to disentangle the different parameters). Recently, the possibility to measure with high precision ^{17}O in water has enabled to introduce a new parameter, $^{17}\text{O}_{\text{excess}}$, resulting from the combination of $\delta^{18}\text{O}$ and ^{17}O . When measured in ice core, this parameter is expected to be a more direct tracer of relative humidity of the oceanic evaporative regions than d-excess.

In order to better understand this new parameter as well as to extract the maximum climatic information from the combination of $^{17}\text{O}_{\text{excess}}$ and d-excess, we present different original studies combining the two parameters in several key regions. First, concentrating on the African monsoon system (squall line and seasonal variability), we confirm the strong influence of relative humidity on $^{17}\text{O}_{\text{excess}}$ through the reevaporation process. Moreover, the combination of $^{17}\text{O}_{\text{excess}}$ and d-excess in this study is shown to be a powerful tool to constrain the parameterization of the reevaporation process as implemented in different models. Second, we study how local processes (precipitation, sublimation) in polar region can affect $^{17}\text{O}_{\text{excess}}$ archived in ice core with respect to d-excess records through (1) isotopic measurements of vapor versus precipitation collected at the NEEM station (Greenland) and (2) surface $^{17}\text{O}_{\text{excess}}$ measurements performed in Antarctica surface from the coast to very remote inland stations (Dome A). Third, we present $^{17}\text{O}_{\text{excess}}$ measurements on different Antarctic ice cores over the last deglaciation in order to constrain the change in source relative humidity over this period.