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Ten years of isotopic composition of precipitation at Concordia Station, East Antarctica

Oxygen and Hydrogen isotopic composition (delta18O and deltaD) in ice cores has been widely used as a proxy for reconstructing past temperature variations. However, the atmospheric dynamics determining the precipitation isotopic composition on the Antarctic Plateau are yet to be fully understood, as well as the post-depositional processes modifying the pristine snow isotopic signal: both are fundamental for the interpretation of the isotopic records from deep Antarctic ice cores drilled in low accumulation areas in order to improve past temperature reconstructions.

Since 2008, daily precipitation has been continuously collected by the winter-over personnel on raised surfaces (height: 1 m) placed in the clean area of Concordia Station on the East Antarctic plateau. Each sample has been analyzed for δ18O, δD and deuterium excess (d): this represents a unique record, still ongoing, for the isotopic composition of precipitation in inland Antarctica.

In order to better comprehend the relationship between local temperature and the isotopic signal of precipitation, temperature data (T2m) from the Dome C Automatic Weather Station of the Programma Nazionale di Ricerche in Antartide (PNRA) were correlated with precipitation sample delta18O, deltaD and d from 2008 to 2017. A significant positive correlation between delta18O and deltaD of precipitation and T2m is observed when using both daily and monthly-averaged data. The measured precipitation isotopic data were also compared to the simulated delta18O, deltaD and d from the isotope-enabled atmospheric general circulation models ECHAM5-wiso and ECHAM6-wiso, with the latter showing significant improvement in simulating the isotopic data of precipitation.

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Track Classification: Progress in proxy development and interpretation