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Isotopic composition along the atmosphere-precipitation-snow continuum in the Dome C region, East Antarctica

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The ability to infer past temperatures from ice core records has in the past relied on the assumption that after precipitation, the stable water isotopic composition of the snow surface layer is not modified before being buried deeper into the snowpack and transformed in ice. However, in extremely dry environments, such as the East Antarctic plateau, the precipitation is so sparse that the surface is exposed to the atmosphere for some time before burial. Several processes have been recently identified as impacting the snow isotopic composition after snowfall, also called post-depositional processes: (1) exchanges with the atmosphere (i.e. sublimation/condensation cycles), (2) wind effects (i.e. redistribution and pumping) and (3) exchanges with the firn below (i.e. metamorphism and diffusion).

Here we present the results of the analysis of in-situ observations of the isotopic composition along the precipitation-atmosphere-snow continuum in the Dome C region, located on the high East Antarctic Plateau. Together with meteorological data, this dataset gives insight on how the isotopic composition varies in the upper layer of the snowpack and which surface processes are at play on different time scales. We also use a surface snow model which includes vapor-snow exchanges and diffusion in the snow to disentangle and quantify the impact of each physical process on the observed isotopic composition of the snow surface.

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Track Classification: Progress in proxy development and interpretation