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Variability of isotopic compositions in surface snow along the Kohnen-Plateau Station traverse of 2017-2018 (Dronning Maud Land)

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The Cofi (Coldest Firn) project aims at better understanding how densification occurs in regions of Antarctica where the firn is particularly cold and comparable to glacial periods. To complete this aim, a German traverse was realized during the summer season 2017-2018, starting from Kohnen (Dronning Maud Land, Antarctica) towards the American Plateau Station, before returning to Kohnen. Three main stops were realized, at locations named Cofi 5 (or OIR Camp), Cofi 6 (or Plateau Station) and Cofi 7 (between Cofi 5 and Cofi 6, a little to the south). At each of these stops, a 200-meter firn core was drilled. These 200-meter cores are still under study.

Here, we present the results of isotopic compositions in snow samples collected during the traverse at daily stops (1 m snow pits) and for the three main stops (3 m snow pits). The aim is to evaluate how isotopic compositions vary geographically, as well as vertically, to better understand the processes active during and after deposition.

To evaluate geographical variations, twice a day during the traverse, a pluriannual surface snow sample was obtained by digging a one-meter snow pit, and mixing the snow over this first meter of the snowpack. δ^{18}O and d-excess values were then obtained from these samples using a Picarro instrument at LSCE. As expected from the distillation process, δ^{18}O values decrease when going to higher latitudes, higher elevations and with increasing distance to coast.

In the 3-meter snow pits, samples were collected every 3 cm, with a duplicate sampling at 1.5 cm resolution, only for the first meter. Again, δ^{18}O and d-excess values were obtained using a Picarro Instrument, and for Cofi 5 only, ^{17}O-excess values were also measured by means of fluorination. There is a strong anti-correlation between d-excess and δ^{18}O at Cofi 5 and Cofi 7, but not at Cofi 6 (Plateau Station). This could result from greater variability in air mass sources at this location which has higher elevation and is located closer to the divide. In terms of periodicity, the wavelength of δ^{18}O cycles is larger than the one expected from accumulation; this implies that some annual cycles are missing, maybe because of mechanical reworking of the deposited snow. This could also be due to isotopic diffusion acting upon a noise dominated signal.