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Spatial variability in isotopic composition of surface snow along the East Antarctic International Ice Sheet Traverse (EAIIST)

Content

The isotopic signal of oxygen and hydrogen, archived in the Antarctic ice sheet through snow precipitation, is an important proxy of climatic conditions. This signal depends on several parameters such as local temperature, climatic conditions in the moisture source areas and air mass pathways. Moreover, the isotopic composition may be affected by spatial variability induced by the interactions of the snow surface with the overlying atmosphere along the direction of the prevailing winds. In regions where the snow accumulation is very low, interactions between the atmosphere and the snow surface could modify the pristine signal through isotopic exchanges, sublimation processes and mechanical mixing originated from wind action.

The EAIIST (East Antarctic International Ice Sheet Traverse) traverse, that took place during the 2019-2020 Antarctic field season, starting from Concordia Station towards the South Pole, provides a perfect path of study. Along the EAIIST traverse, areas with homogeneous accumulation rates can be compared to areas influenced by wind scouring and mega-dunes formation. Extremely low accumulation and wind-surface snow interaction observed in these areas could be representative of glacial period conditions in the Antarctic Plateau.
Here we present the isotopic composition (δD and δ18O) of surface (a few cm of depth), bulk (1 m depth) and snow pit (2 m depth) samples along the EAIIST traverse to evaluate the parameters explaining the spatial variability of this proxy. The δD, δ18O and, the deuterium excess will be evaluated with respect to geographical features (elevation, latitude, distance from the coast, slope) and climatic conditions (temperature, accumulation, wind speed and direction). Wind action is expected to play a major role in explaining the isotopic spatial variability in these areas.
Understanding the spatial variability in the deposition process, which strongly decreases the ratio between signal and noise, is essential to better interpret high-resolution isotopic profiles from firn and ice cores, collected along the EAIIST traverse, which will be analyzed soon.

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