EGU22-13362
https://doi.org/10.5194/egusphere-egu22-13362
EGU General Assembly 2022

Water vapor isotopic signature along the EAIIST traverse

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Stable water isotopes are a tracer of hydrological processes and a paleoclimate proxy from ice core records. The interpretation of the latter relies on fractionation processes throughout the hydrological cycle, from the evaporation over the ocean, during each precipitation event, and during post-deposition processes, in particular due to the exchanges between the snow and the moisture in the atmosphere. Thanks to new developments in infrared spectroscopy, it is now possible to monitor not only the snow isotopic composition but also the vapour continuously, and thus document exchanges between the snow and the vapour. On the East Antarctic Plateau, records of water vapour isotopic composition in Kohnen and Dome C during summer have revealed significant diurnal variability which can be used to address the exchange between surface snow and atmospheric water vapour as well as the stability of the atmospheric boundary layer.

In this study, we present the first vapour monitoring on a transect across East Antarctica for a period of 3 months from November 2019 to February 2020 during the EAIIST traverse, covering more than 3600 km. In parallel, we also monitored the vapour isotopic composition at two stations: Dumont D'Urville (DDU), the starting point, and Dome C, half way through. Efforts on the calibration on each monitoring station, as well as cross-calibration of the different instruments offer a unique opportunity to compare both the spatial and temporal (diurnal variability or at the scale of several days) gradients of humidity, temperature and water vapour isotopic composition in East Antarctica during the summer season.

With the use of the Modele Atmospherique Régional (MAR), we compare the variability measured in water vapour isotopic composition, temperature and humidity with the different systems (fixed or mobile location). Although further comparisons with the surface snow isotopic composition are required to quantify the impact of the snow-atmosphere exchanges on the local surface mass balance, these three simultaneous measurements of the vapour isotopic composition show the potential of using water stables isotopes to evaluate hydrological processes in East Antarctica.