Characterisation of the marine air above the Wedell Sea from water vapor stables isotopes ($\delta^{18}O$, $\delta^{2}H$): influence of evaporation, sea-ice cover and atmospheric circulation

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Abstract

Water stable isotopes (e.g. $\delta^{18}O$ and $\delta^{2}H$) in Antarctica ice cores provide key insights to reconstruct past surface conditions of the oceanic moisture source. The assumption behind it is that the isotopic fingerprint acquired during sea surface evaporation is in part preserved along transport to Antarctica. For this purpose, continuous measurements have been recently collected from tropical to polar oceans to investigate how isotope fractionation during evaporation and precipitation events, coupled with mixing processes, control the water vapor isotope variability in the marine boundary layer.

Here, we present water vapor isotope measurements acquired at 17 m above the Weddell sea surface during the summer 2017 (WAPITI cruise aboard the R.R.S James Clark Ross). Because understanding the isotope composition variability in marine air intrusion to Antarctica is an important concern for ice core paleoclimate studies, we investigate the different processes affecting the moisture balance in the Wedell Sea boundary layer. From water vapor isotope measurements and weather observations, we identify moistening of the marine boundary layer *via* sea surface evaporation and drying via mixture with dry and cold air masses from the continent. In particular, we explore: 1. How the humidity budget over the Weddell sea is controlled by evaporation and mixing processes, 2. How fractionation processes during local evaporation affect the water vapor isotopes and 3. The relation between sea-ice coverage, water vapor isotope and humidity variability.