

Stable isotopes in Antarctic precipitation – from paleoclimatology to Polar Ocean freshening

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The project ACOSIA (FWF P28695) aims at a better understanding of the complex relationship between stable isotopes in Antarctic precipitation and the air temperature at the deposition site in order to improve both the paleoclimatic interpretation of ice core data and the parameterization of isotopic fractionation in models of various scales. At the German Antarctic wintering base “Neumayer”, continuous measurements of water vapor stable isotopes were carried out using a cavity ring-down spectrometer (CRDS) during Austral summer 2017/18. These measurements are complemented by a comprehensive surface snow sampling program. Neumayer is a fully equipped meteorological station including a meteorological mast and daily radiosonde launches. Thus the measured isotope data can be related to the meteorological conditions. To put these field measurements into a long-term temporal perspective, the unique data set of isotope ratios of Neumayer fresh snow samples will be used. Fresh snow samples have been taken at the end of major precipitation events since 1981. Since 2013, an extra sample for the analysis of the 17O excess has been taken. So far, the 17O excess is poorly understood, and this study under well-known meteorological conditions will yield a deeper insight into the relationship between 17O excess of Antarctic snow/ice and moisture source conditions.

In cooperation with the Swiss Polar Institute: ACE (Antarctic Circumnavigation Expedition): Project: Quantifying precipitation and its contribution to surface freshening in the Southern Ocean:

The salinity of the Southern Ocean has decreased in recent years, the cause of this trend is not yet clear, though. There are three significant sources of freshwater to the surface of the Southern Ocean: melting of the Antarctic ice sheet and icebergs calved from it, sea ice, and precipitation. Of these, precipitation is the least well known. Direct measurements of precipitation that our project made during the ACE cruise are combined with evaluation of the larger scale weather and sea ice patterns to determine how precipitation influences the ocean. Along with ocean salinity sampling, samples of ocean water and precipitation were collected at regular intervals for laboratory analysis of its oxygen isotopic composition. The oxygen isotope signature of the ocean water and precipitation will give us information about the contribution of different factors to the ocean salinity changes. In addition to the measurements in the ocean mixed layer, different water masses were sampled within the water column using a CTD (conductivity, temperature depth) profiling rosette sampler to collect water from different depths.