Stable water isotope observations during INTAROS cruises North of Svalbard: links to atmospheric circulation and sea ice processes

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Water isotopes measured in ice cores are well-known tracers of paleoclimate variations. The ratio of heavy to light isotope in snow is indeed strongly controlled by the temperature during condensation along the entire airmass transport. This allows the utilization of isotope variability in the water cycle in current climatic conditions, and on weather time scales, to try to pinpoint key events and processes building up (or re-stating) the isotope signature of a given air mass. Because isotopic fractionation occurs every time water changes phase, it is highly beneficial to sample concurrently the different water reservoirs (i.e. seawater, sea ice, snow, rain and vapor) in order to truly understand the processes at work.

Here we present stable water isotope data from two cruises north of Svalbard within the INTAROS project (summer 2018 and summer 2019). During these cruises, vapor isotope composition was measured quasi-continuously on the coast guard icebreaker KV Svalbard. Seawater and precipitation samples were collected continuously throughout the cruises. The 2018 cruise mainly targeted locations within the Marginal Ice Zone north of Svalbard. On the 2019 cruise, sea ice samples and snow samples were collected at 8 ice stations, all the way to the North Pole. The liquid/solid samples were later analyzed at FARLAB at the University of Bergen.

A first analysis of the dataset shows that stable water isotope values vary with air mass origin, with marked differences between "18O-enriched" air coming from the south-east (Barents Sea) and "18O-depleted" air from the north-west (Inner Arctic) during the second cruise. During the 2019 cruise, vapor in air from the south-east tends to have relatively low d-excess values whereas precipitation is largely at equilibrium with the ambient vapor. This INTAROS dataset will be highly beneficial for studies using (coupled) isotope-enabled models, such as earth system models or high-latitude regional climate models, to validate their representation of the high-latitude water cycle.