EGU General Assembly 2020

EGU2020-12445
https://doi.org/10.5194/egusphere-egu2020-12445
EGU General Assembly 2020

MOSAiC's Pan Arctic Water Isotope Network: Sea ice-water vapor isotope interactions and transport processes within, into and out of the Arctic

Ben Kopec[1], Eric Klein[2], David Noone[3], Hannah Bailey[4], Kaisa-Riikka Mustonen[4], Pete Akers[5], Jean-Louis Bonne[6], Martin Werner[6], Hans Chirstian Steen-Larsen[7], Sonja Wahl[7], Franziska Aemisegger[8], Bjorn Klove[9], Alun Hubbard[10], and Jeff Welker[1,4]

[1]University of Alaska Anchorage, Biological Sciences, Anchorage, United States of America (bgkopec@alaska.edu)
[2]University of Alaska Anchorage, Geology, Anchorage, United States of America
[3]University of Auckland, Auckland, New Zealand
[4]University of Oulu, Ecology and Genetics, Oulu, Finland
[5]Institut des Géosciences de l'Environnement, CRNS, Grenoble, France
[6]Alfred-Wegener-Institut Helmholtz-Zentrum fu□r Polar- und Meeresforschung, Bremerhaven, Germany
[7]University of Bergen, Geophyical Institute, Bergen, Norway
[8]ETH Zurich, Environmental Systems Science, Zurich, Switzerland
[9]University of Oulu, Water, Energy and Environmental Engineering, Oulu, Finland
[10]UiT The Arctic University of Norway, Center for Arctic Gas Hydrate, Environment and Climate, Tromso, Norway

MOSAiC is a one of a kind, year-long study of the Arctic Basin's behavior focused in large part on interactions between sea ice, atmospheric processes, ecosystem dynamics and oceanography, as well as connections between the Arctic and the mid-latitudes. Our MOSAiC project is focused on how the Arctic Basin's water cycle behaves throughout the year, especially now that sea ice loss allows for a new source of moisture to the atmosphere during times when this basin was formerly frozen over. These massive changes in open water and corresponding fluxes in conjunction with significant shifts in atmospheric circulation, are altering how moisture is transported into, within, and out of the Arctic Basin. In order to help quantify these Arctic hydrologic cycle variations, we have established the AWIN (Arctic Water Isotope Network) that uses continuous water vapor isotope measurements (δD, δ^{18}O, and deuterium excess) at eight land-based stations from Barrow in Alaska to Ny Alesund in Svalbard, as well as on board the Polarstern.

With a network of sites rather than a single station, we gain the significant advantage of being able to track water vapor and how it varies from site to site, allowing us to identify the sources of moisture, and how and where that moisture is transported into, within, and out of the Arctic. For this analysis, we focus on the first months of the expedition (October-December 2019) to closely examine cases of critical events including a major low-pressure system in mid-November that impacted much of the Arctic Ocean basin and three key repeating transport regimes – 1) transport into the Arctic from the North Atlantic via the Greenland Sea, 2) transport into the Arctic via Baffin Bay, and 3) transport out of the Arctic via the Greenland Sea, as well as transport within the Arctic

during each of these regimes. For example, in the scenario of transport into the Arctic via Baffin Bay, at our site in Thule, Greenland, we see significant reductions in deuterium excess each time the southerly flow initiates, suggesting significant moisture evaporating from nearby in Baffin Bay. We then can track that moisture to another site to observe how much of that locally-sourced vapor is transported to a given downwind location, allowing us to quantify vapor fluxes and isotopic fractionation processes across the Arctic. By examining these scenarios under varying sea ice conditions and large-scale atmospheric circulation patterns, this circum-Arctic network of water isotope measurements is transforming our understanding of the Arctic hydrologic cycle during MOSAiC.