Deuterium excess variations in seasonal snowpack during the winter seasons of 2015-2017 in Alaska

Konosuke Sugiura[1,2,3], Shin Nagai[2], Hideki Kobayashi[2], Masayuki Takigawa[2] and Hajo Eicken[3]
[1]*University of Toyama*
[2]*Japan Agency for Marine-Earth Science and Technology (JAMSTEC)*
[3]*International Arctic Research Center/University of Alaska Fairbanks (IARC/UAF)*

It is widely known that the second-order isotope parameter deuterium excess *d* has often been used to identify vapor source regions. The deuterium excess *d* is defined as $d = \delta D - 8\delta^{18}O$ using stable isotopes (δD and $\delta^{18}O$)(Dansgaard, 1964). To obtain data of deuterium excess variation in seasonal snowpack, snow surveys were carried out in Alaska along a latitudinal gradient. Sampling points in Alaska are shown in Figure 1 (#1: vicinity of Prudhoe Bay, #2: vicinity of Toolik Lake, #3: the foot of the Brooks Range, #4: vicinity of Wiseman, #5: vicinity of the Yukon River, #6: Poker Flat Research Range, #7: vicinity of Cantwell, #8: vicinity of Summit Airport, #9: vicinity of Willow, #10: vicinity of Wasilla, #11: vicinity of Mirror Lake). The snow surveys were conducted at the end of the snow accumulation period in the three winter seasons of 2015-2017. The total layer snowpack was collected using a large-aperture cylindrical snow sampler with 0.005-m^2 area to keep losses of depth hoar within the sampled snow pack to a minimum. Measurements of δD and $\delta^{18}O$ were conducted on melt water of the total layer snowpack using mass spectrometry techniques.

Figure 2 shows the deuterium excess during the three winter seasons of 2015-2017. The study region comprises three zones: the North Slope of Alaska facing the Arctic Ocean, interior Alaska including the Yukon River valley and the southern region facing the Gulf of Alaska. This study reveals clear regional variations of deuterium excess in Alaska. That is, the total layer snowpack near to the ocean and river is characterized by distinctly higher deuterium excess values. It has been demonstrated in numerous studies that deuterium excess reflects specific source conditions and is controlled by the relative humidity of the air masses over the evaporating surface (e.g. Merlivat and Jouzel, 1979). In this presentation, we discuss the data obtained until now and water vapor origins. Future research will provide additional insights on interannual variation and spatial patterns.

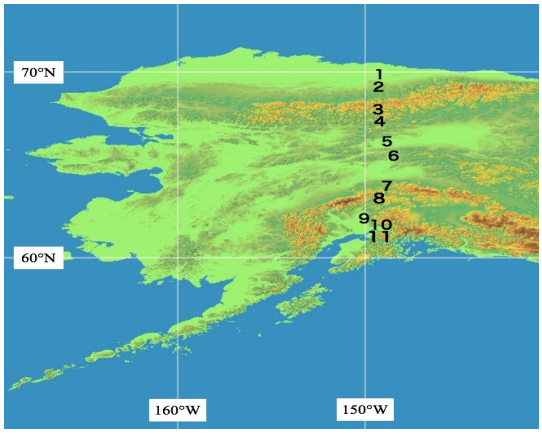

Figure 1. Sampling points in Alaska.

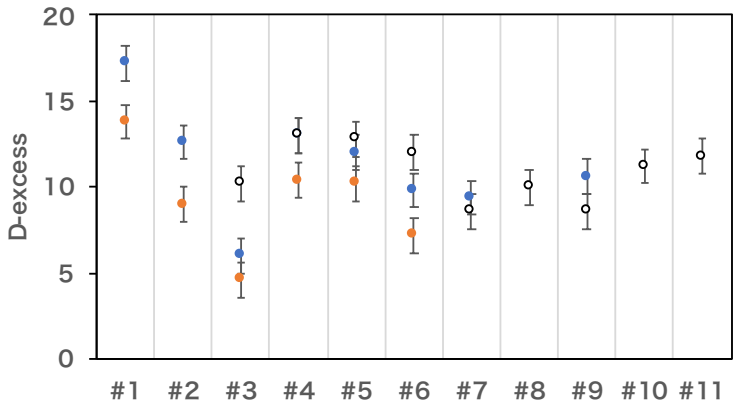

Figure 2. Deuterium excess variations. ●: 2015, ●: 2016, ○: 2017.

References

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