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High Latitude Dust (HLD) contributes 5% to the global dust budget, but HLD measurements are sparse. Iceland has the largest area of volcaniclastic sandy desert on Earth where dust is originating from volcanic, but also glaciogenic sediments. Total Icelandic desert areas cover 44,000 km^2 which makes Iceland the largest Arctic as well as European desert. Icelandic volcanic dust can be transported distances > 1700 km towards the Arctic and deposited on snow, ice and sea ice. It is estimated that about 7% of Icelandic dust can reach the high Arctic (N>80°). It is known that about 50% of Icelandic dust storms occurred during winter or subzero temperatures in the southern part of Iceland. The vertical distributions of dust aerosol in high atmospheric profiles during these winter storms and long-range transport of dust during polar vortex condition were unknown.

Dust observations from Iceland provide dust aerosol distributions during the Arctic winter for the first time, profiling dust storms as well as clean air conditions. Five winter dust storms were captured during harsh conditions. Mean number concentrations during the non-dust flights were < 5 particles cm^{-3} for the particles 0.2-100 µm in diameter and > 40 particles cm^{-3} during dust storms. A moderate dust storm with > 250 particles cm^{-3} (2 km altitude) was captured on 10th January 2016 as a result of sediments suspended from glacial outburst flood Skaftahlaup in 2015. Similar particle number concentrations were reported previously in the Saharan air layer. Detected particle sizes were up to 20 µm close to the surface, up to 10 µm at 900 m altitude, up to 5 µm at 5 km altitude, and submicron at altitudes > 6 km.

Dust sources in the Arctic are active during the winter and produce large amounts of particulate matter dispersed over long distances and high altitudes. HLD contributes to Arctic air pollution and has the potential to influence ice nucleation in mixed-phase clouds and Arctic amplification.

Reference:

Dagsson-Waldhauserova, P., Renard, J.-B., Olafsson, H., Vignelles, D., Berthet, G., Verdier, N., Duverger, V., 2019. Vertical distribution of aerosols in dust storms during the Arctic winter. **Scientific Reports** 6, 1-11.