



## **High Latitude Dust (HLD) sources and pathways in Polar Regions - Antarctica and the Arctic**

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The Arctic and Antarctic regions include large areas of High Latitude Dust sources, from where dust is transported long distances. The first estimates are that all high latitude dust sources cover > 500,000 km<sup>2</sup> and contribute to at least 5 % of global dust budget. Iceland is the largest Arctic as well as European desert with high dust event frequency (~135 dust days annually). 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°).

Total extent of the deserted areas is about 44,000 km<sup>2</sup>. This represents that > 40% of Iceland is poorly vegetated and with high erosion rates, not including the 10% extent of the glaciers. These areas used to be, however, vegetated while forests covered at least 25% of the country about 800 years ago. Woodlands were reduced due to medieval agricultural methods to almost total elimination about 100 years ago. Cold climate and massive erosion caused a collapse turning vegetated ecosystem into desert. Today dust events frequently occur in the winter and during sub-zero temperatures.

Icelandic dust was compared to local dust sources in Ny-Alesund, Svalbard, showing that it contains of large fractions of fine dust. Metal oxide particles and volcanic glass are the most representative markers to identify Icelandic dust. In 2011, Icelandic dust reached Svalbard, over 1700 km from the dust source, and deposited in Ny-Alesund. This study confirms our theory that Icelandic volcanic dust can have a significant influence on the cryosphere in Greenland and elsewhere.

Active dust sources were monitored also in the Southern Hemisphere. In situ measurements in the Antarctic Peninsula showed that the air is polluted by local dust sources, as well as due to long-range transport from Patagonia. The PM<sub>10</sub> concentrations in Antarctica were higher than those in natural areas of the Northern Europe. We present newly identified HLD sources as well as the first evidence that Icelandic volcanic dust reaching the High Arctic, Svalbard Islands. Impacts of High Latitude Dust on climate should be investigated and incorporated into climate scenarios.