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Iceland as the largest source of natural air pollution in the Arctic

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Arctic aerosols are often attributed to the Arctic Haze and long-range transport tracers. There is, however, an important dust source in the Arctic/Sub-arctic region which should receive more attention. The largest desert in the Arctic as well as in the Europe is Iceland with > 40,000 km2 of desert areas. The mean dust suspension frequency was 135 dust days annually in 1949-2012 with decreasing numbers in 2013-2015. The annual dust deposition was calculated as 31-40 million tons yr-1 affecting the area of > 500,000 km2. Satelite MODIS pictures have revealed dust plumes traveling > 1000 km at times.

The physical properties of Icelandic dust showed differences in mineralogy, geochemical compositions, shapes, sizes, and colour, compared to the crustal mineral dust. Icelandic dust is of volcanic origin, dark in colour with sharp-tipped shards and large bubbles. About 80% of the particulate matter is volcanic glass rich in heavy metals, such as iron and titanium. Suspended dust measured at the glacial dust source consisted of such high number of close-to-ultrafine particles as concentrations during active eruptions. Generally, about 50% of the suspended PM10 are submicron particles in Iceland. Contrarily, suspended grains > 2 mm were captured during severe dust storm after the 2010 Eyjafjallajokull eruption when the aeolian transport exceeded 11 t m-1 of materials and placed this storms among the most extreme wind erosion events recorded on Earth.

Our reflectance measurements showed that Icelandic dust deposited on snow lowers the snow albedo and reduces the snow density as much as Black Carbon. Icelandic volcanic dust tends to act as a positive climate forcing agent, both directly and indirectly, which is different to what generally concluded for crustal dust in the 2013 IPCC report. The high frequency, severity and year-round activity of volcanic dust emissions suggest that Icelandic dust may contribute to Arctic warming.