



## The most unusual dust event cases from Iceland

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Iceland has the largest area of volcanoclastic sandy desert on Earth where dust is originating from volcanic, but also glaciogenic sediments. Total Icelandic desert areas cover over 44,000 km<sup>2</sup> suggesting Iceland being the largest Arctic as well as European desert. Satellite MODIS pictures have revealed dust plumes traveling over 1000 km at times. The mean frequency of days with dust suspension was to 135 dust days annually in 1949-2011. The annual dust deposition was calculated as 31 - 40.1 million tons yr<sup>-1</sup> affecting the area of > 500,000 km<sup>2</sup>, which places Iceland among the most active dust sources on Earth. Volcanic dust is distributed over local glaciers (about 4.5 million t annually) and surrounding oceans (6 – 14 million t annually). Mean dust emissions were calculated for minor, medium and major dust events as 0.1, 0.3 and 1 million tons per event, respectively.

Three unusual dust events were observed and measured: The first, an extreme wind erosion event of the fresh Eyjafjallajokull 2010 volcanic ash, the second, a Snow-Dust Storm in 2013, and the third, a suspended dust during moist and low wind conditions. Frequent volcanic eruptions in Iceland (new eruption each 3-4 years on average) represent important inputs to dust variability. Freshly deposited ash prolongs impacts of volcanic eruptions as we observed after the 2010 Eyjafjallajokull eruption. In September 2010, an extreme storm was recorded with the maximum wind speed of 38.7 ms<sup>-1</sup>. The maximum saltation was 6825 pulses per minute while the aeolian transport over one m wide transect and 150 cm height reached 11,800 kg m<sup>-1</sup>. The largest previously measured amount in Iceland in one storm was about 4,200 kg m<sup>-1</sup>. This storm is among the most extreme wind erosion events recorded on Earth.

Dust events in South Iceland often take place in winter or at sub-zero temperatures. The Snow-Dust Storm occurred in March 6-7th 2013 when snow was nearly black with several mm thick dark layer of dust deposited on snow. Dust was transported over 250 km causing impurities on snow in the capital of Iceland, Reykjavik. This has been the first observation of clumping mechanism of particles on snow in natural conditions. Maximum one-minute PM<sub>10</sub> concentration was measured as 6500 μg m<sup>-3</sup> while the mean (median) PM<sub>10</sub> concentration during 24-hour storm was 1,281 (1,170) μg m<sup>-3</sup>.

Dust can be also suspended during rainy period as a result of surface heating. We measured particle number concentration (PM<sub>~0.3-10</sub> μm) up to 149,954 particles cm<sup>-3</sup> min<sup>-1</sup> during wet and low wind/windless conditions in August 2013. The particles were mainly of the close-to-ultrafine size. Wet dust particles were mobilized within < 4 hours.