



Atmospheric circulation patterns fostering the development of dust plumes over Iceland

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The knowledge on mineral dust emitted at high latitudes is limited, but its impact on the polar environments is diverse. Within a warming climate, dust emitted from regions in cold climates is expected to increase due to the retreat of the ice sheet and increasing melting rates. Therefore, and for its extensive impacts on different aspects of the climate system, a better understanding of the atmospheric dust life-cycle at high latitudes/cold climates in general, and the spatio-temporal distribution of dust sources in particular, are essential.

At high-latitudes, glacio-fluvial sediments as found on river flood plains e.g. supplied by glaciers are prone to wind erosion when dry and bare. In case of the occurrence of strong winds, sediments are blown out and dust plumes develop. As dust uplift is controlled by soil surface characteristics, the availability of suitable sediments, and atmospheric conditions, an interannual variability in dust source activity is expected.

We investigated atmospheric circulation patterns that favour the development of dust plumes over Iceland, which presents a well-known dust source at high latitudes. Using the ECMWF reanalyses data, we examine the atmospheric circulation patterns for dust days identified from synoptic observations by means of composite analyses. Based on pressure fields chosen for days on which dust was observed and preselected stations, the outcomes illustrate (1) the predominance of certain pressure distributions other fostering dust emission, i.e. the position of cyclones and anti-cyclones with regard to the dust source, but also with regard to each. And (2) argue for a holistic discussion on dust emission, wind direction transporting dust off the source region and towards the weather station, and pressure gradients resulting into winds sufficiently strong for dust mobilization. Overall, outcomes from this study contribute to efforts explaining the interannual variability in dust source activity in Iceland.