Arctic Observing Summit 2024 – Poster Abstract

Location, timing and trajectory of dust emissions from ice-free Greenland (2016-2021)

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Modern dust originating from ice-free regions within the Arctic plays an important role in the transfer of nutrients across terrestrial, marine and cryospheric systems. It makes an important contribution to the development of Arctic soils and can be lofted into the atmosphere to act as ice-nucleating particles in the formation of mixed phase clouds. However, beyond Iceland, the source locations from which this dust is emitted remain poorly mapped at the regional scale and the nature and impact of temporal patterns of dust emissions are not well understood. Using true colour Sentinel-2AB (10 m spatial resolution) satellite imagery we mapped dust emissions from ice-free Greenland from 2016-2021 using conservative cloud and scene coverage settings. Of the c.1000 potential sources examined, active dust emission was observed from over 80 locations with the frequency of dust events from these locations ranging from 1 to 24 over the six years.

In order to understand and model the present and future distribution and dynamics of regional-scale Greenland dust emissions, we developed a land-surface classification of the active dust sources identified. The classification includes 3 types of delta, 4 non-deltaic glacio-lacustrine landforms and other forms such as alluvial fans, moraines and sand dunes. Fjordhead and lake deltas and topographically restricted outwash plains are the most frequent dust source types and were associated with the highest number of dust events. The overall spatial distribution of dust sources maps closely to the distribution of land-terminating glaciers on Greenland and to glaciers that discharge high concentrations of suspended sediment. Given that suspended sediment delivery to proglacial floodplains and deltas is increasing and many Greenland deltas are prograding it is expected that the extent of, and fine sediment supply to, potential dust sources will increase over the next few decades.