EGU21-11854
https://doi.org/10.5194/egusphere-egu21-11854
EGU General Assembly 2021

High Latitude Dust: contemporary emissions and geomorphic interactions

Joanna Bullard
Loughborough University, Geography, Leicestershire, United Kingdom of Great Britain – England, Scotland, Wales (j.e.bullard@lboro.ac.uk)

The world's largest contemporary dust sources are in low-lying, hot, arid regions, however the processes of dust production and emission also operate in cold climate regions at high latitudes and altitudes. This lecture focuses on contemporary dust emissions originating from the high latitudes (≥50°N and ≥40°S) and explores three themes before setting out an integrated agenda for future research. The first theme considers how much dust originates from the high latitudes and methods for determining this. Estimates from field studies, remote sensing and modelling all suggest around 5% of contemporary global dust emissions originate in the high latitudes, a similar proportion to that from the USA (excluding Alaska) or Australia. This estimate is a proportion of a highly uncertain figure as quantification of dust emissions from Eurasian high latitudes is limited, and the contribution of local and regional emissions (from any latitude) to the global total is thought to be considerably under-estimated. Emissions are particularly likely to be under-estimated where dust sources are topographically constrained, and where cold climates reduce vertical mixing of dust plumes restricting the altitudes to which the dust can rise, because both these characteristics present particular challenges for modelling and remote sensing approaches. The second theme considers the drivers of contemporary high latitude dust emissions that reflect complex interactions among sediment supply, sediment availability and transport capacity across different geomorphic sub-systems. These interactions determine the magnitude, frequency and timing of dust emissions at a range of time scales (diurnal, seasonal, decadal) but both the drivers and response can be nonlinear and hard to predict. The third and final theme explores the importance of high latitude dust cycling for facilitating cross-boundary material fluxes and its impact in the atmosphere, cryosphere, and terrestrial and marine ecosystems. This is influenced not only by the quantity and timing of dust emissions but also by dust properties such as particle-size and geochemistry. Landscape sensitivity, spatial environmental transitions and temporal environmental change are highlighted for their importance in determining how the interactions among drivers and cycles are likely to change in response to future environmental change.