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Variation and Distribution of Sediments in a Mixed Glacifluvial-Aeolian System in West Greenland

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There is a clear association between the distribution of wind-blown sediments and the former extent of ice sheets and glaciers. Glacial erosion processes produce significant quantities of fine sediments that are washed out from beneath glaciers by meltwater. Once deposited and desiccated, aeolian processes may transport them across the landscape resulting in the formation of sand dunes and loess, and adding dust to the atmosphere. This research reports the use of digital imaging and laser sizing to obtain the grain size distribution and textural attributes of sand and dust in Sandflugtdalen, a valley adjacent to the West Greenland ice sheet. An initial assessment of the rates of sand and dust transport, made using semi-isokinetic directional sediment samplers, indicate that the flux of aeolian sediment comprises clays, silts and sand-sized particles. Digital imaging of the surficial sediment deposits provides a rapid means of sampling the large, spatially and temporally variable, proglacial valley. Sediments were initially photographed during June 2007 and then resampled after a 9-week interval. The grain size distribution and surface texture were computed using a calibrated autocorrelation method. It is estimated that individual particles may be resolved down to a size of 0.045 mm.

The regions of aeolian entrainment, transport and deposition are directly linked to the development and distribution of sediments on the proglacial floodplain, which varies considerably in terms of surface roughness. On the floodplain close to the ice sheet, aeolian flux is controlled by sediment supply and lag formation and the total surface roughness is determined by the combination of grain-scale roughness and topography. Further down valley, recycling of sediments by aeolian and fluvial activity is significant and wind speed becomes an important controlling factor. Within the dunefields, surface roughness is principally determined by topography and vegetation. Close to the ice sheet, significant aeolian sediment fluxes occur during the summer, whenever freshly deposited and desiccated sediments are available. However, within the dunefields, the maximum flux occurs in early summer prior to the development of the annual vegetation cover.