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Contemporary proglacial aeolian sediment transport in West Greenland

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Glacial erosion processes produce significance quantities of fine sediments that are washed out from beneath glaciers by meltwater. When deposited on the glacier floodplain they dessicate and strong ice-driven winds can entrain and transport them across the landscape resulting in the formation of sand dunes and loess, and adding very fine particles (dust) to the atmosphere. Recent studies suggest that locally-generated dust can play an important role in regulating albedo and the melting rate of glaciers. Very few field process studies have examined the relationship between sediment-delivery to the proglacial floodplain by meltwater and the subsequent aeolian erosion and deposition of these fine sediments. This research reports the use of semi-isokinetic directional sediment samplers to make an initial assessment of the rates of transport of dust and sand in Sandflugtdalen, a valley adjacent to the West Greenland ice sheet. Vertical arrays (z(m) = 0.18, 0.43, 0.85, 1.4) of samplers were deployed in a down valley transect over a distance of 4 km. Trapped sediments were retrieved after intervals of 1 week and 9 weeks. The mass of sediment collected in the traps varied from 0.002-3.62 g cm^2 wk^{-1}. As expected, near surface traps collected more, and coarser, sediment than those deployed at 1.4 m height but the decrease in mass of sediment with height was highly variable. The array closest to the glacier trapped the greatest quantity of suspended sediment and the density of suspended sediment decreased with distance down valley.

The flux of aeolian sediment comprises clays, silts and sand-sized particles. Areas of aeolian entrainment, transport and deposition are closely linked to the development and distribution of sediments on the proglacial floodplain which varies considerably in terms of surface roughness. At the east end of the valley, close to the ice sheet, aeolian sediment flux is controlled by sediment supply and topography rather than wind speed. Further down valley, recycling of sediments by fluvial and aeolian activity is important and wind speed is an important controlling factor. Within the dunefields in the valley, surface roughness is determined by topography and also by vegetation. Maximum aeolian sediment transport is in early summer before the annual vegetation cover within the dunefield has fully developed.