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QUANTIFYING ASPECT CONTROL ON TRANSPORT EFFICIENCY AND MOBILE REGOLITH FLUX AT THE SUSQUEHANNA SHALE HILLS CRITICAL ZONE OBSERVATORY

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Feedbacks between climatic, hydrologic and biologic activity have potential to influence soil transport efficiency on hillslopes with varying aspect. However, few studies show a systematic influence of aspect on transport efficiency across a range of hillslope gradients in forested landscapes. Here, we present an analysis of 131 meteoric ^{10}Be measurements from regolith and bedrock to quantify rates of mobile regolith flux and test the utility of different transport rules within the Susquehanna Shale Hills Critical Zone Observatory (SSHO), in central Pennsylvania. Regolith samples were collected from north- and south-facing hillslopes in three *en echelon* watersheds in and adjacent to the SSHO. We observe a systematic asymmetry in hillslope gradients across these watersheds: north-facing hillslopes are steeper than south-facing hillslopes, spanning a range of ~10 – 25°. Hydrologic, geochemical and geophysical observations at SSHO reveal that mobile regolith on south-facing hillslopes is thin and subject to pronounced wetting and drying cycles, while thicker mobile regolith on north-facing hillslopes retains moisture. Meteoric ^{10}Be data show that along all six hillslopes, mobile regolith fluxes are similar and increase linearly with distance from ridgecrests. Along ridgelines at SSHO, where mobile regolith thickness is uniformly thin, flux is linearly proportional to local gradient. At lower hillslope positions, where mobile regolith thicknesses are greatest, regolith fluxes depend on the product of local gradient and mobile regolith thickness. This transition occurs on all six hillslopes at a mobile regolith thickness of approximately 50 cm. Our data imply that in order for mobile regolith flux on shallow, south-facing hillslopes to keep pace with fluxes on steep, north-facing hillslopes, transport efficiencies must be greater on south-facing hillslopes by nearly a factor of two. Our results provide systematic evidence that the critical zone responds to aspect-related microclimate differences by modulating transport efficiency, which is directly observable in regolith transport rates and hillslope gradients at SSHO.

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T18. Critical Zone Evolution: Climate and Exhumation
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