Poster #1-35

Soil Morphology and Organic Matter Distributions of Alaskan Arctic Foothills Toposequences

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Hillslope processes affect rates of transport, deposition, and decomposition, which impact the distribution of soil organic carbon (SOC) stocks in many regions. In the Arctic, hillslope processes and SOC stocks are further impacted by the added complexity of permafrost-affected solifluction and other lateral mass movements, cryoturbation, and patterned-ground formation. Despite increasing numbers of studies on permafrost-region SOC stocks, quantitative information across soil toposequences in the continuous permafrost zone remain limited. For instance, observations from hill-toe deposits comprise only about 2.5% of existing soil profiles for Alaska. A better understanding of soil morphology and SOC stocks across toposequences in hilly permafrost terrains is therefore critical for informing and improving future modeling efforts. In this study, two toposequences in the Arctic Foothills, north of the Brooks Range of Alaska were investigated. The soils of both toposequences were formed on loess over glacial till parent material and support moist acidic tundra vegetation. Seven locations along the toposequence (encompassing summit/shoulder, backslope/footslope, and toeslope/basin positions) were sampled by opening soil pits, taking soil cores, or a combination of both to a depth of 2-3 m. Ice-wedge polygons were present at summit/shoulder and toeslope/basin positions. Ice-wedge polygons in the basins were clearly defined, with deep inundated troughs that receive discharge from snowmelt and storms, as well as lateral discharge from thawing of the active layer and the transient layer of upper permafrost. The locations of ice-wedges at the summit/shoulder positions were less clear, but marked by surficial soil cracks, with drier troughs unless hydrologically disturbed. The thickness of surficial organic horizons was greater in the toeslope/basin positions, and some ice-wedge polygons in basins contained deep peat deposits infused with ground ice. Volumetric ice content was variable across the toposequences, most likely due to the complexity associated with patterned ground formations, such as non-sorted circles, but it was generally higher in summit/shoulder and toeslope/basin positions. Soil samples collected across the toposequences are currently being analyzed for SOC and total nitrogen concentrations. This ongoing study suggests it might be possible to uncover common patterns of soil morphology, ice contents, and organic matter distributions for arctic hillslopes but clearly underscores the need for more research on these landscapes.