Poster #1-33

Degradation State of Soil Organic Matter in Arctic Coastal Plain Ice-Wedge Polygons

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Estimates of the amount of soil organic matter (SOM) stored in permafrost-region soils and its susceptibility to mineralization or mobilization with changing climate or physical disturbance are improving but remain highly uncertain. In lowland permafrost soils, much of the SOM exists in a poorly degraded state and is often weakly associated with soil minerals due to the cold, wet environment and cryoturbation. Thus, the impacts of permafrost thaw likely will depend, at least initially, on the extent of SOM degradation before incorporation into permafrost. We are investigating particle size fractionation as an indicator of the relative degradation state of SOM in permafrost region soils. Soil samples with bulk soil organic carbon concentrations ranging from 0.8% to 47% (n = 150) and representative of soil horizons in flat-, low-, and high-centered ice-wedge polygons near Barrow, Alaska, were size-fractionated to isolate fibric (coarse; >250 μm) from more degraded (fine; 53−250 μm) particulate organic matter and to separate mineral-associated organic matter into silt- and clay-sized fractions. Data from these samples were used to develop calibration models that can predict the amount of carbon associated with each size fraction from the mid-infrared (MIR) spectra of unfractionated bulk soils. The MIR calibration models were then used to supplement measured data to estimate the size distribution of SOM throughout entire soil profiles (to a depth of 3 m) of the sampled ice-wedge polygons. We found that the relative degradation state of SOM varied spatially and vertically within polygons and differed among polygon types. Our findings suggest that accounting for polygon- related variations could improve estimates of the relative degradation state of SOM in areas dominated by ice-wedge polygons and provide valuable data on the potential decomposability of permafrost region SOM stocks for benchmarking local, regional, and earth system models.