Poster #3

Nitrate and Oxyanion Concentrations in Unsaturated High-Topography Polygonal Features: Implications for a More Fertile Arctic

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The extreme sensitivity of the Arctic system to changing climate conditions is amplifying global feedbacks at an alarming rate. Soil moisture content is a major determinant of nutrient-cycling rates in Arctic soils: with increasing drainage network efficiency and the continuing thawing and degradation of permafrost regions, nutrients are becoming more readily available. Nitrate (NO_3^-) is an essential nutrient within the Arctic and has the potential to increase rapidly with hydrologic evolution toward drying conditions. Here, under the auspices of the Next Generation Ecosystem Experiments: Arctic (NGEE) funded by the DOE, we use field geochemistry to characterize the current nitrate content of unsaturated geomorphic features in the polygonal tundra region of the Barrow Environmental Observatory (BEO), where our data suggests a strong correlation between high nitrate concentration and low soil moisture content. Coupling these geochemistry measurements with remote geospatial observations, we calculate the possible ranges of nitrate content within the BEO and assess the impact of possible future drying scenarios on nitrate production. The projected hydrologic evolution of permafrost regions may lead to a significant increase in nitrate production in future years, and assuming that the entirety of the ~1000 km^3 of polygonal terrain that comprises 53% of the Alaskan Arctic Coastal Plain would undergo the same drying evolution and nitrate production as the BEO, this region has the potential to increase nitrate production by several orders of magnitude. This impending nutrient flux directly impacts primary productivity and biogeochemical cycles within the Arctic and has severe implications for future biological communities.
Abstract LA-UR-17-21154 (LANL unclassified release number)