**Poster #25**

## Predicting Potential C Mineralization of Tundra Soils Using Spectroscopy Techniques

Roser Matamala[1], Julie Jastrow[1], Zhaosheng Fan[2], Chao Liang[3], Francisco Calderón[2], Gary Michaelson[4], Chien-Lu Ping[4], and Umakant Mishra[1]

[1] Argonne National Laboratory
[2] USDA Agricultural Research Service
[3] Chinese Academy of Science
[4] University of Alaska Fairbanks

Contact: Roser Matamala [matamala@anl.gov]

The large amounts of organic matter stored in permafrost-region soils are preserved in a relatively undecomposed state by the cold and wet environmental conditions limiting decomposer activity. With pending climate changes and the potential for warming of Arctic soils, there is a need to better understand the amount of the carbon stored in the soils of this region and its potential susceptibility to mineralization. Studies have suggested that soil C:N ratio or other indicators based on the molecular composition of soil organic matter could be good predictors of potential decomposability. In this study, we investigated the capability of diffuse reflectance Fourier-transform mid infrared (DRIFT) spectroscopy to predict the evolution of carbon dioxide ($CO_2$) produced by Arctic tundra soils during a 60-day laboratory incubations. Soils collected from four tundra sites on the Arctic Coastal Plain and Foothills of the North Slope of Alaska were separated into active-layer organic, active-layer mineral, and upper permafrost and incubated at 1, 4, 8 and 16°C. Carbon dioxide production was measured throughout the incubations. Total soil organic carbon (SOC) and total nitrogen (TN) concentrations, and the DRIFT spectra of the soils were measured. Multivariate partial least squares (PLS) modeling was used to predict cumulative $CO_2$ production, and the other measurements. DRIFT reliably estimated SOC, TN and the C:N of these soils. Predictive $CO_2$ production models were good across the different temperatures (1°C, R2 =0.77; 4°C, $R^2$=0.82; 8°C, $R^2$=0.82; 16°C, R2=0.80), for soil horizons (Organic, $R^2$=0.70; Mineral, $R^2$=0.79; Permafrost, R2= 0.77), and for soils with low C and N concentrations (SOC<10%, $R^2$=0.80; TN<2%, $R^2$=0.76). The number of PLS factors involved varied across different $CO_2$ production models from 7 to 19. Analysis of the standardized beta coefficients from the PLS models of $CO_2$ production indicated a small number (8) of influential spectral bands. These bands were associated with clay mineral contents, silicates, and phenolic OH, aliphatic, carboxylic acid, and polysaccharide compounds. These bands were further explored to determine their relative importance in explaining $CO_2$ production in soils and their indicator capabilities. Our results demonstrate that the DRIFT spectra contained information that can be used for predicting potential decomposability of tundra soils.