Characterization of the dissolved organic matter from arctic soils under climate change

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Expected thawing of the arctic permafrost will lead to the activation of soil biogeochemical cycles (C, N, trace elements). An increase of dissolved organic matter (OM) concentration in surface water can already be observed in North Europe and North America. To characterize the dissolved OM potentially produced by arctic ecosystems, soils from the Abisko region (Sweden) were sampled at 4 sites representative of peatland, heathland, forest and altitude meadow (from 360 to 1048m a.s.l.). Samples of the main vegetation species were also collected to characterize the soil OM sources. For all samples, organic C and N contents were measured through elemental analyzer. For each ecosystem, several soil samples were characterized through solid state ^{13}C nuclear magnetic resonance and the proportion of 4 chemical shift regions was assessed (alkyl, O-alkyl, aromatic and carbonyl C). Soil extraction with $CaCl_2$ (0.25 mM) is running to mimic the dissolved OM pool of Abisko soil solution. Dissolved C and N will be quantified and the extracted OM will be characterized.

A high intra-ecosystem variability of soil C and N contents (from 0.6 to 49.7% and 0.04 to 4.5%, respectively) is observed and the resulting C/N ratios ranged from 23.9 to 62.7. Soil OM quality presents a high heterogeneity considering the alkyl C/O-alkyl C and the aromatic C/O-alkyl C ratios. Based on the same indicators (C, N, alkyl C, O-alkyl C and aromatic C contributions) the different vegetation species also reflect a large range of OM qualities. The alkyl C/O-alkyl C and aromatic C/O-alkyl C ratios were especially low and C/N especially high for lichen species. The characteristics of soil OM seem to be related to the altitude of the site, whereas no relationship to the soil water content could be noticed. This may be associated to different mean annual temperature leading to different decomposition rate of the OM. But the various species proportion in different ecosystems may also be responsible of variable soil OM quality. The on-going work on dissolved OM should thus allow highlighting potential changes that might be induced by the thawing of soils of different ecosystems and by possible evolution in species proportion under climate change. The impact on the dynamics of dissolved OM will be assessed and the potential consequences for associated cycles considered.