Preliminary report for measurements of CO_2 concentration in soil layers throughout the year on Svalbard, high-Arctic Norway

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The Arctic terrestrial carbon balance is still unknown. Climate change might result in significant increase of CO_2 emissions to the atmosphere because of thawing of previously frozen soil organic matter. Soil respiration is a major flux in the carbon cycle. Although there are some reports that significant soil respiration occurred during winter season (Elberling, 2007; Björkman, et al. 2010), continuous measurements during winter is difficult in the Arctic because of harsh environmental condition. In order to estimate more accurate annual soil respiration to evaluate annual carbon balance, continuous soil respiration measurement throughout the year is required.

In order to estimate soil respiration throughout the year, we have installed Vaisala CO_2 sensors from 0 cm to 50 cm into the soil in the summer season of 2016 at deglaciated area in the forefront of the East Brøgger Glacier near Ny-Ålesund, Svalbard, Norway (79˚N). The study site can be characterized a semi-desert ecosystem (Uchida, et al., 2010) with dominant vascular plants and mosses at the study site such as Salix polaris, Sanionia uncinata and Hylocomium splendens. Based on year round eddy covariance measurements, a low but persistent CO_2 release occurs during winter and spring (snow-covered ground), over-layed by considerable CO_2 exchange events in both directions associated with high wind speed and changes of air masses and atmospheric air pressure (Lüers, J et al., 2014).

Electricity for the censors was supplied from AWIPEV enclosure about 70m distance from our study site. The CO_2 concentrations were recorded every hour by a data logger. We show preliminary results of the first winter and summer soil CO_2 concentration (July 2016 - July 2017). Soil CO_2 concentration tended to decrease from autumn to winter at most of depths in the soil. The CO_2 concentration fluctuated during the snow melting season in 2017. Those fluctuation patterns were different among soil depths. We will analyze the relationship between environmental factors and soil CO_2 concentrations. Furthermore, our analysis will include seasonal fluctuations of soil CO_2 concentration in each soil layer and the potential driving factors, such as thawing and freezing of soil and snow cover dynamics.

References

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