

Winter CO₂ Fluxes Measurements in Northern Environments using a Snowpack Gas Diffusion Method

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ABSTRACT

In arctic and boreal regions, the amount of carbon dioxide (CO₂) released from the soil outside of the growing season is highly uncertain. The insulating properties of snow allow the ground to maintain soil temperatures high enough to allow soil respiration, thus generating CO₂ emissions from the soil to the atmosphere despite the freezing air temperatures. Although winter soil respiration is weak, winter covers most of the year in northern environments. As a result, the winter soil respiration contribution to the annual carbon balance for these large environments cannot be neglected in order to determine whether these regions are net carbon sources or sinks. The harsh environmental conditions combined with the challenge to access the snow-covered ground surface without altering the snowpack present several technical difficulties for the measurement of winter soil respiration. Here we present preliminary results obtained in arctic and boreal environments using a snowpack gas diffusion method. This technique consists of extracting air samples within the snowpack with syringes in order to measure CO₂ concentration gradient to estimate CO₂ diffusion through the snowpack and, thus, the CO₂ fluxes. Snowpack stratigraphy and microstructure were also retrieved to quantify the impact of snow characteristics on winter CO₂ emission. The method makes it possible to estimate the CO₂ fluxes between the soil and the atmosphere without altering the snowpack. It is also an efficient technique to study the spatial variability of CO₂ fluxes. The presentation will show the spatial variability of winter CO₂ emission along snow characteristics across two boreal forest sites (Forêt Montmorency and Havipak Creek) and two tundra sites (Trail Valley Creek and Cambridge Bay).

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