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The contribution of litter derived carbon to winter respiration in an alpine tundra ecosystem

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Although soil respiration rates from snow-covered ecosystems are relatively low, they add up to a substantial fraction of the annual CO_2 efflux over the whole winter, which lasts for more than half of the year in the Alpine. It is still unclear, however, which carbon sources are respired preferentially in winter.

In a new experiment at the Stillberg tree line research site near Davos, Switzerland, we added ^{13}C-labelled litter (*Leucanthemopsis alpina* L.) to an alpine tundra ecosystem and measured its contribution to the CO_2 efflux at different soil temperatures over winter. The litter was placed either at the soil surface or at 5 cm depth, and soil temperature was decreased by manually reducing snow depth to half of of that of the control plots. Soil respiration was measured by means of a chamber system, and gas samples were analysed for their isotopic composition.

Preliminary results indicate that soil respiration in early winter was about half compared to that measured in late fall. Lower soil temperatures under a shallow snow cover further decreased respiration by 40%. Litter addition increased respiration rates by 10 to 30%. At the beginning of the winter season, a higher respiration rate was found for the plots where litter was applied at the surface than at 5 cm soil depth. This effect, however, decreased with the progression of the winter as later measurements have shown. The isotopic composition of the respired CO_2 suggests that carbon from the additional litter contributed about 5 to 15% to the total CO_2 efflux, and that this fraction was higher in plots with lower soil temperatures.

Our results show considerable and non negligible amounts of C-loss in winter. By exploring the effect of the snow cover and soil temperatures on the decomposition of fresh plant litter, this experiment will give a more detailed insight into the environmental controls of soil respiration processes and the sources of respiratory CO_2 release in Alpine ecosystems.