



Observing carbon labelling kinetics in a temperate grassland ecosystem

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To study carbon fluxes in grassland ecosystems, a ^{13}C labelling technique with open-top-chambers was established for field use and applied on a temperate grassland. The open-top-chambers were optimised with respect to homogeneous CO_2 distribution, exclusion of wind incursion and prevention of biases in soil CO_2 efflux due to pressure effects. This includes dispersion of air entering the chamber and installing a buffer volume at the top exit, as well as varying the opening diameter at the top and the air flow through the chamber.

During a tracer experiment in September 2006, labelling was accomplished by flushing the chambers during daytime with air containing CO_2 at ambient concentration but enriched or depleted in ^{13}C relative to natural conditions. $\delta^{13}\text{C}$ in the chambers was (-43.8 ± 0.3) per mil and (-1.9 ± 0.2) per mil, respectively, providing constant labelling conditions.

The tracer was observed in respired CO_2 during nighttime by measuring CO_2 concentration and isotopic composition online in the field. The observed net discrimination during tracer uptake in assimilation and subsequent release in respiration of (20.4 ± 0.2) per mil compares well with natural conditions (19.8 per mil). After two weeks of labelling, 74% of total respired CO_2 were labelled, indicating only small contributions of non-labelled sources like decomposition of soil organic matter to total ecosystem respiration.