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Combining an automated closed chamber system with a quantum cascade laser for high-frequency measurements of δ^{13}C of ecosystem CO_2 fluxes

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Advances in laser spectroscopy have allowed for online high-frequency measurements of the isotopic composition of C and O in CO_2, thereby providing new ways to investigate CO_2 flux partitioning and carbon cycling in natural ecosystems. In this study, we combined an Aerodyne quantum cascade laser for CO_2 isotopes with the LI-COR LI-8100A/8150 automatic closed chamber system to yield the δ^{13}C of CO_2 during automated closed chamber measurements. The system was used during a two month campaign in a Danish beech forest, where δ^{13}C was measured for a total of 12 chambers, each enclosing either intact soil, trenched soil, tree stem or a tree root. By applying the Keeling plot methodology to the change in δ^{13}C of CO_2 during a chamber measurement, the isotopic composition of the respired CO_2 was determined. The poster presents δ^{13}C data of ecosystem CO_2 fluxes on both a daily and diel scale for soil, roots and tree stems that revealed interesting information about forest ecosystem carbon cycling. Furthermore, it explores the unique setup and the tests required for precise automated chamber-based measurements of $\delta^{13}C$ by a quantum cascade laser.

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