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Natural abundance and ^{13}C-enriched characterisation of atmospheric methane uptake in a forest soil

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Whilst much attention is focused on CH_4 emission inventories, CH_4 sinks are sometimes overlooked and not accurately accounted for in national budgets. Two primary reasons for this disjunction include uncertainties about the magnitude and mechanism of terrestrial CH_4 oxidation, and an under-appreciation of the quantity of CH_4 that is removed from the atmosphere by microorganisms. These uncertainties in part are caused by a lack of high-resolution field data that quantify microbial soil CH_4 sink. To fully characterize the soil CH_4 sink, isotopic fractionation of CH_4during uptake and the fate of CH_4 carbon following oxidation by soil microorganisms should be quantified in addition to CH_4 fluxes.

Here we report on field tests studying CH_4 uptake in soil using a Picarro G2201-i cavity ringdown spectrometer (CRDS). Short term atmospheric CH_4 uptake was continuously measured in a forest soil in Leigh Woods, UK where the soil methanotrophic community and soil CH_4 uptake kinetic isotopic effect (KIE) had been previously quantified using stable isotope probing and conventional stable isotope analysis techniques (Maxfield *et al*., 2008). Two methodological approaches were tested: (i) direct measurement of the soil CH_4 uptake KIE at subambient CH_4 concentrations, and (ii) methanotrophic carbon conversion efficiency (CCE) where CCE was evaluated through monitoring the direct conversion of ^{13}C-labelled CH_4 to ^{13}C-labelled CO_2. The suitability of the G2201-i analyzer as a continuous isotopic CH_4 and CO_2 analyzer for use at both subambient CH_4 concentrations and high ^{13}C-enrichments will be discussed.

Maxfield, P.J., Evershed, R.P. and Hornibrook, E.R.C. (2008) Physical and biological controls on the in situ kinetic isotope effect associated with oxidation of atmospheric CH_4 in mineral soils. Environmental Science & Technology, 42, 7824-7830.