Contribution of vegetation to methane emission produced in the soil of an upland forest: a $^{13}CH_4$-labelling approach

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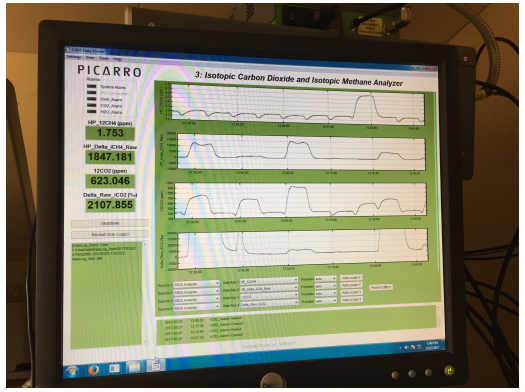

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State of the art

In upland forests:

- Soil is the main methane sink
- But vegetation can either increased or decreased this CH_4 uptake.

Origin of CH_4 emitted by vegetation:

- can be produced locally (in tree stem)
- and/or transported from deep anoxic soil layers where CH_4 is produced to the atmosphere through plant stems.

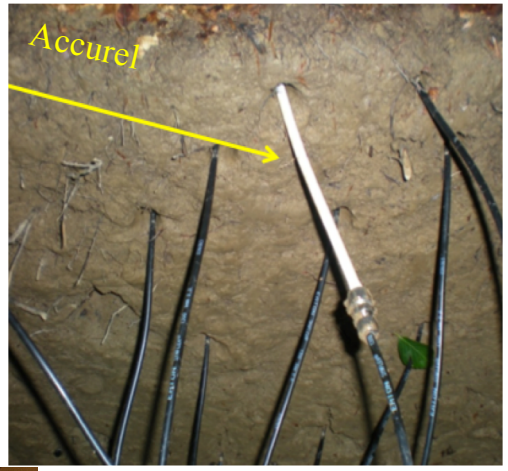
Objectives

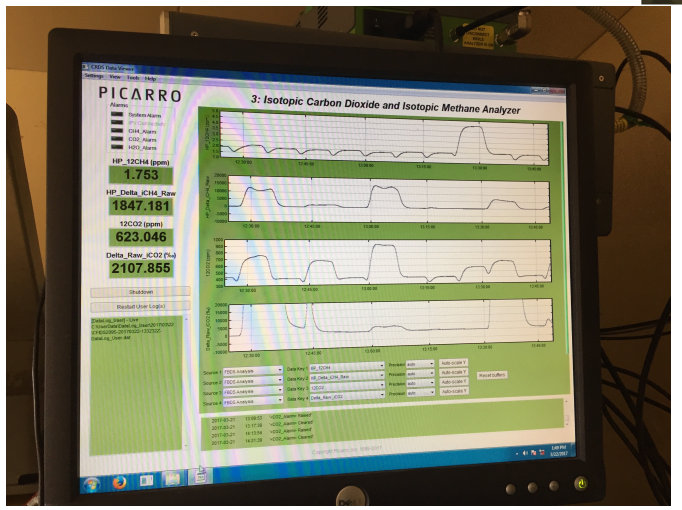
Are the understorey vegetation and tree stems preferential ways of methane emission from the methane produced in the soil in our site?

Method

A $^{13}CH_4$ pulse-labelling at 40 cm depth in the soil

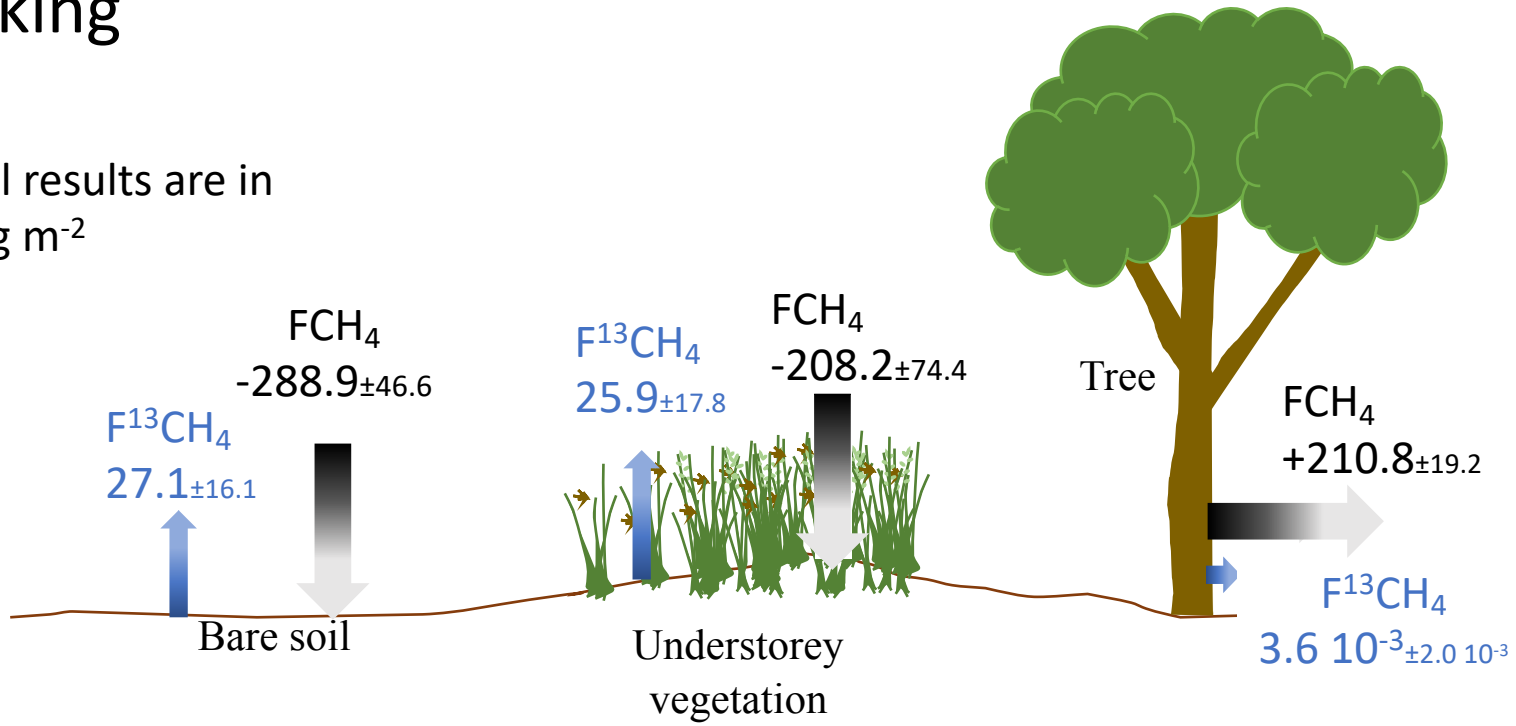
- **Tracking of labelled CH_4** (during 42h after the introduction of $^{13}CH_4$)
  - **Where ?**
    - Soil profiles (-0, -5 cm and -25 cm depth)
    - 2 soil chambers without vegetation
    - 2 soil chambers with understorey vegetation
    - 2 tree stem chambers
  - **How ?**
    - With a spectrophotometer (G2201-i Picarro)
    - measurement of each chambers every 128 min
    - Purge during 5.30 min and measurements during 1.30 min





Net methane effluxes and labelled methane emitted by bare soil, soil with understorey vegetation and tree stems during the 42 hours of labelled methane tracking

All results are in µg m^{-2}



Trees a net methane source

Labelled methane was emitted by tree stem -> **trees can emit methane produced in the soil**

- ✓ But only 0.1% of $^{13}CH_4$ injected was emitted by tree stems
- ✓ representing only 0.01% of CH_4 emitted by tree stems during the same period.

Soil with or without vegetation was a net methane sink

- **70 %** of **$^{13}CH_4$** injected has been **oxidised** in the **first 25-cm of soil**
- Only **1 % of $^{13}CH_4$** injected had been **emitted** by bare **soil** and soil with understorey vegetation.

$^{13}CH_4$ retrieve in soil chamber with or without vegetation is similar

-> **limited impact** of understorey vegetation with aerenchym on **$^{13}CH_4$ emission**

What is the main origin of methane emitted by tree stems ? Methane produced in deeper horizons? Methane produced in tree stems?

Highlights

- Labelling experiment = good tool to trace the methane emission from deep soil layers to the atmosphere by different paths.
- $^{13}CH_4$ emitted by all paths even if the forest was a net methane sink during the label tracking period.
- Only a small amount of the injected $^{13}CH_4$ was recovered, highlighting high rate of oxidation in soil.
- In our study, tree stems and the understorey vegetation have a limited contribution to the $^{13}CH_4$ emission