The use of FTIR-spectrometry for flux measurements

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JRA1: WP13.2
Combine the FTIR-analyzer with micrometeorological techniques for multi-species biosphere-atmosphere exchange flux measurements

InGOS Annual Meeting
21-24 September 2015

University of Bremen

Outline

1) FTIR-analyzer with different flux measurement techniques

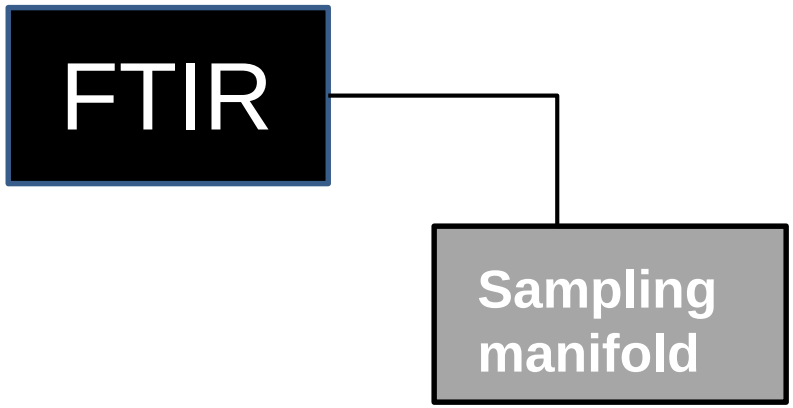
- Set up field experiment
- Different field experiments
- Practical considerations

2) Process based studies

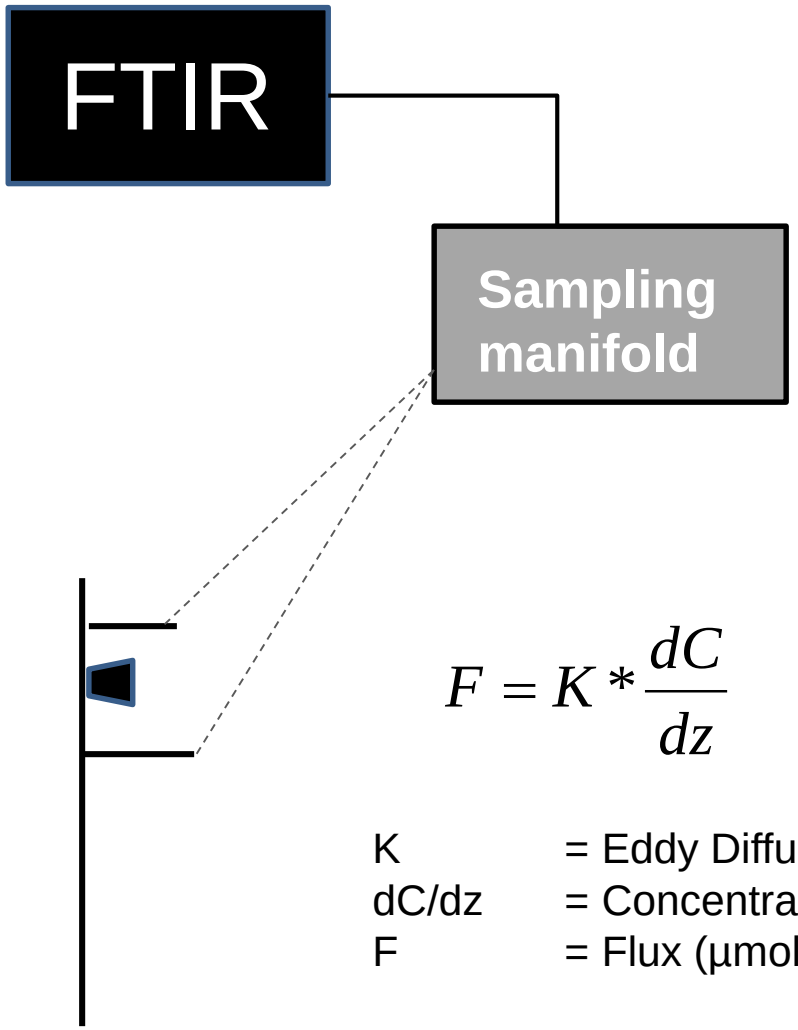
- Photo and thermal degradation
- Respiratory isotopic measurements
- Ratio-nocturnal boundary layer
- ^{15}N labeling experiment

3) Outlook

Set up field experiment



Set up field experiment



FTIR:

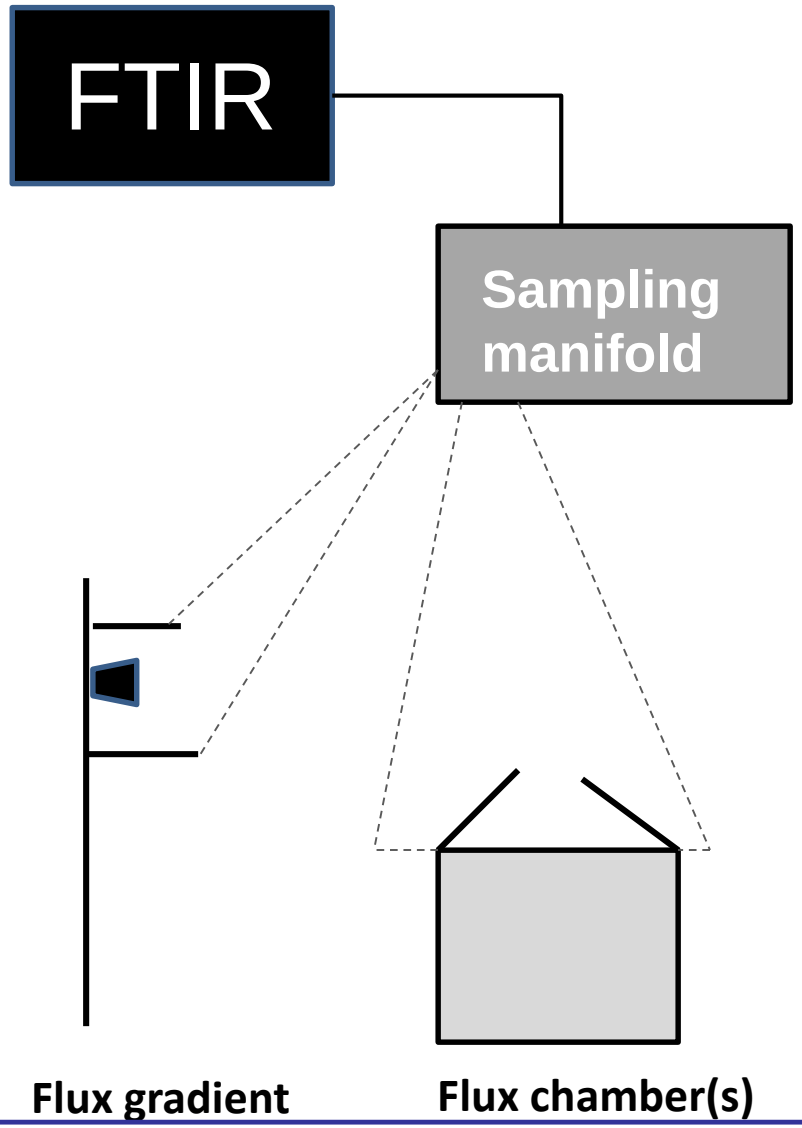
- Flux gradient system
  - Use of sampling bags
  - Sonic anenometer
  - Preferably EC-measurements

$$F = K * \frac{dC}{dz}$$

K = Eddy Diffusivity factor
dC/dz = Concentration gradient
F = Flux (µmol m^{-2} s^{-1})

Flux gradient

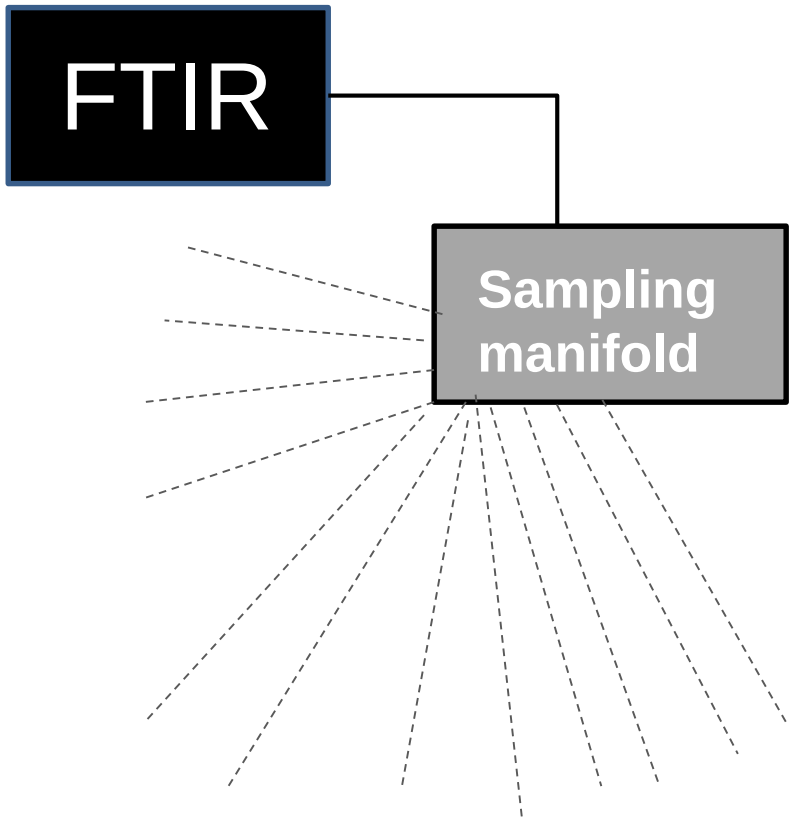
Set up field experiment



FTIR:

- Flux gradient system
- Flux chamber(s)

Set up field experiment



FTIR:

- Flux gradient system
- Flux chamber(s)
- Concentration measurements

Flux gradient

Experiments

- **1st field experiment**: Peat land, Germany , August, November 2012

Experiments

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- **2nd field experiment**: Harvested willow field, Denmark, April 2013
  - N_2O flux chamber intercomparison campaign, organized by RISO

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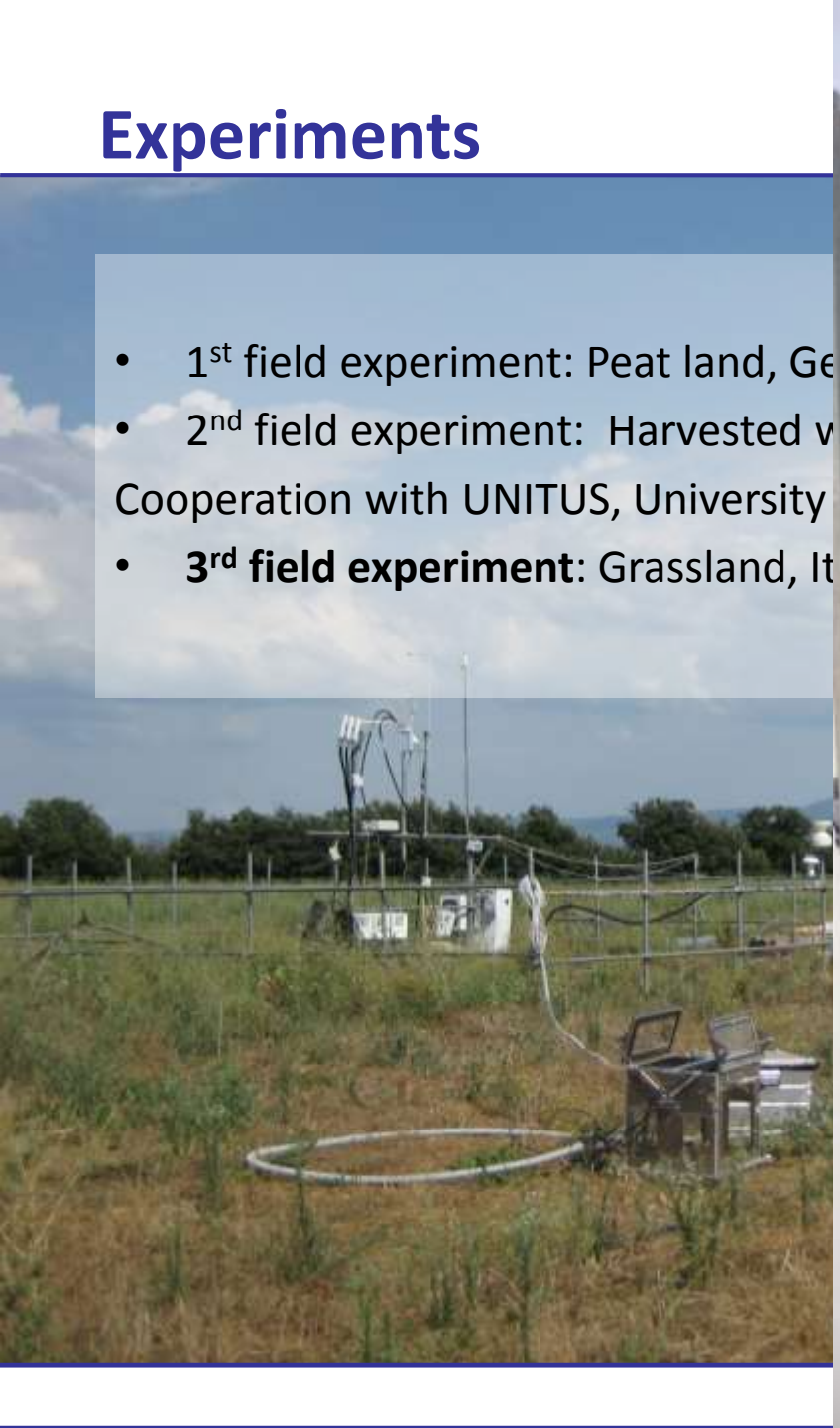
- 1st field experiment: Peat land, Ge
- 2nd field experiment: Harvested w

Cooperation with UNITUS, University

- **3rd field experiment**: Grassland, It



Experiments

- 1st field experiment: Peat land, Germany : August, November 2012
- 2nd field experiment: Harvested willow field, Denmark, April 2013

Cooperation with UNITUS, University of Tuscia, Viterbo, Italy

- 3rd field experiment: Grassland, Italy , August 2013
- **4th field experiment**: Poplar plantation, Italy, October 2013

Talk Giacomo Nicolini : Experimental assessment of storage variability for different GHG`s, Tuesday 20 September, 15.15

Practical considerations

The use of FTIR-spectrometry for flux measurements:

- Flux gradient system
  - Type of sampling lines (Tefflon/stainless steel)
    - CO production in/by Tefflon lines
    - Constant flow or stainless steel
  - Type of pumps

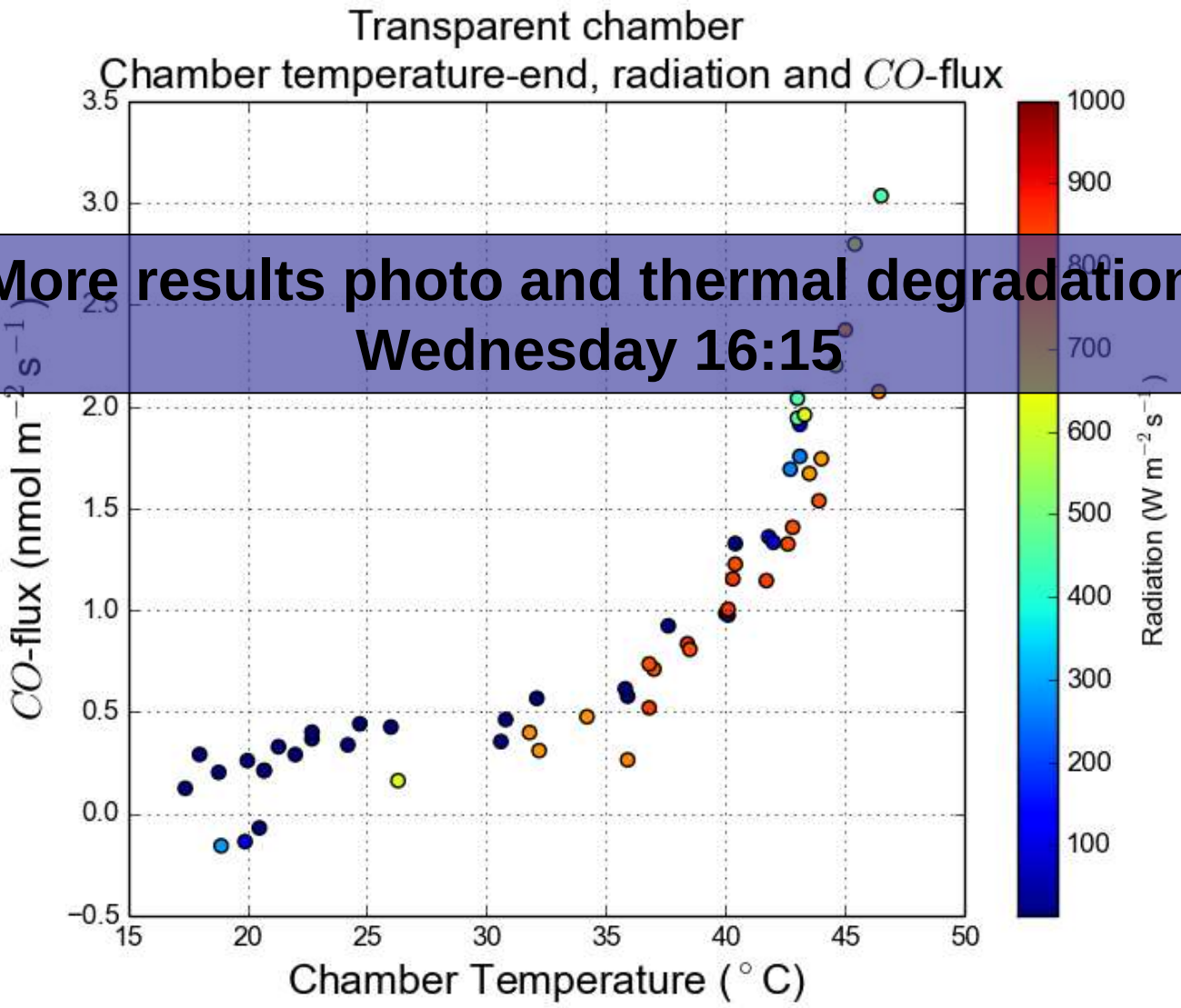
- Flux chamber
  - Transparent/non transparent
  - Temperature measurement in chamber

Photo and thermal degradation

- Photodegradation: *the direct breakdown of organic matter by sunlight produces* CO_2, CH_4, CO

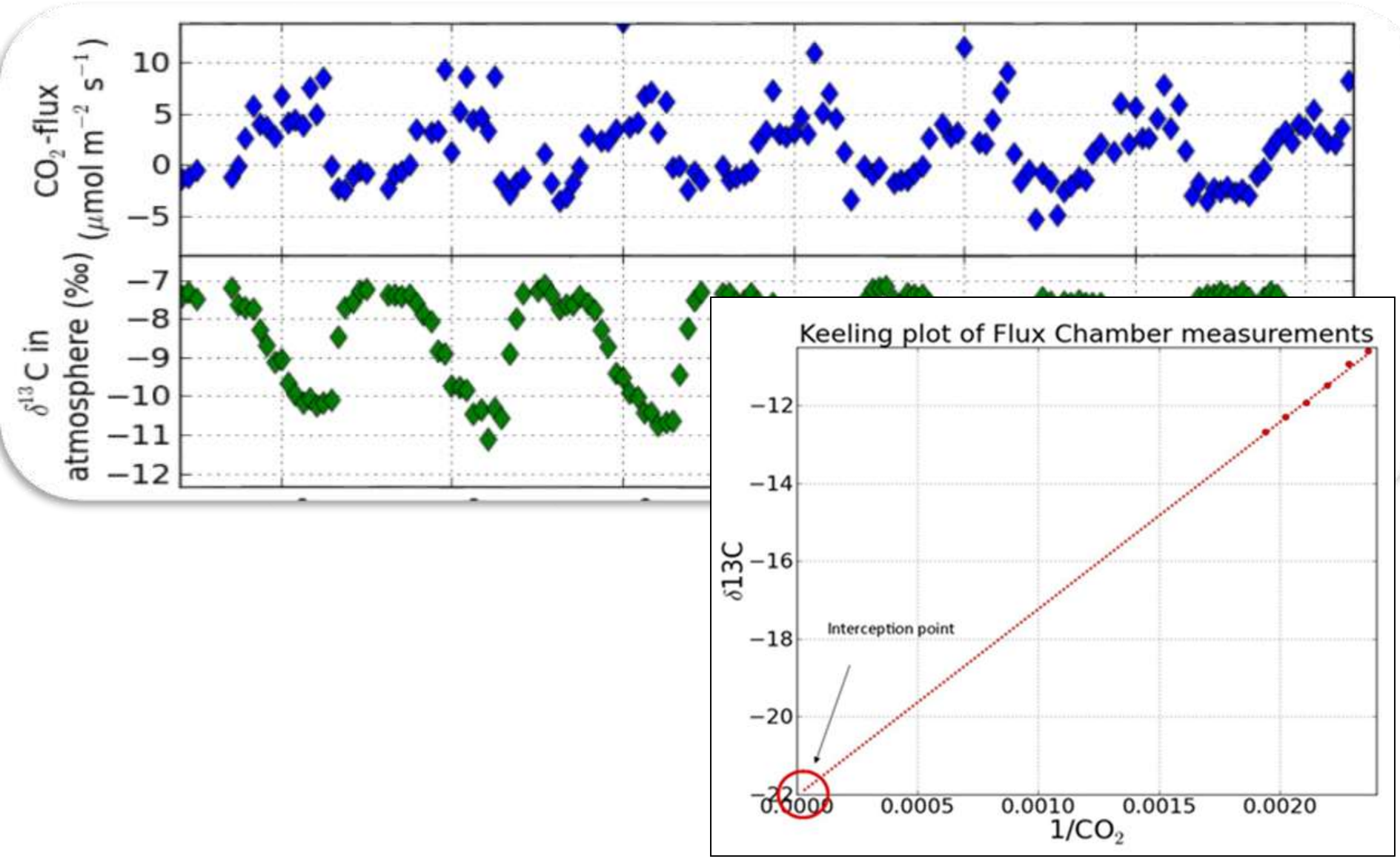
- Important in arid regions

Photo and thermal degradation

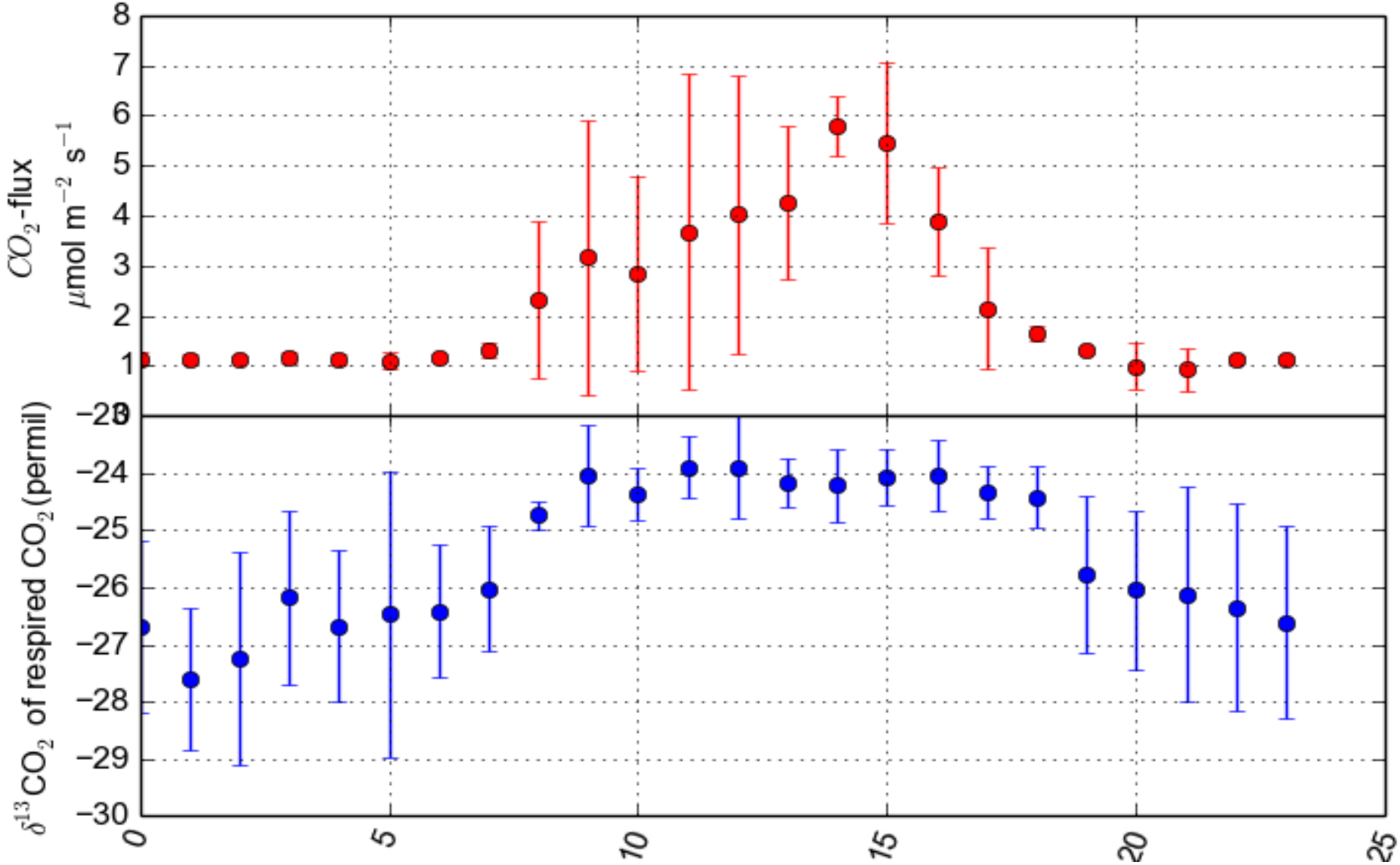


More results photo and thermal degradation: Wednesday 16:15

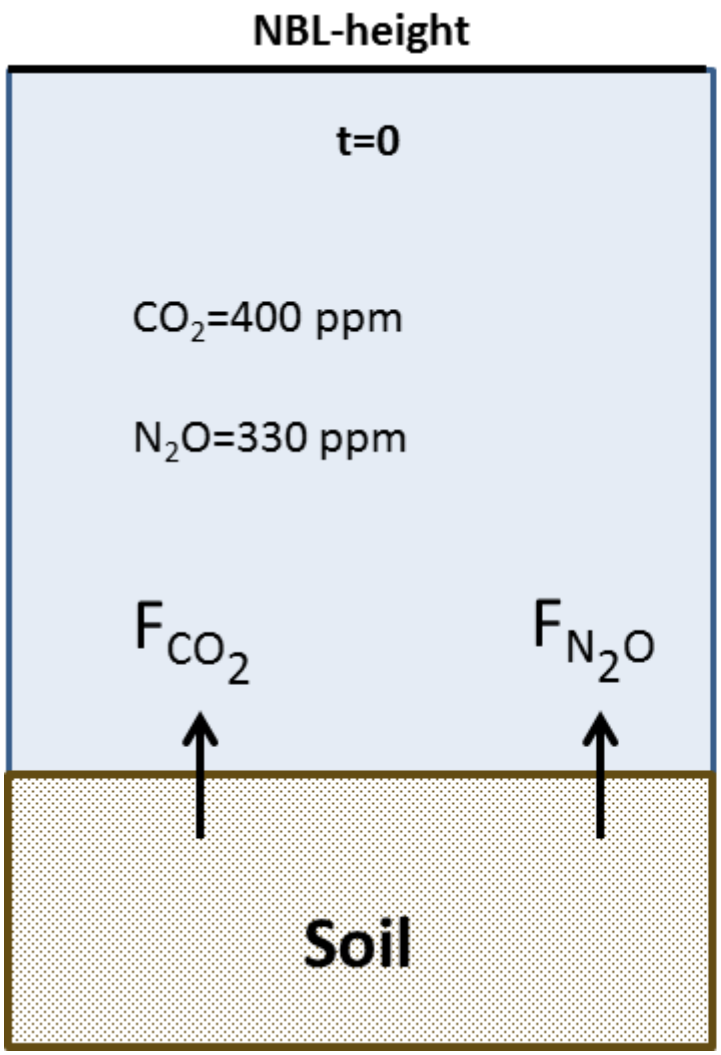
Respiratory isotopic measurements



Respiratory isotopic measurements

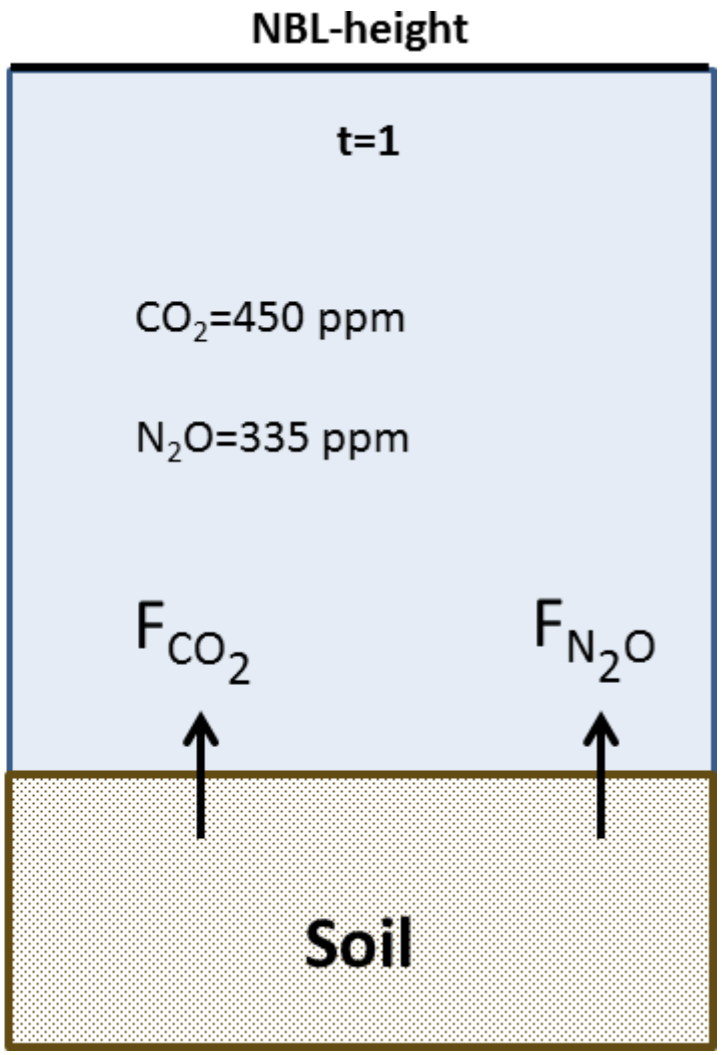


Ratio-nocturnal boundary layer



$$\Delta CO_2 = \frac{F_{CO2} * \Delta t}{z}$$

$$\Delta N_2O = \frac{F_{N2O} * \Delta t}{z}$$



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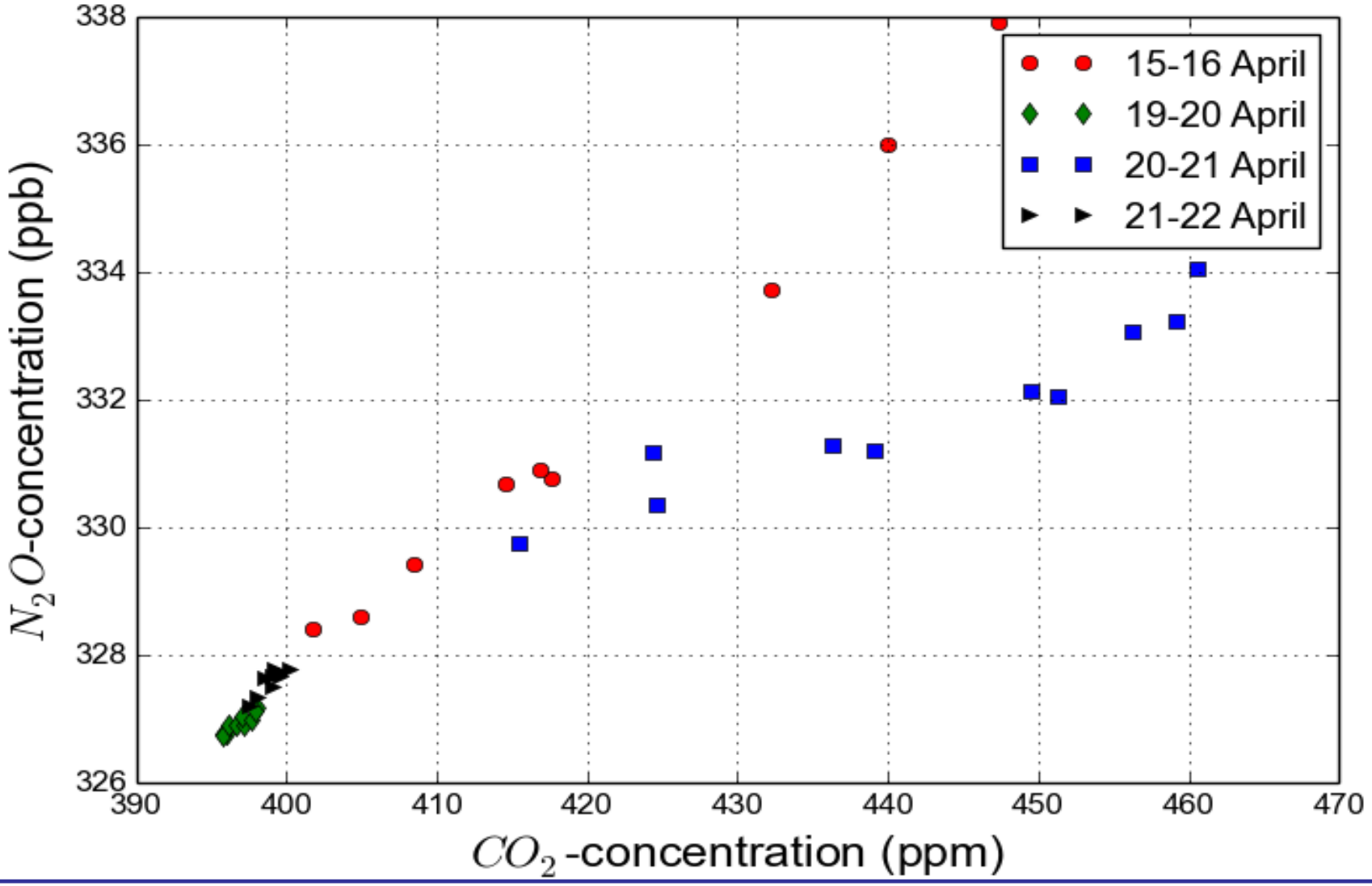

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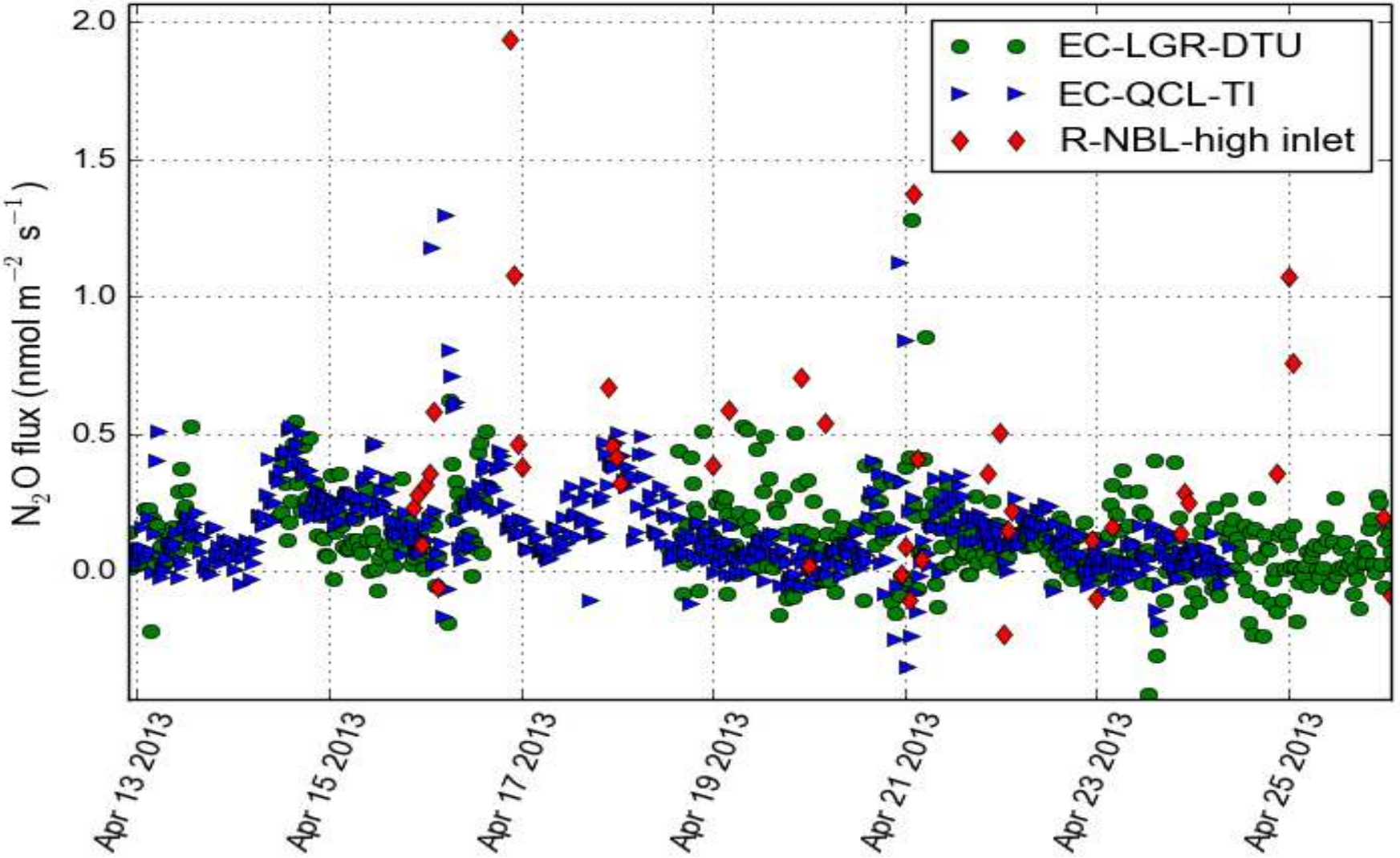
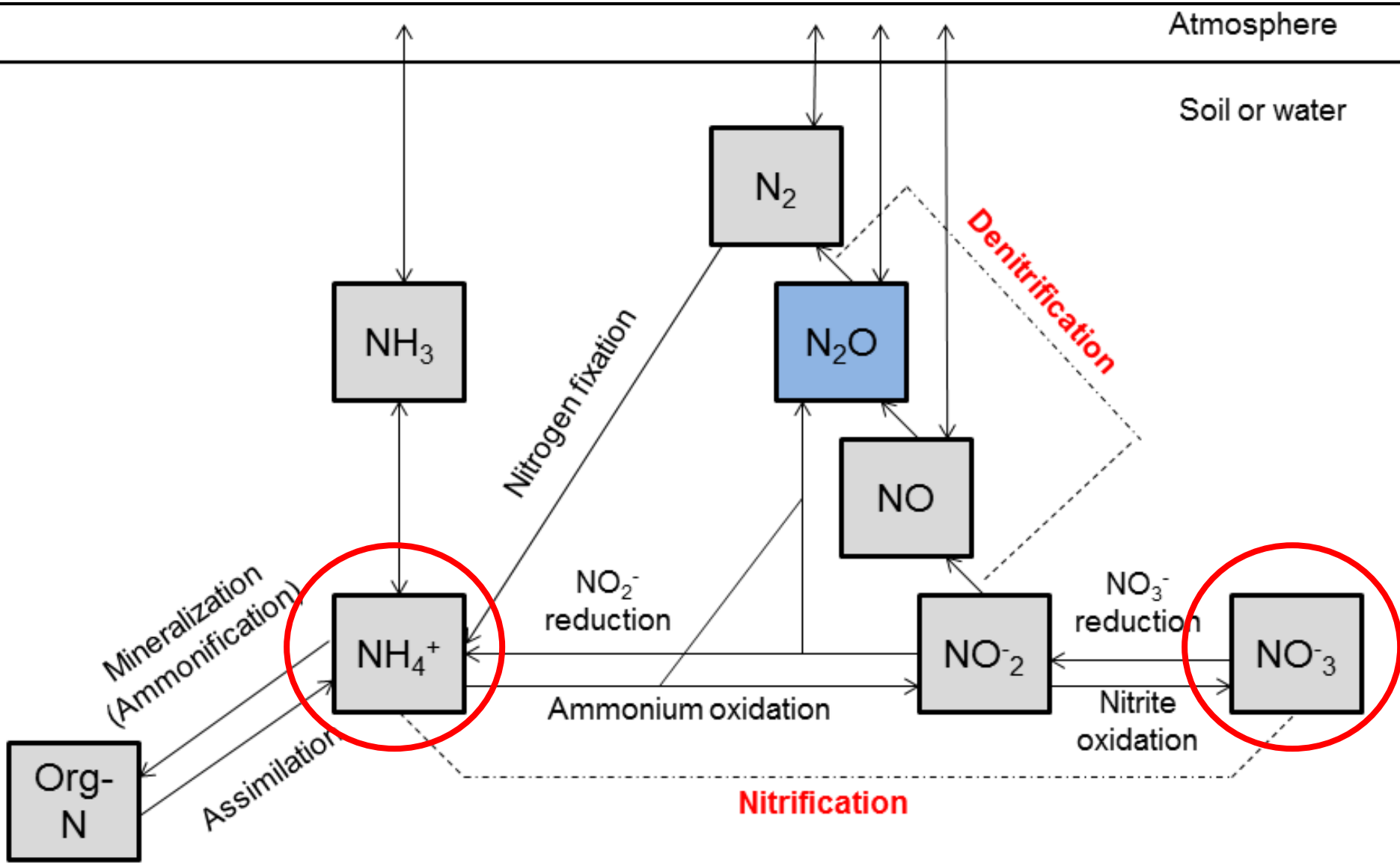


15N labelling technique



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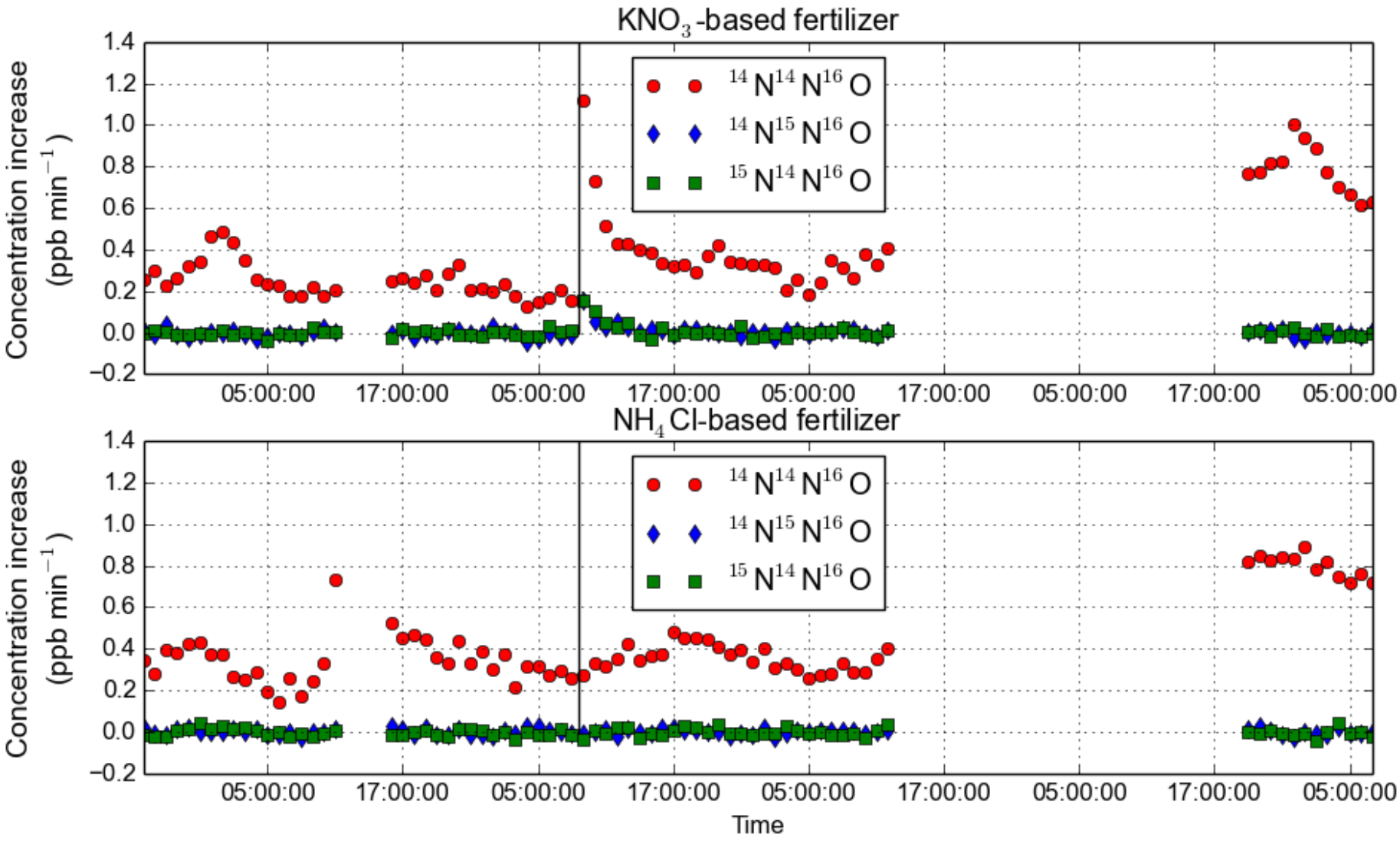
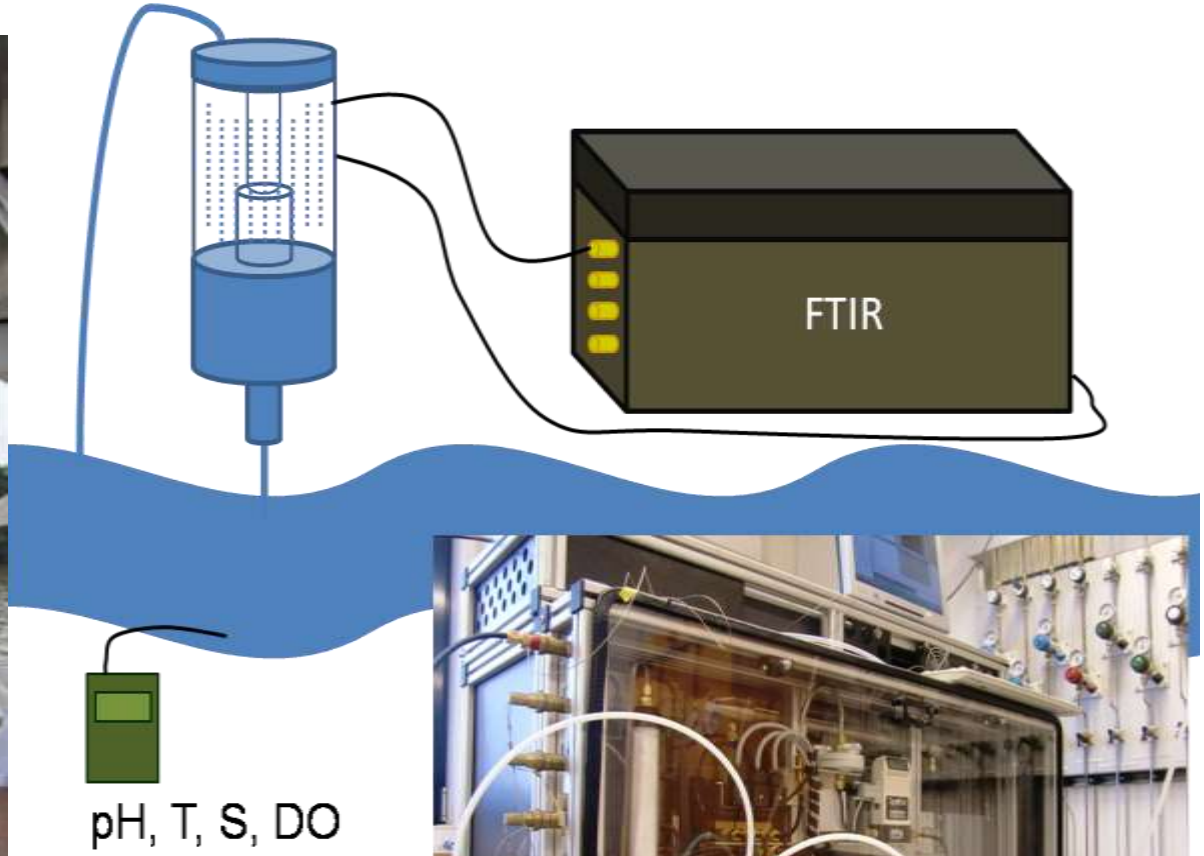


GHG (fluxes) in water



Outlook