Diurnal cycles of CO_2, CH_4 and N_2O fluxes from three Swiss grasslands

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grassland sciences

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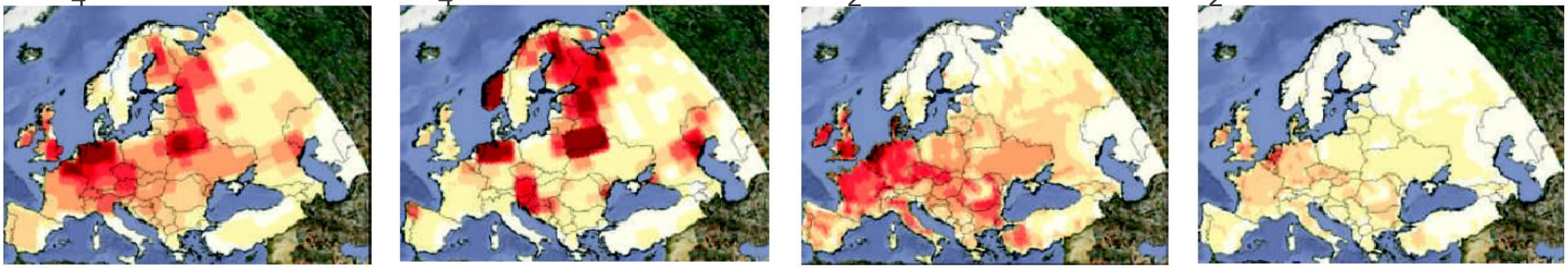
GHG EUROPE

Why study exchange of three greenhouse gases simultaneously?

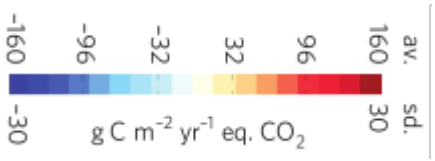
- Besides **CO_2**, **CH_4** and **N_2O** are commonly exchanged greenhouse gases (GHG) on **managed ecosystems**

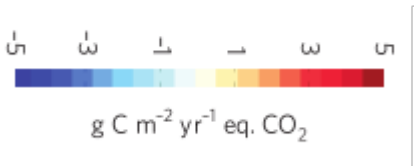
- High **global warming potentials** (GWP) on 100 a horizon of **CH_4** (23) and **N_2O** (298)
  - Impact in **integrated GHG balance**?

CH_4 efflux modeled | CH_4 efflux uncertainties | N_2O efflux modeled | N_2O efflux uncertainties



Schulze *et al.* 2009





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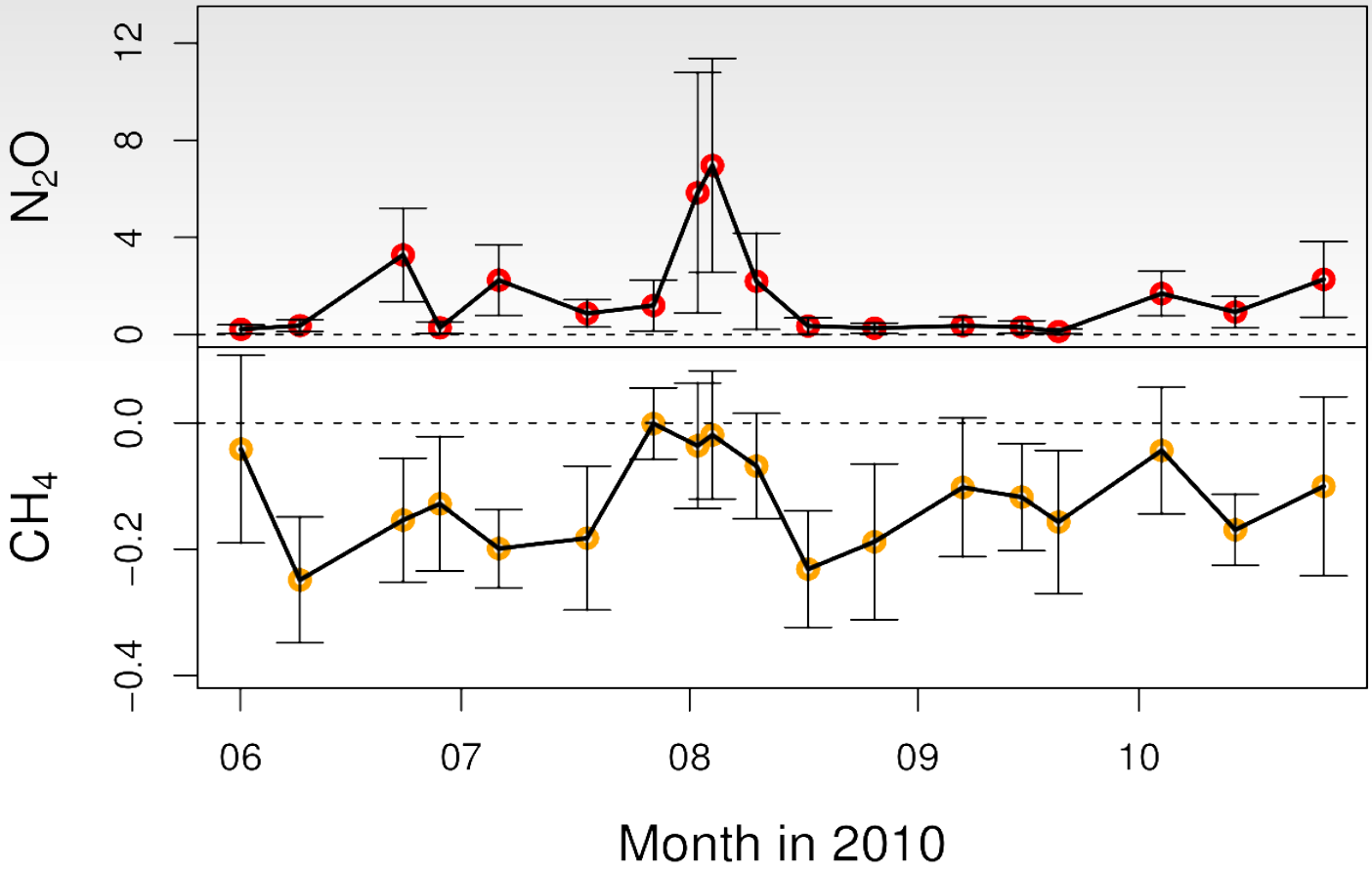
Why study diurnal cycles?

- Integrated **global warming potential**
- Short-term **variations**
- Environmental **drivers**



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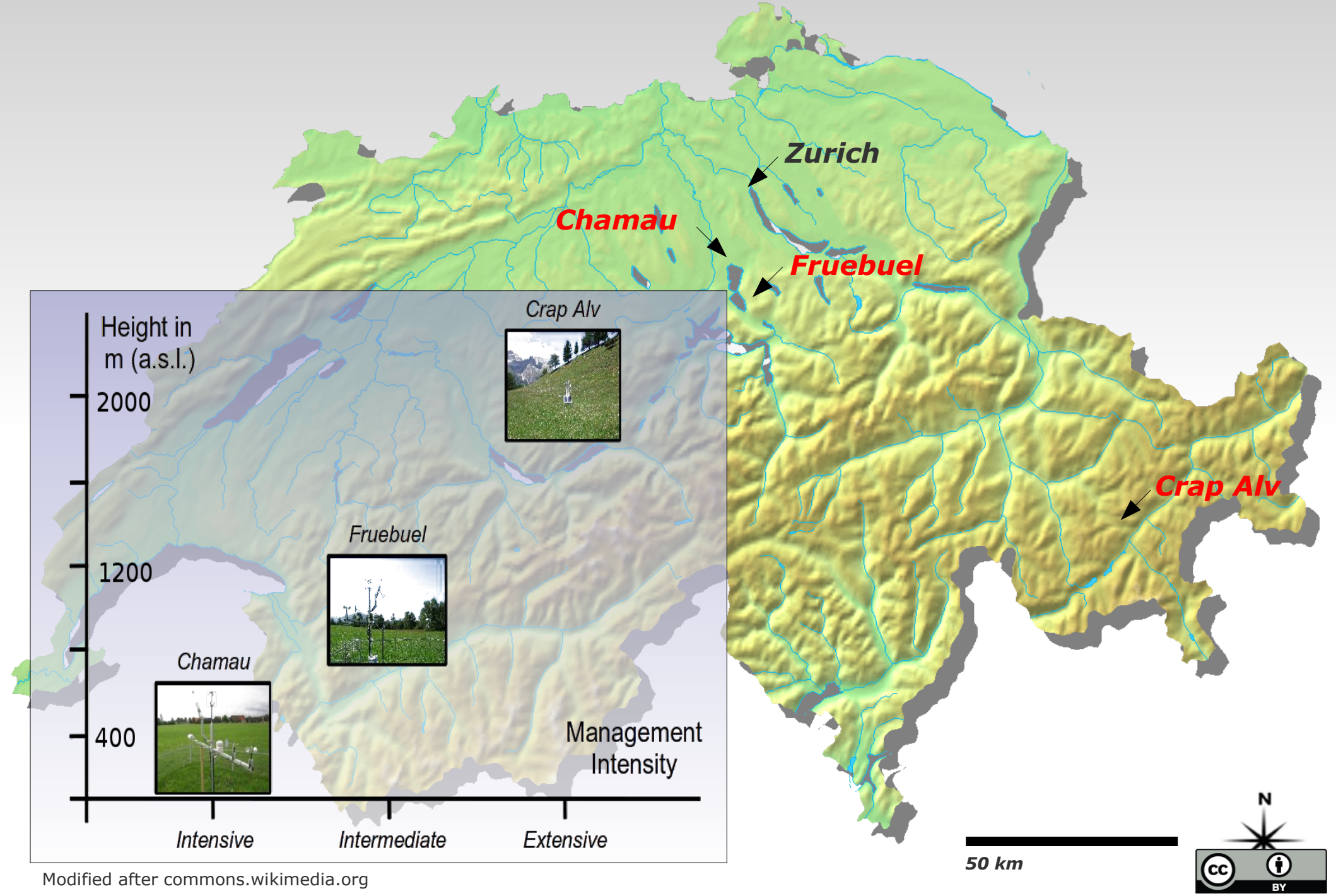

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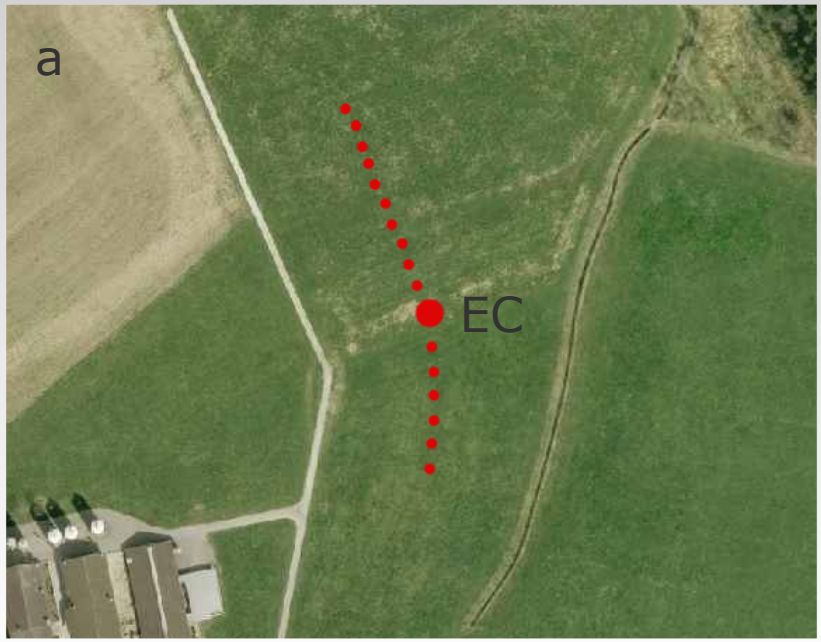
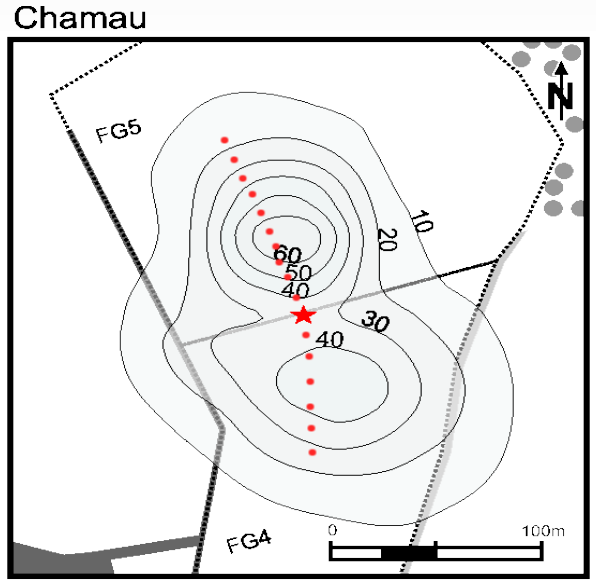
Campaign setup

- Three sites **simultaneously** (Sep. 21 – Sep. 23)
- **16** static soil chambers per site along transects within fetch of **eddy covariance** towers
- Sampling **every 2 h** (each sampling ~ 40 min)
- Sample analysis using **gas chromatography** for CH_4 and N_2O
- Eddy covariance for CO_2





Site setup at Chamau. Big dot (a) and red star (b) indicate EC tower and small dots show positioning of the chambers. (b) Contour lines represent the footprint area modified after Zeeman *et al.* 2010.

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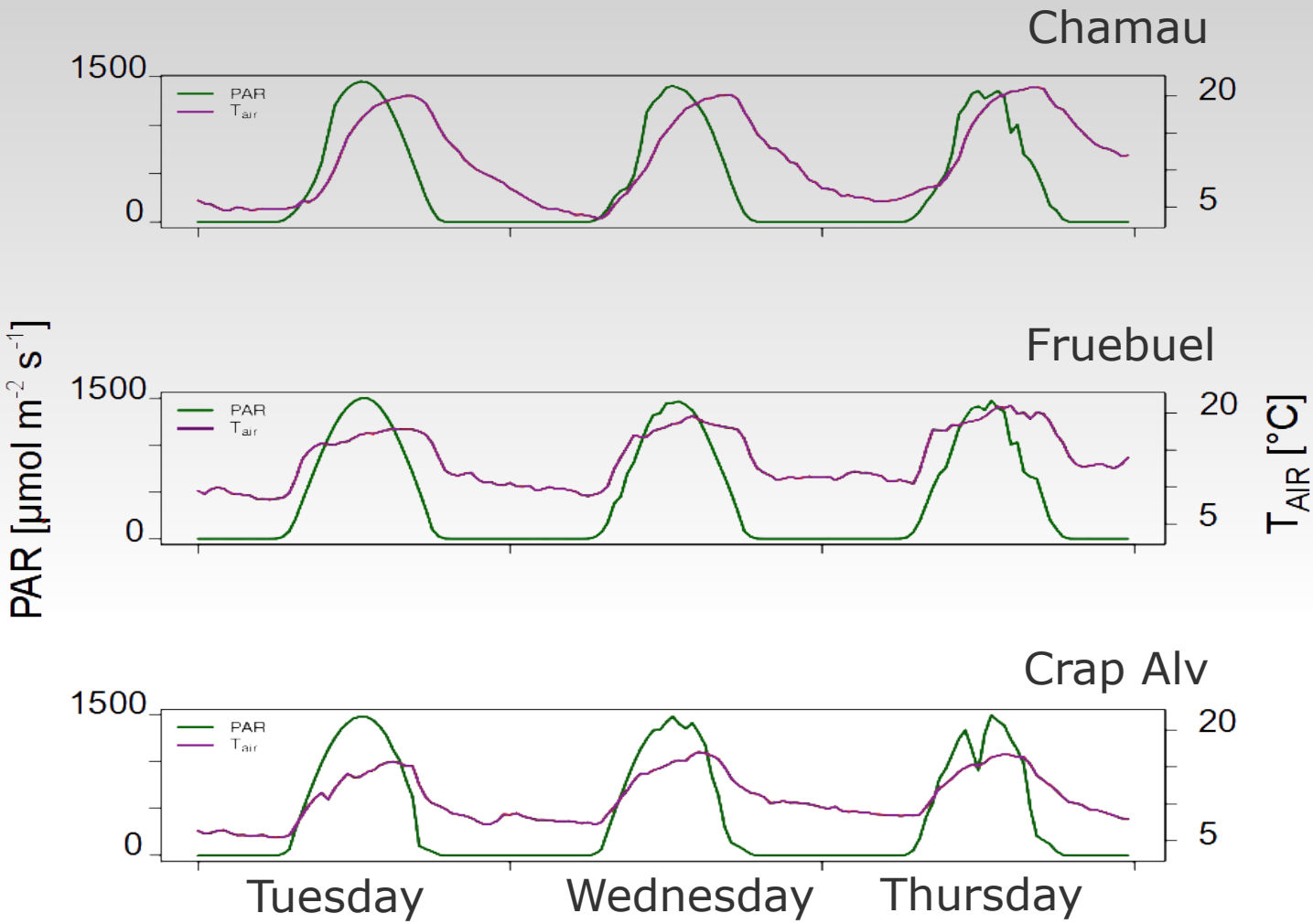
Meteo data

- **Clear** sky days
- **Comparable weather** conditions at all sites
- **Pronounced** diurnal cycles in radiation and temperature



Ecophysiological data

Site	LAI [m^2 m^{-2}]	Biomass [kg m^{-2}]	C [%]	N [%]
Chamau	6.10 (± 0.55)	0.20 (± 0.05)	2.82 (± 0.66)	38.28 (5.41)
Fruebuel	1.13 (± 0.37)	0.11 (± 0.04)	2.25 (± 0.49)	41.50 (± 2.25)
Crap Alv	1.14 (± 0.24)	0.10 (± 0.05)	2.78 (± 0.61)	42.67 (± 0.45)

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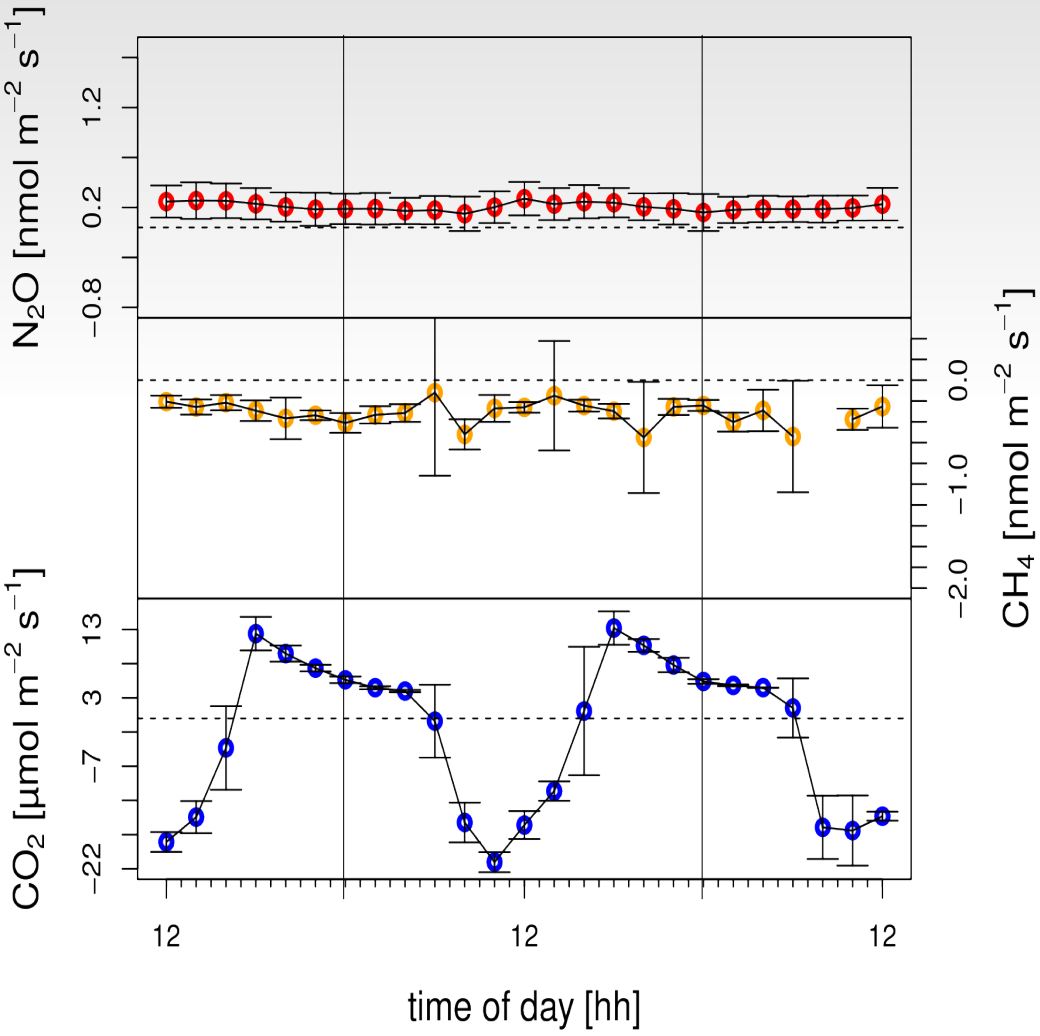
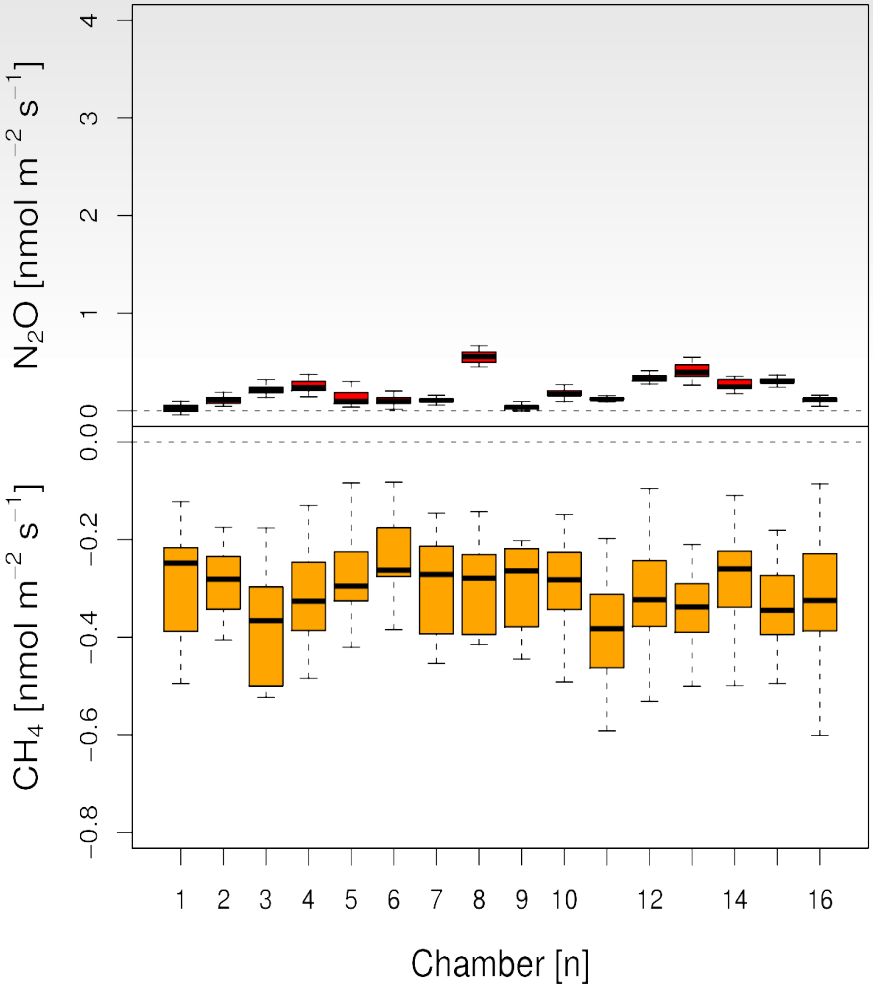
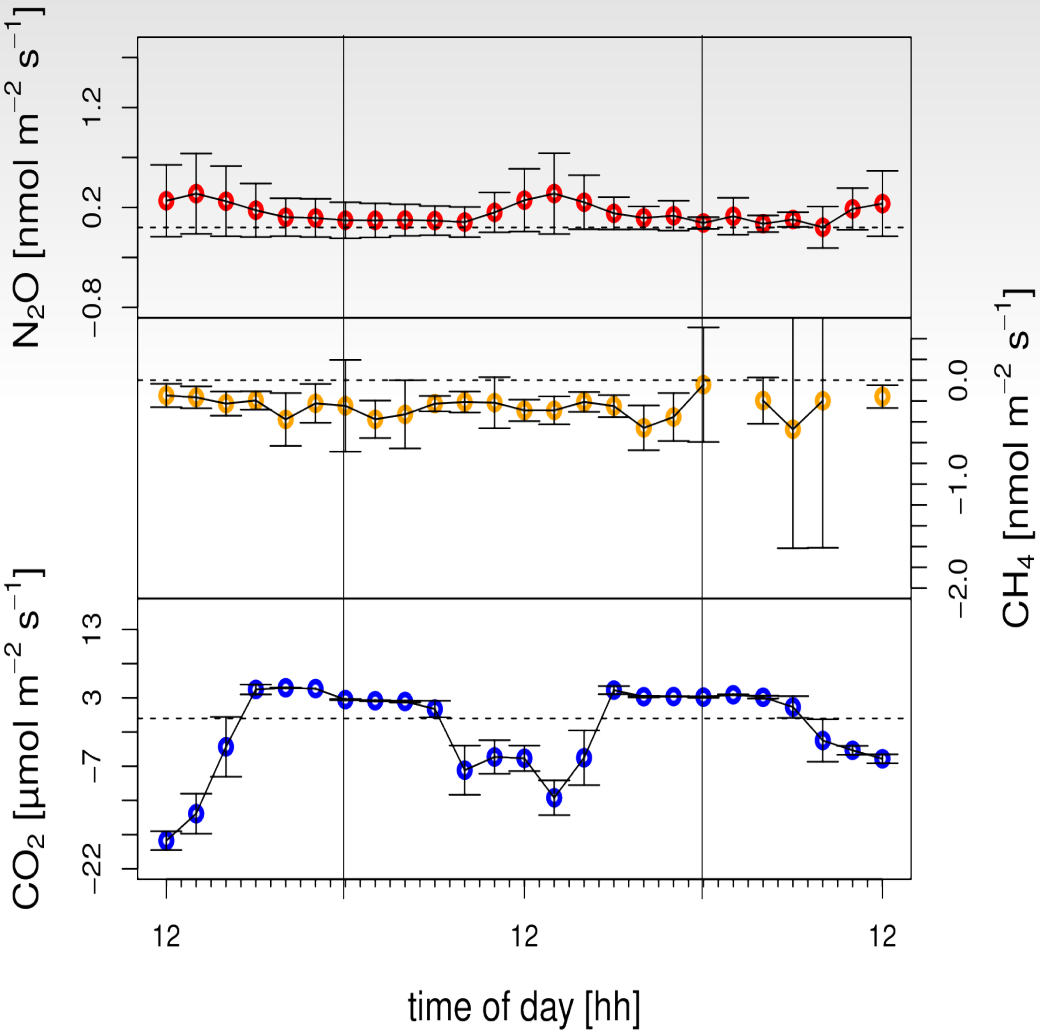
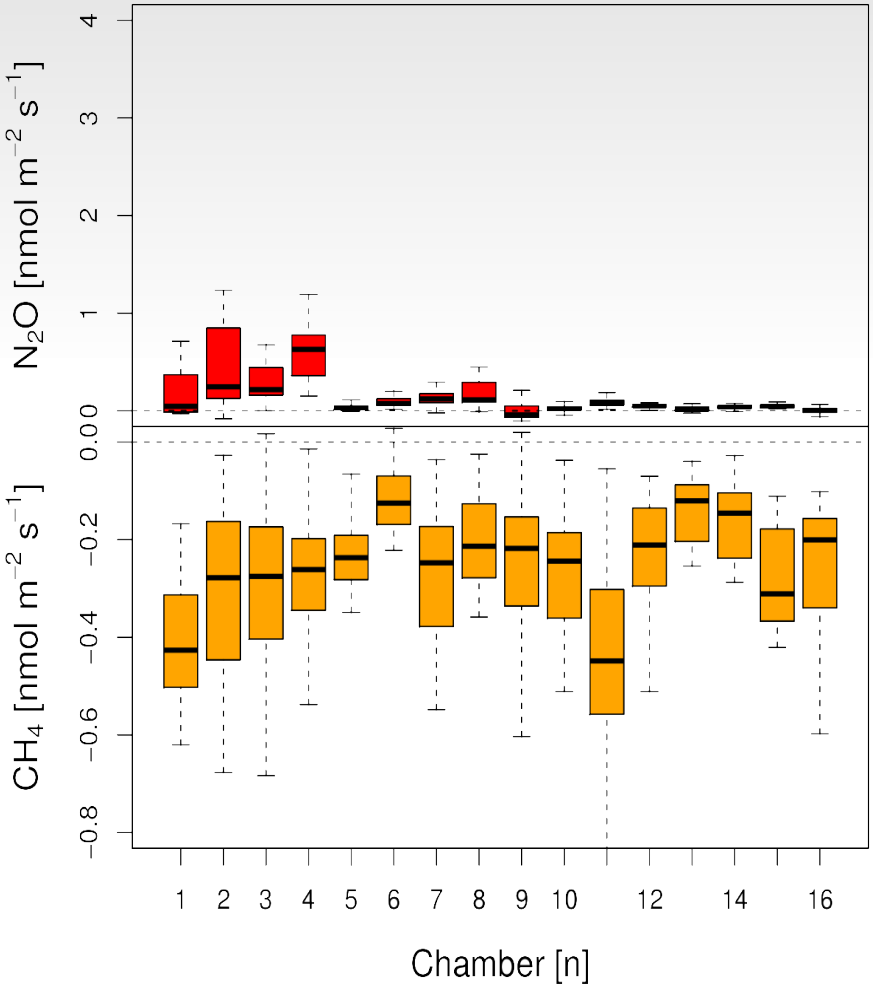
Flux data – Chamau (400 m asl)





Flux data – Fruebuel (1000 m asl)





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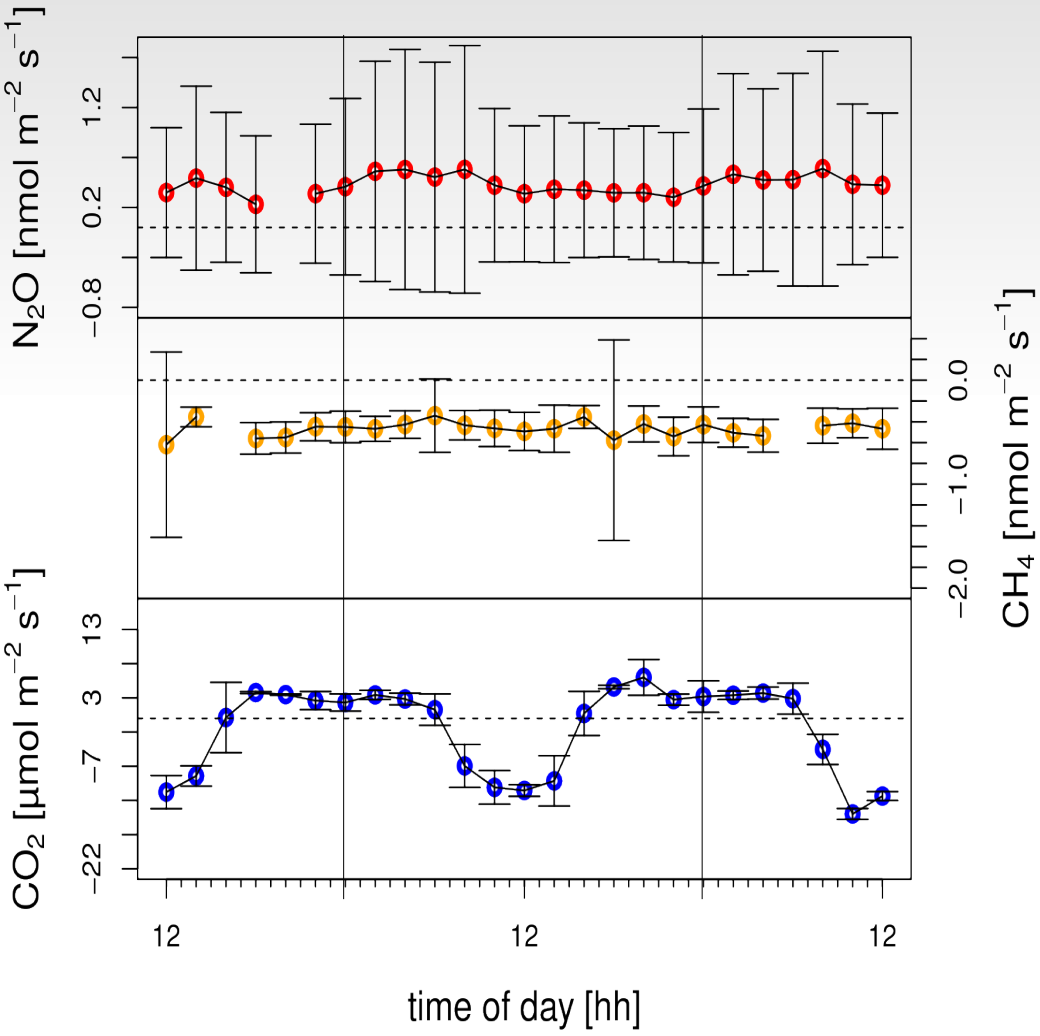
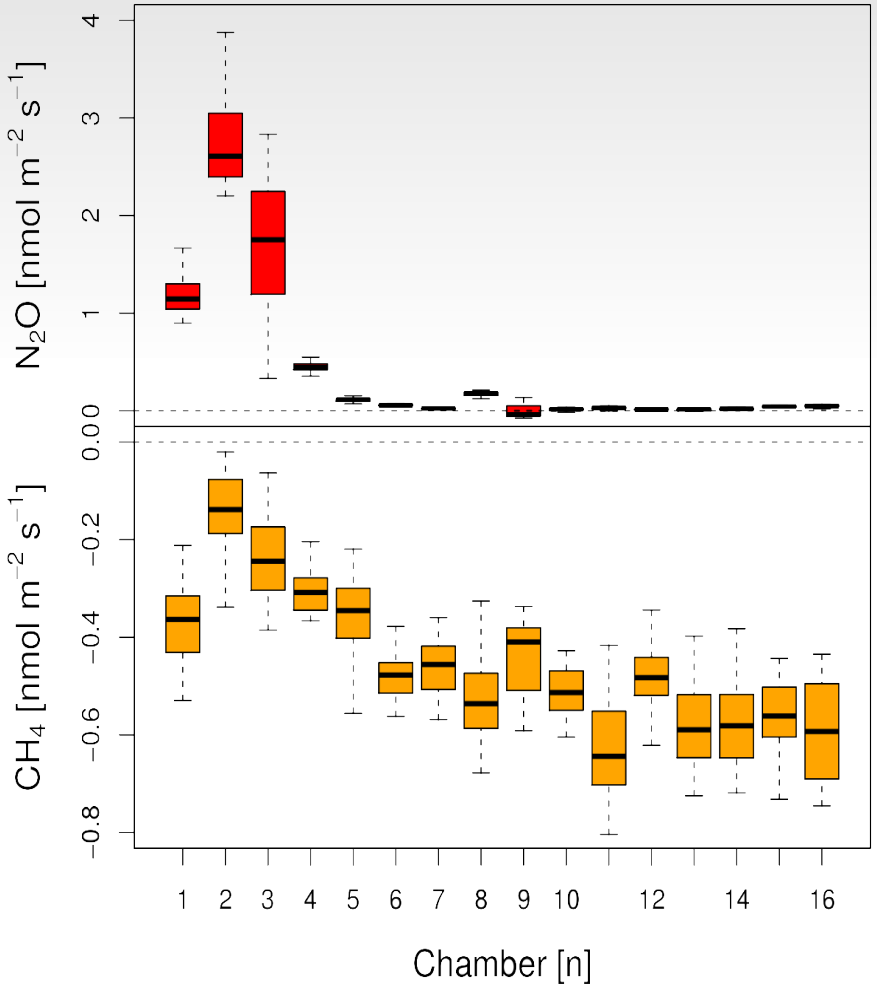
Flux data – Crap Alv (2000 m asl)





09/21 09/22 09/23

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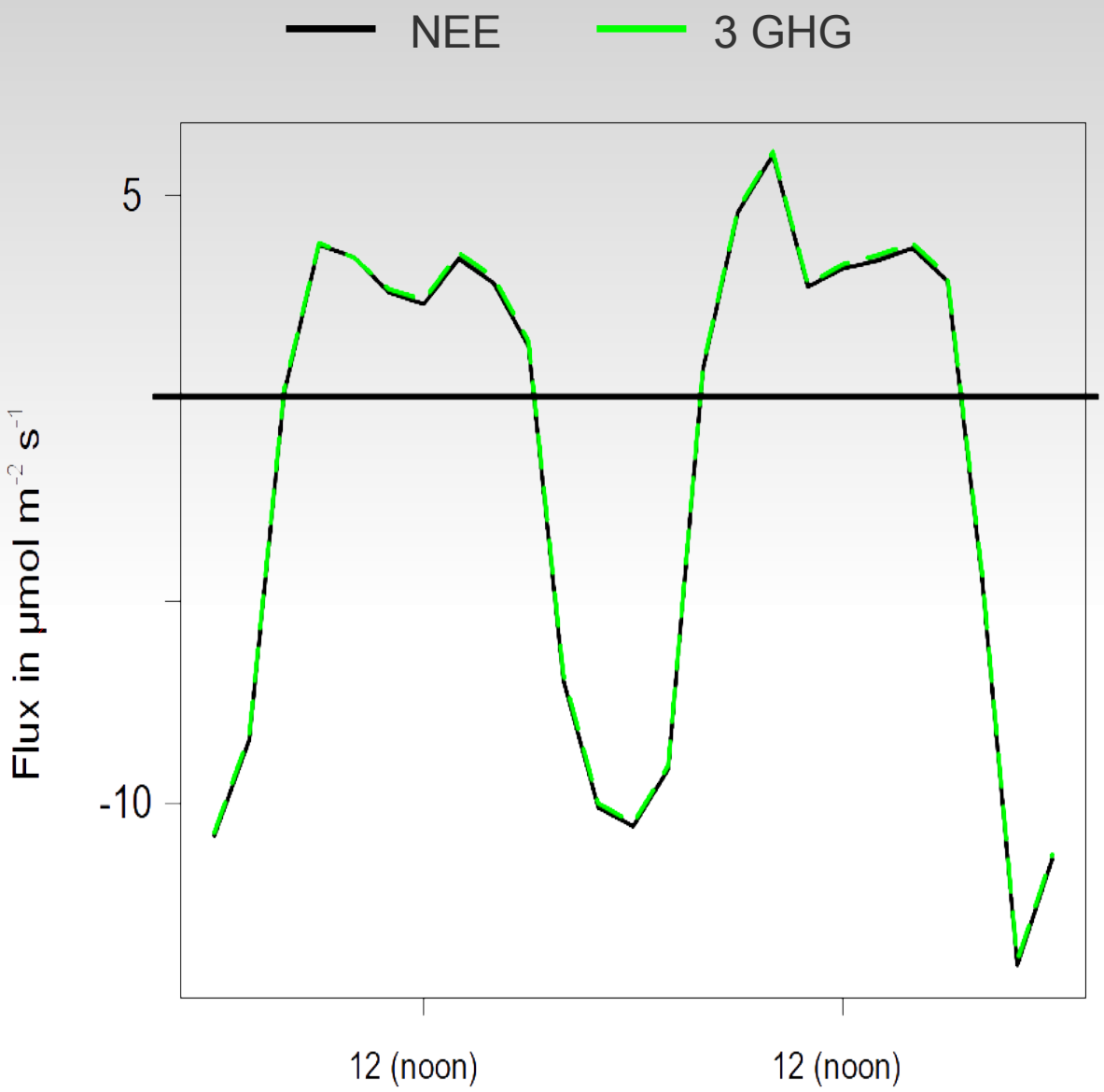
Conclusions

- Diurnal patterns at ecosystem scale detectable for CO_2 and N_2O → **sampling time does matter**
  - Diurnal **pattern negligible** during season
  - Spatial **heterogeneity**
- T_{AIR} and SWC able to explain variability well for N_2O
- **SWC** range too small to explain CH_4



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