ÉCLAIRE Component 1: Emission & Exchange Processes

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+ all C1 Partners

ÉCLAIRE annual meeting
16-18 October, Edinburgh

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eclaire

Effects of climate change on air pollution impacts and response strategies for European ecosystems

SEVENTH FRAMEWORK PROGRAMME

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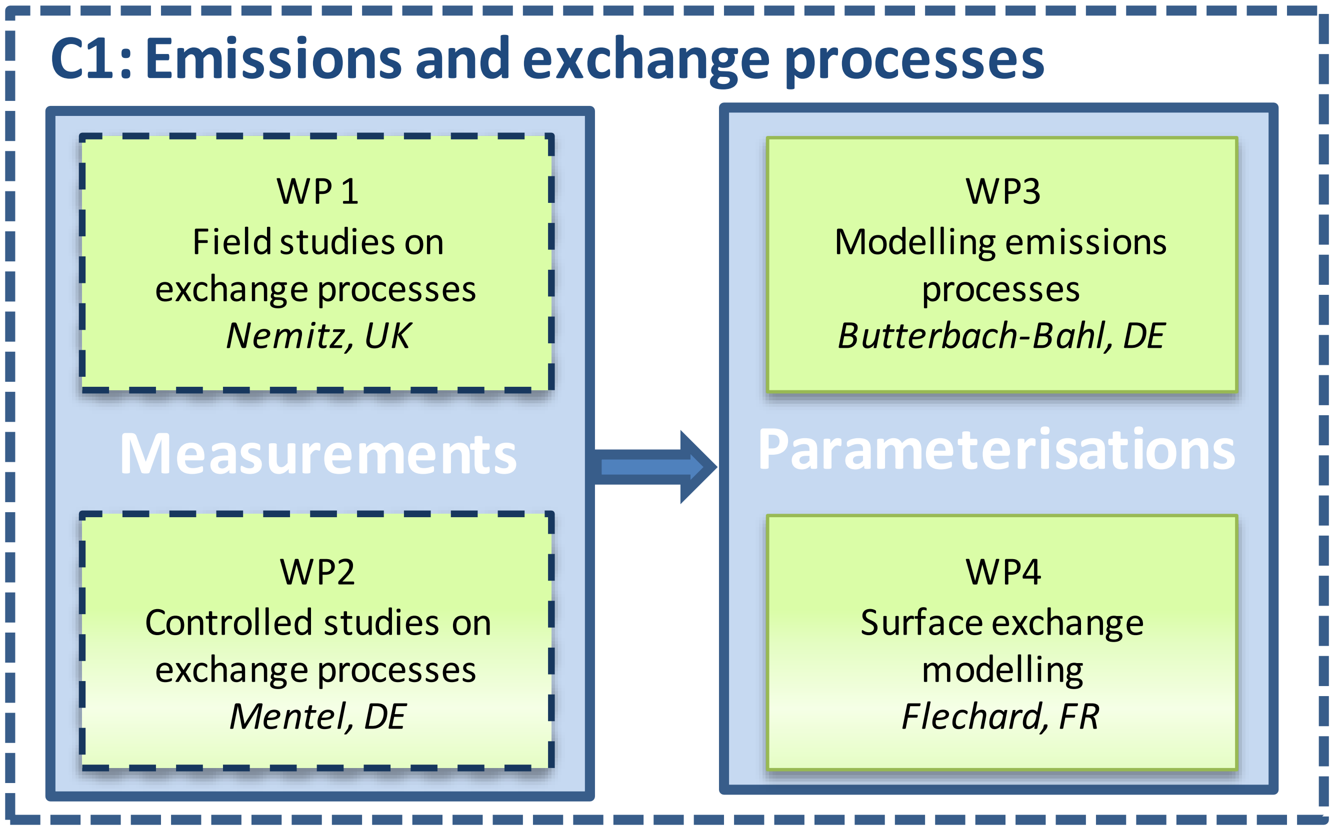
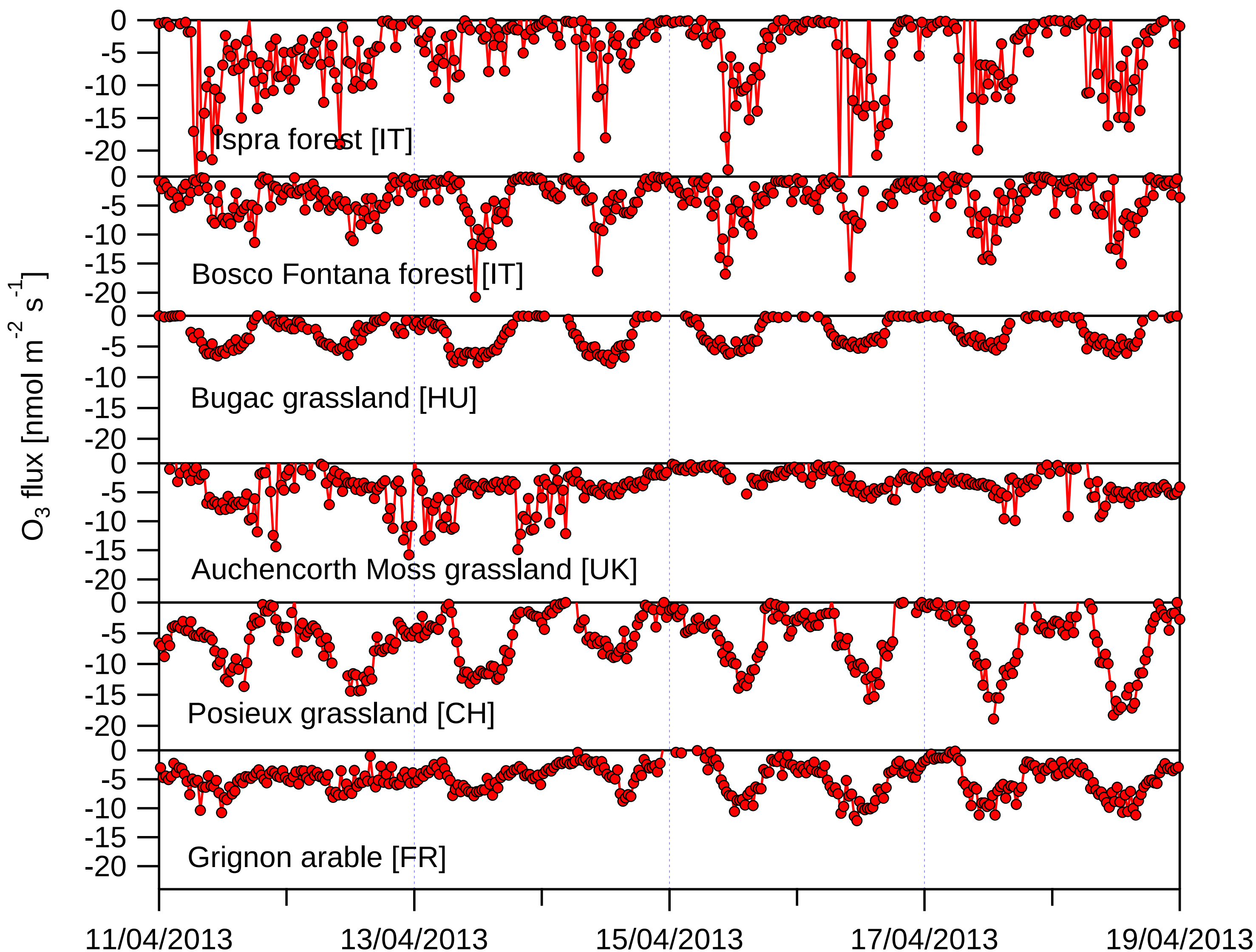
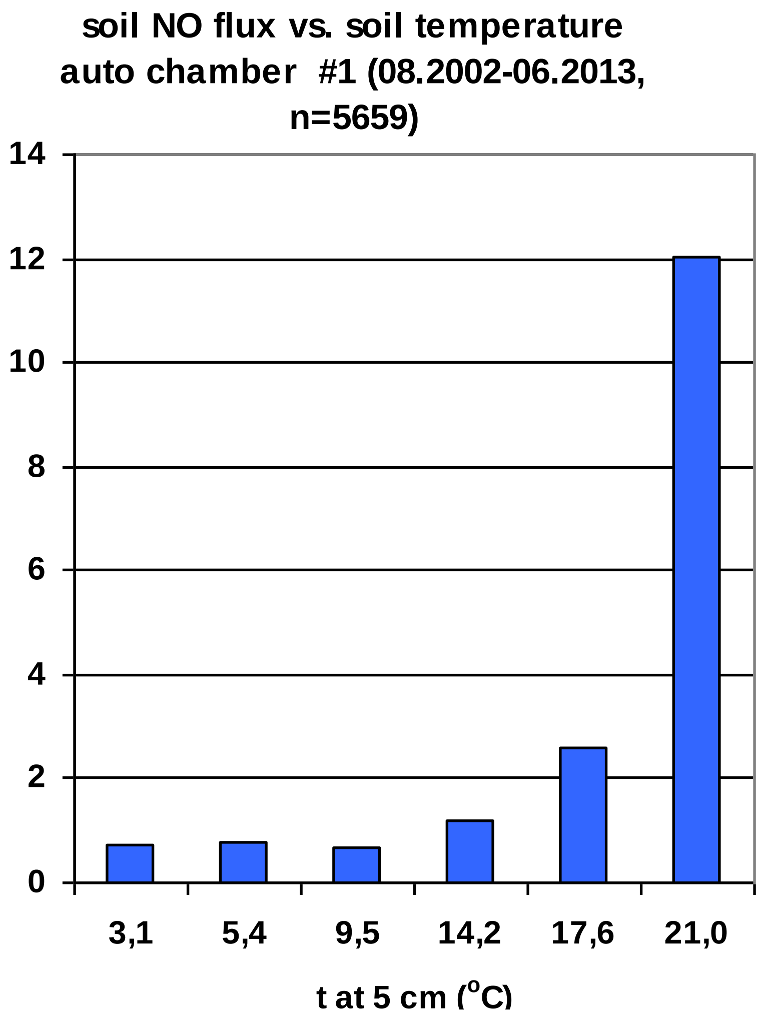
Component 1 Structure

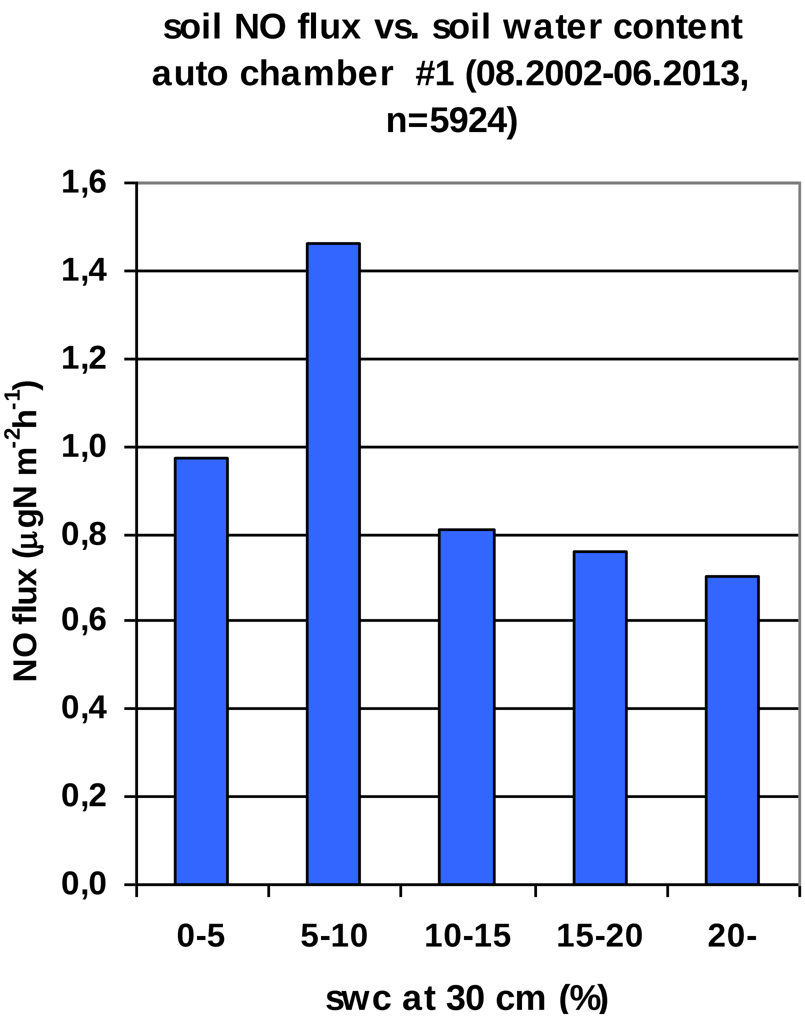


Task 1.1: Flux network



Task 1.1: Bugac - Control of soil NO fluxes





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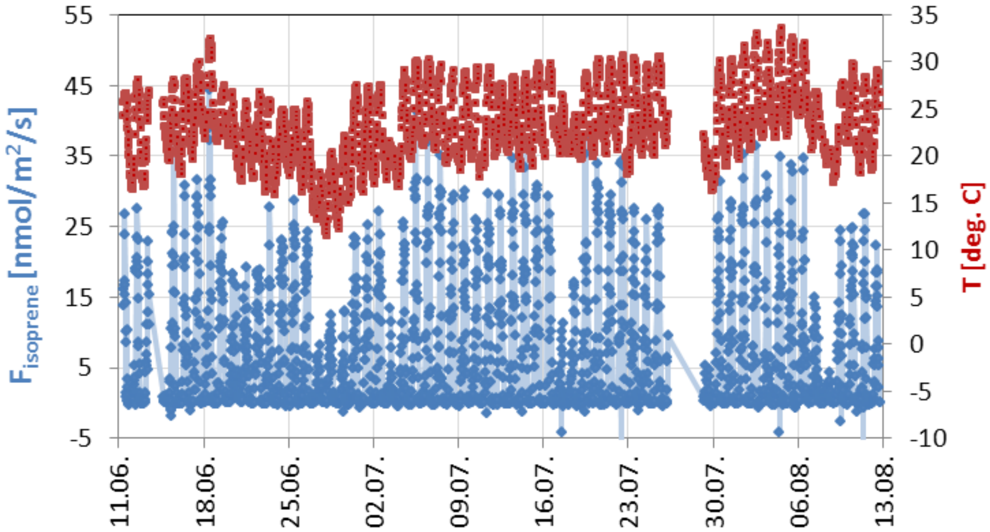
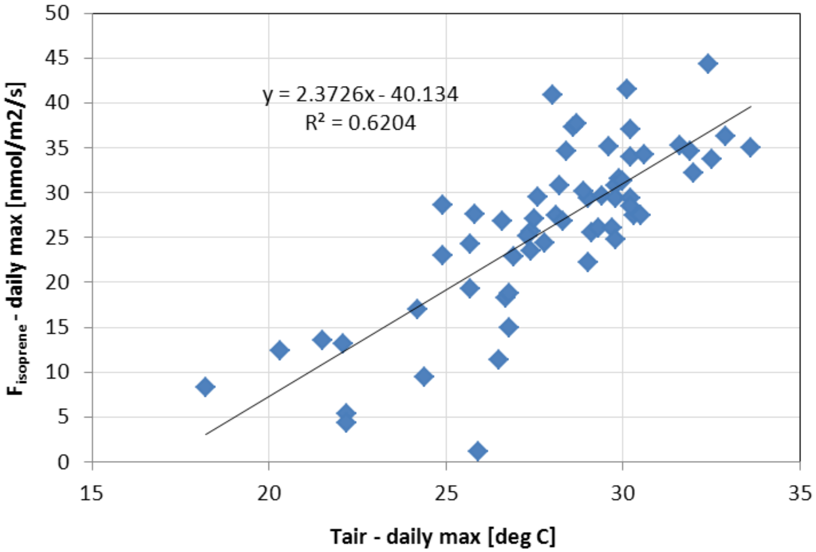
Task 1.2: Isoprene measurements at Ispra





- isoprene fluxes measured for 2 months with Fast Isoprene Sensor (FIS)
- isoprene flux follows daily-max air temperature
- linear fit is only guide to the eye … according A. Gunther et al. (1993) should be exponential
- further evaluation is pending

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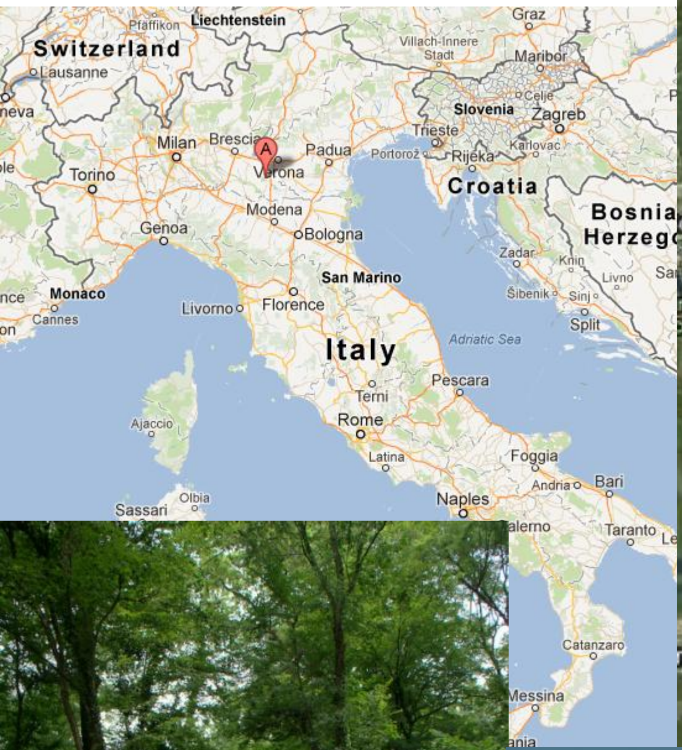
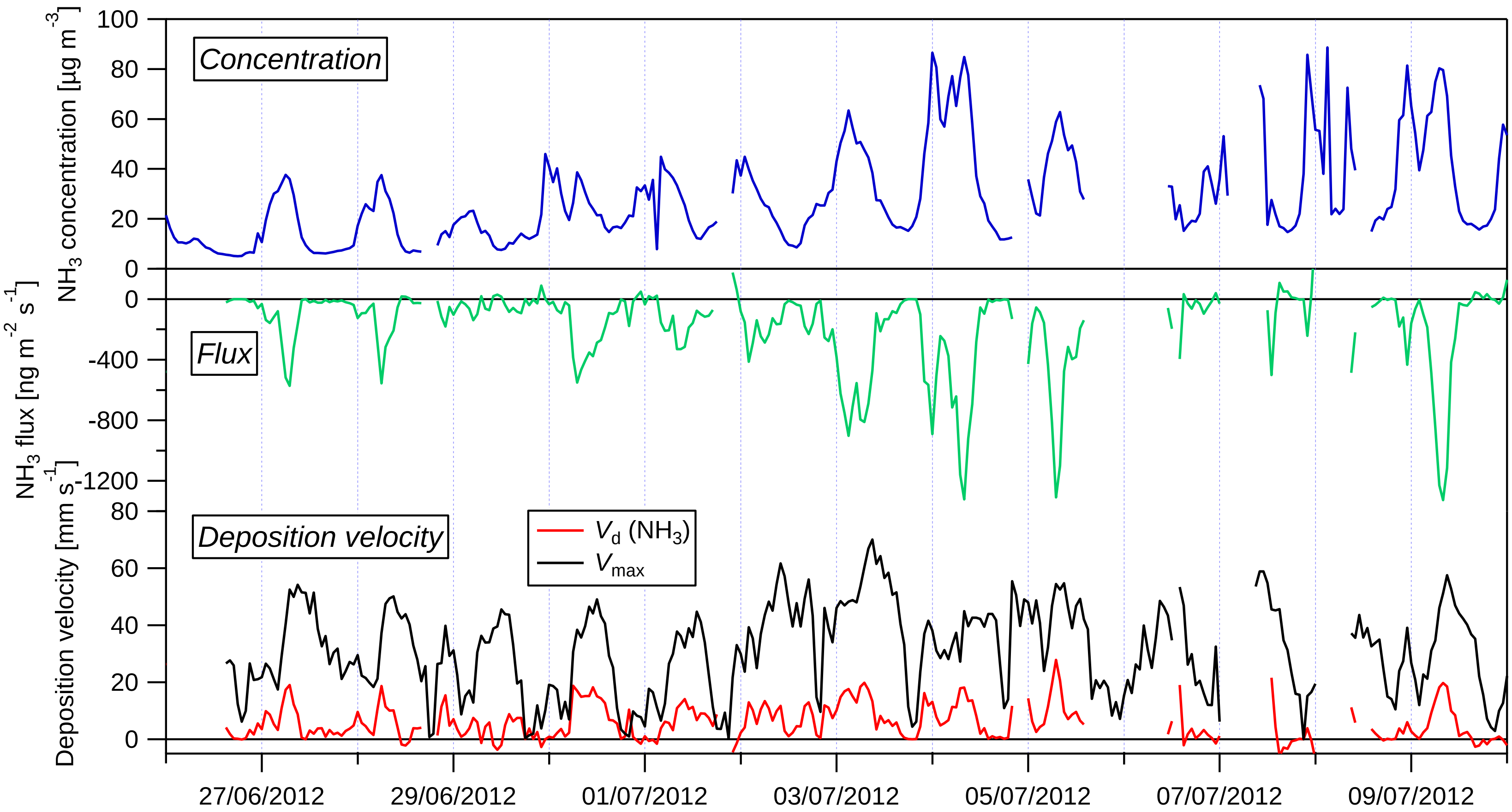
Disclaimer: preliminary data

Task 1.4: Bosco Fontana, Mantova, Italy



Task 1.4: Bosco Fontana –NH_3 fluxes



Average: 184 ng m^{-2} s^{-1} equiv. to 47.8 kg N ha^{-1} yr^{-1}

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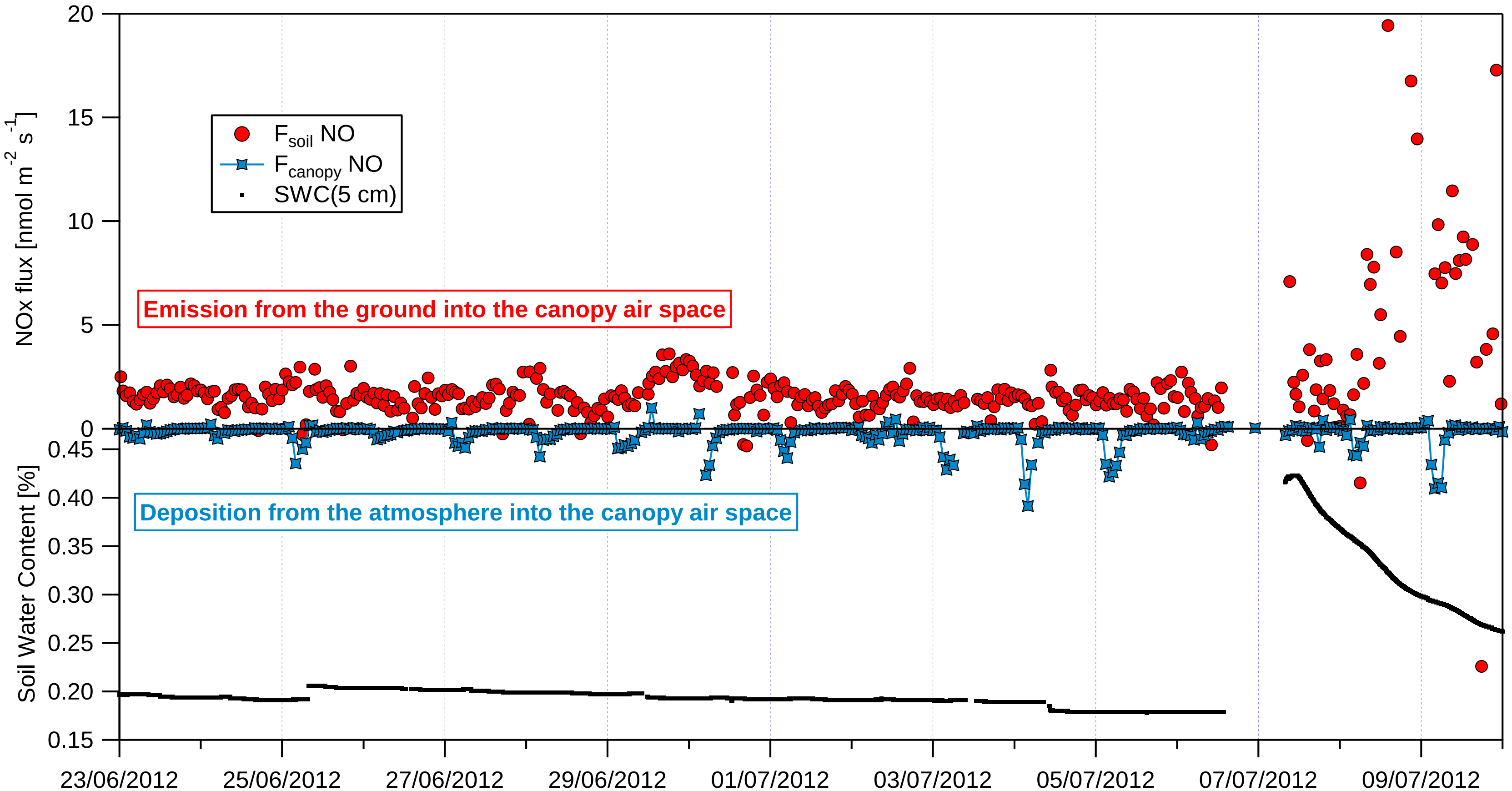
Task 1.4: Bosco Fontana NO fluxes



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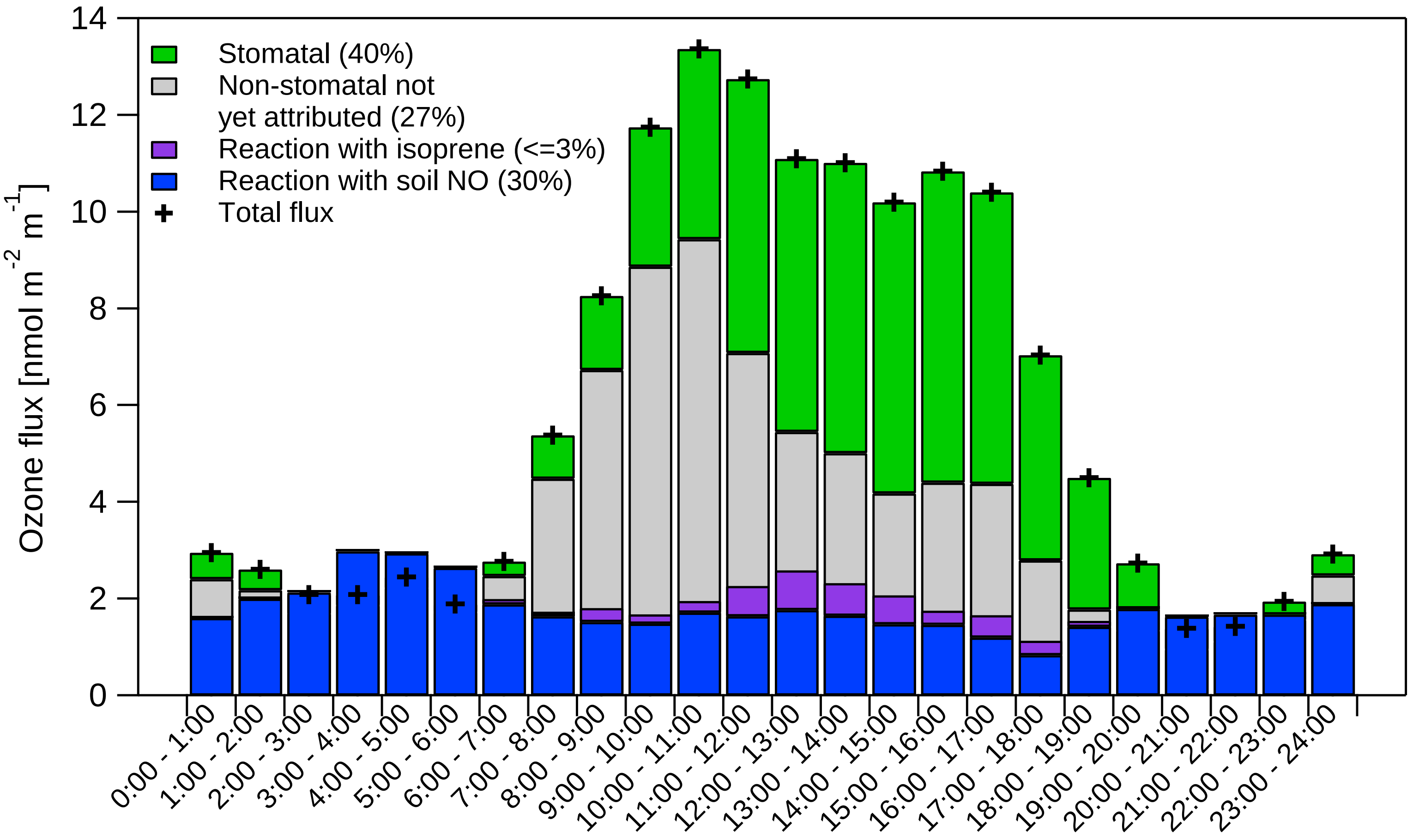
Task 1.4: Attributing the O_3 flux at BF



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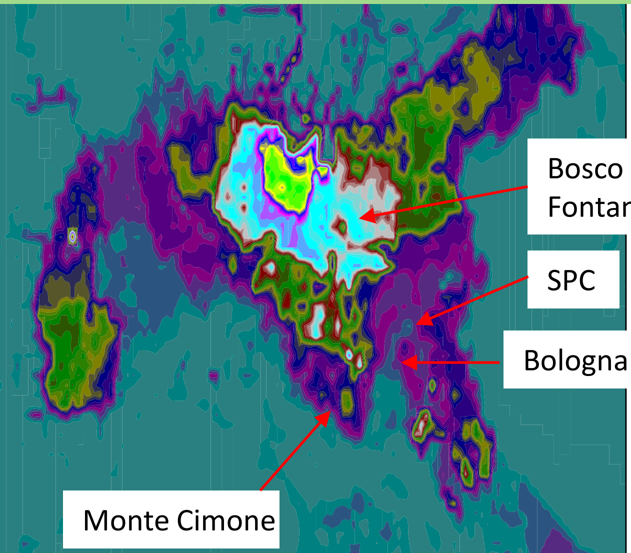
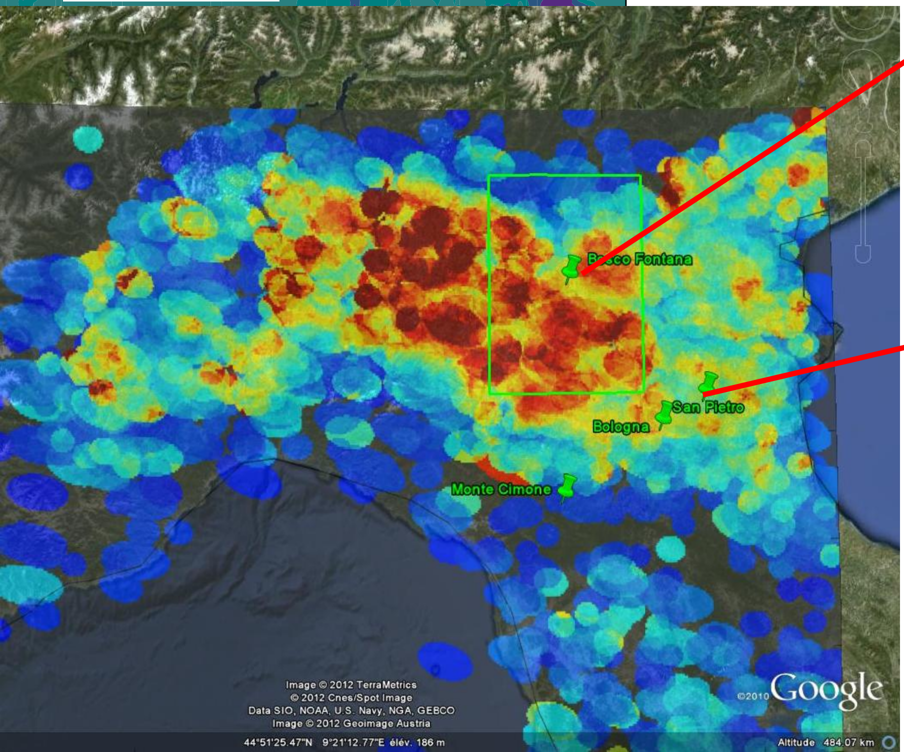
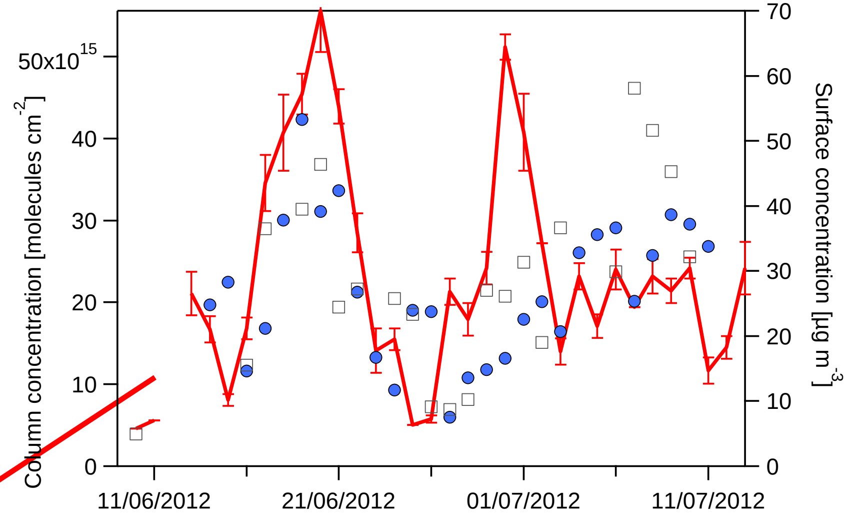
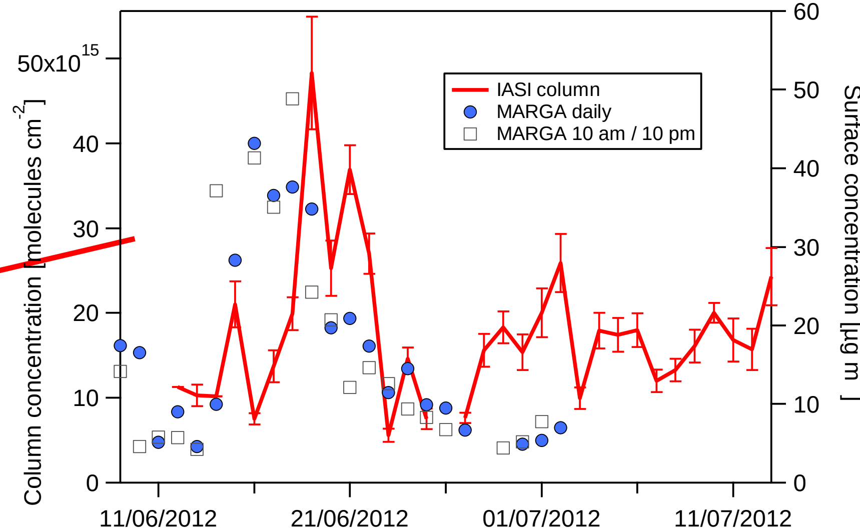
Task 1.4: Comparison satellite vs. ground based NH_3







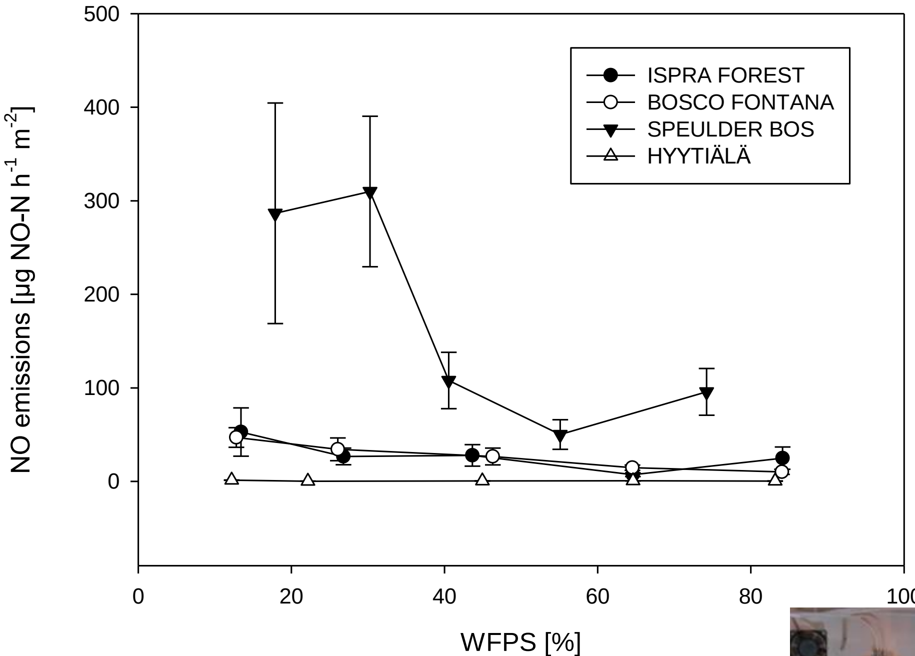


IASI Product

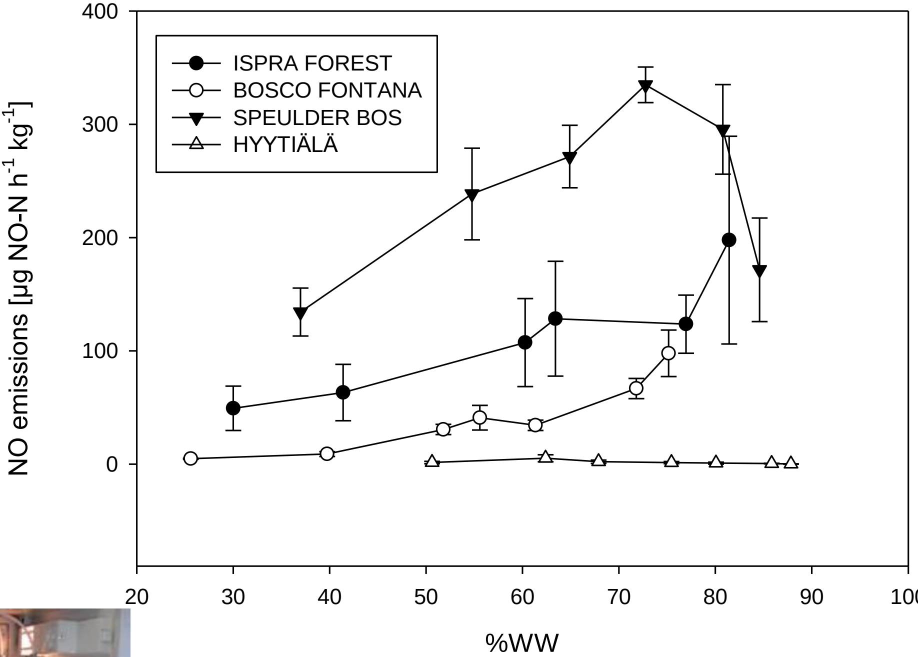
Task 2.1: Laboratory work: NO emissions from soils & litter

ÉCLAIRE flux network / Forest sites

NO soil emissions (top 6 cm) (20˚C)



Litter emissions (20˚C)



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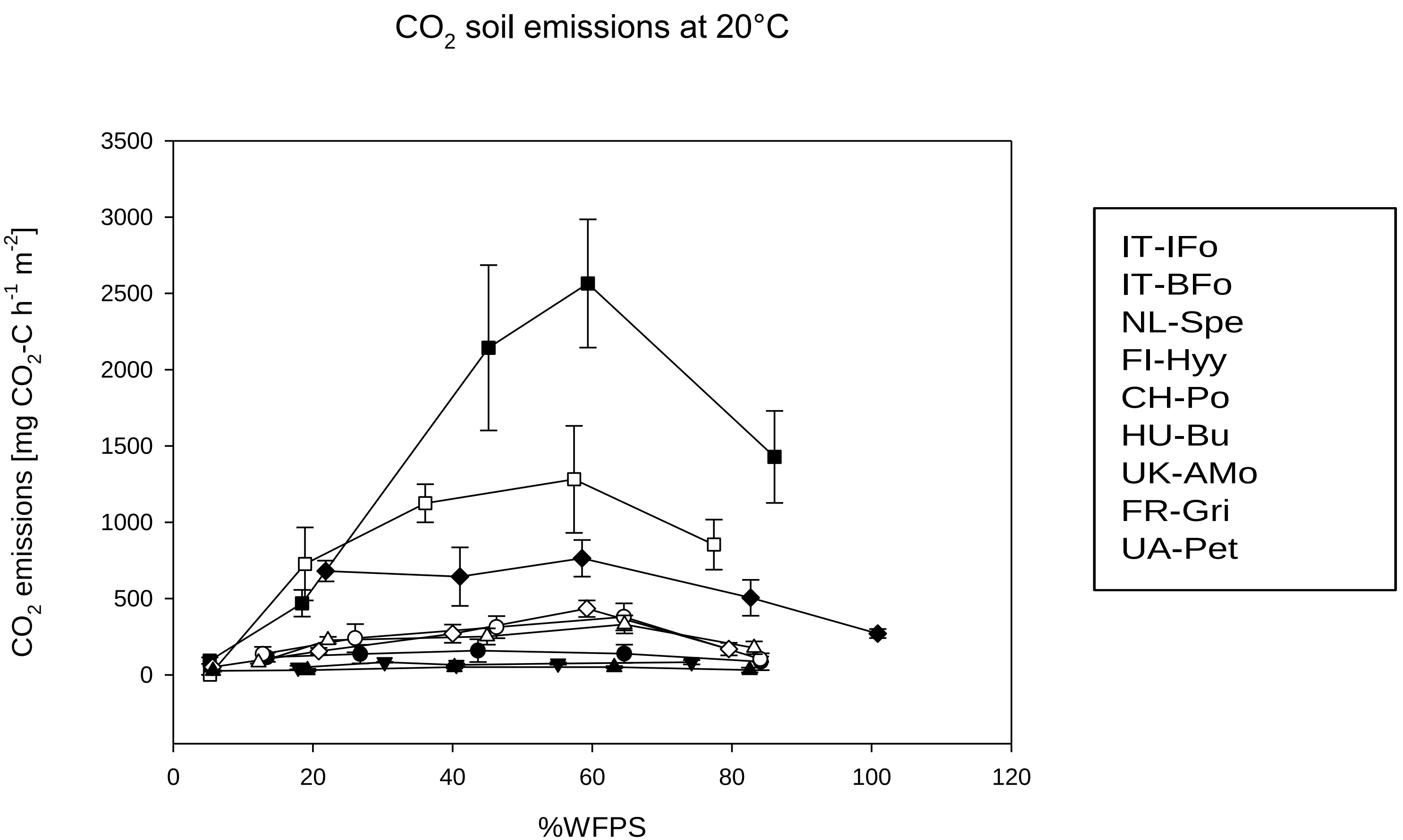
Task 2.1: ÉCLAIRE flux network – CO_2 emissions

measured at different moisture contents coming from the upper (6 cm) mineral soil



Highest soil CO_2 emissions under intermediate soil moisture (WFPS = water filled pore space) from HU-Bugac followed by CH-Posieux (both grasslands) and UK-Authencorth moss.

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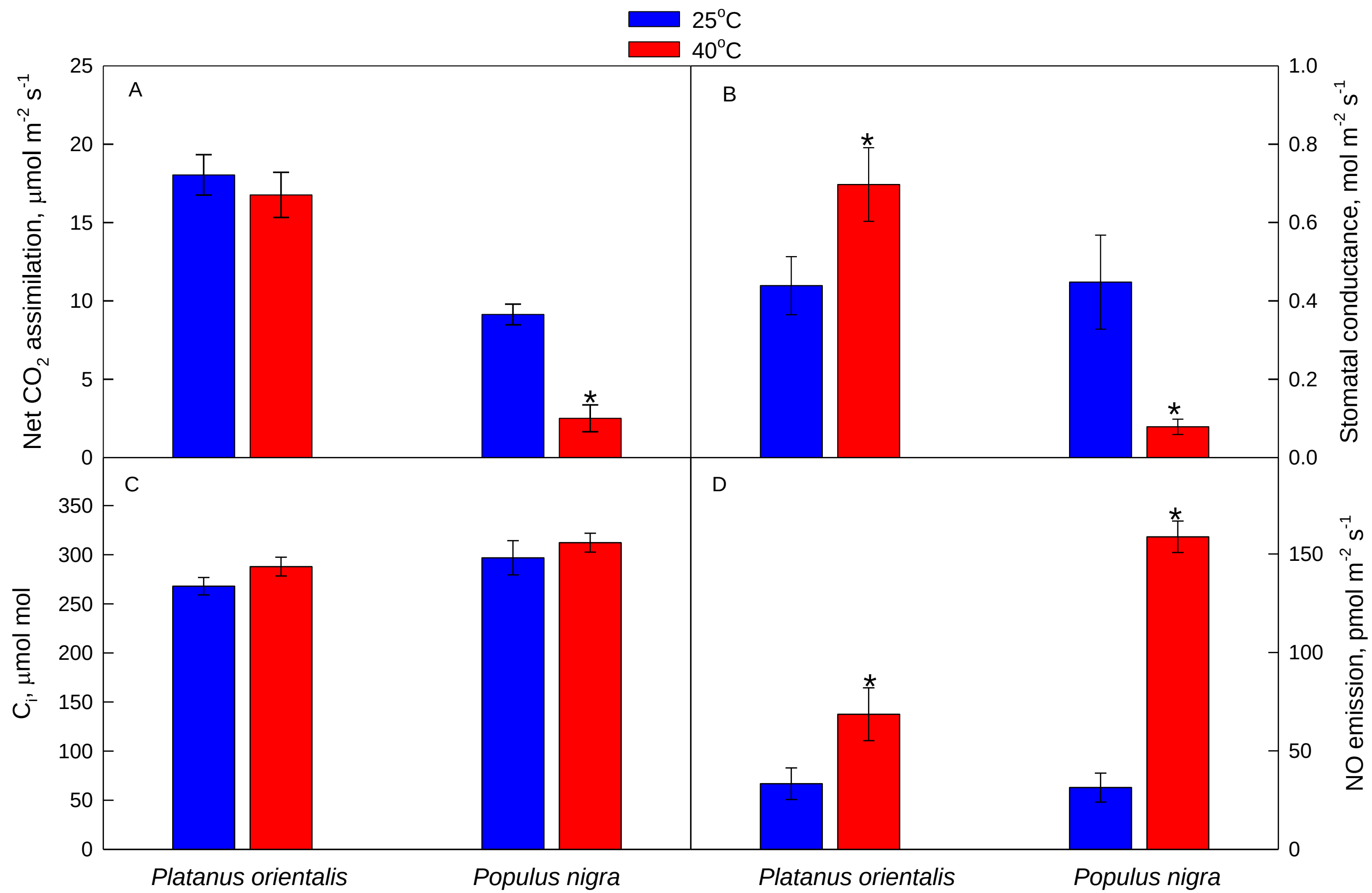
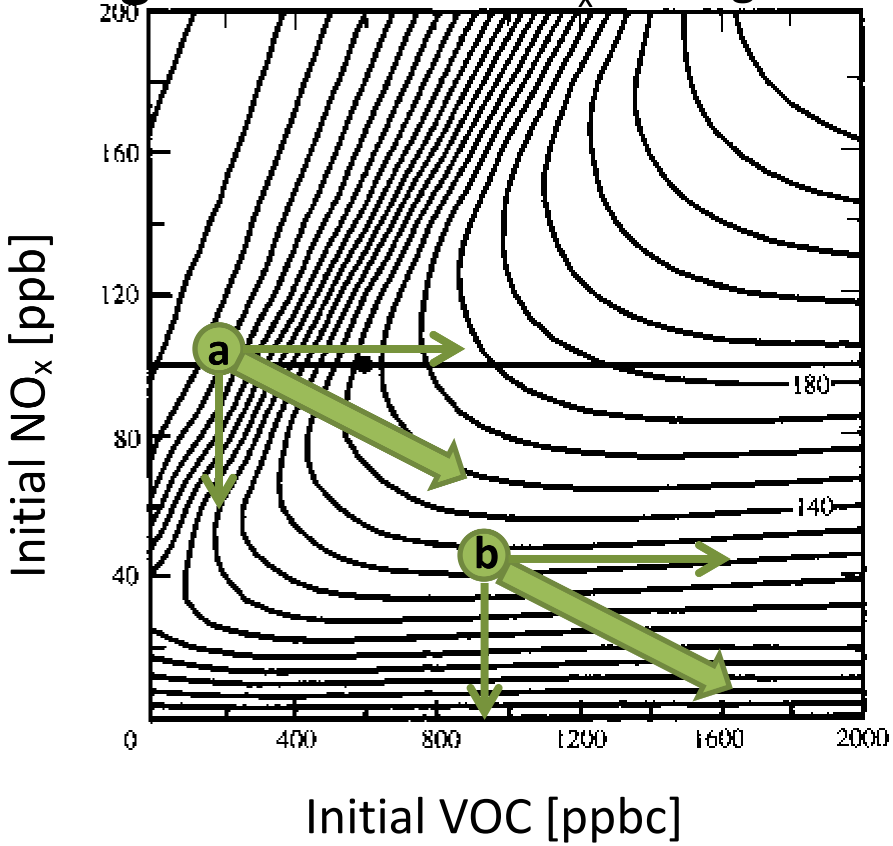
Task 2.3: Effect of high temperature on NO emission and photosynthetic activity



Photosynthetic CO_2 assimilation (A), stomatal conductance (B), intracellular CO_2 concentration (C) and NO emission rate (D) in *P. orientalis* and *P. nigra* plants in response to high temperature (40°C for 4 h). Mean values from 5 replications ± s.e. are presented.

Task 2.4. BVOC emissions and the impact on O_3 deposition and formation (Juelich)

Vegetation: lower NO_x and higher VOC



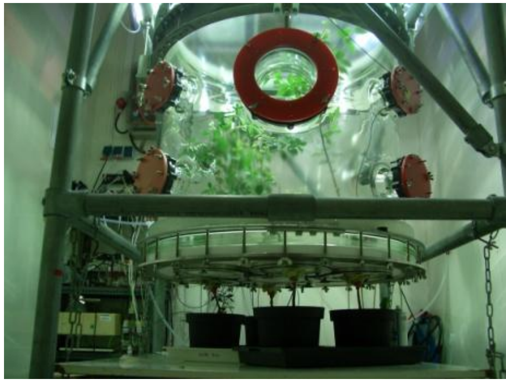


Figure 1: Ozone isopleth diagram with general impacts of vegetation on O_3 formation rates.

Task 2.4: O_3 formation potential as affected by stress to plants

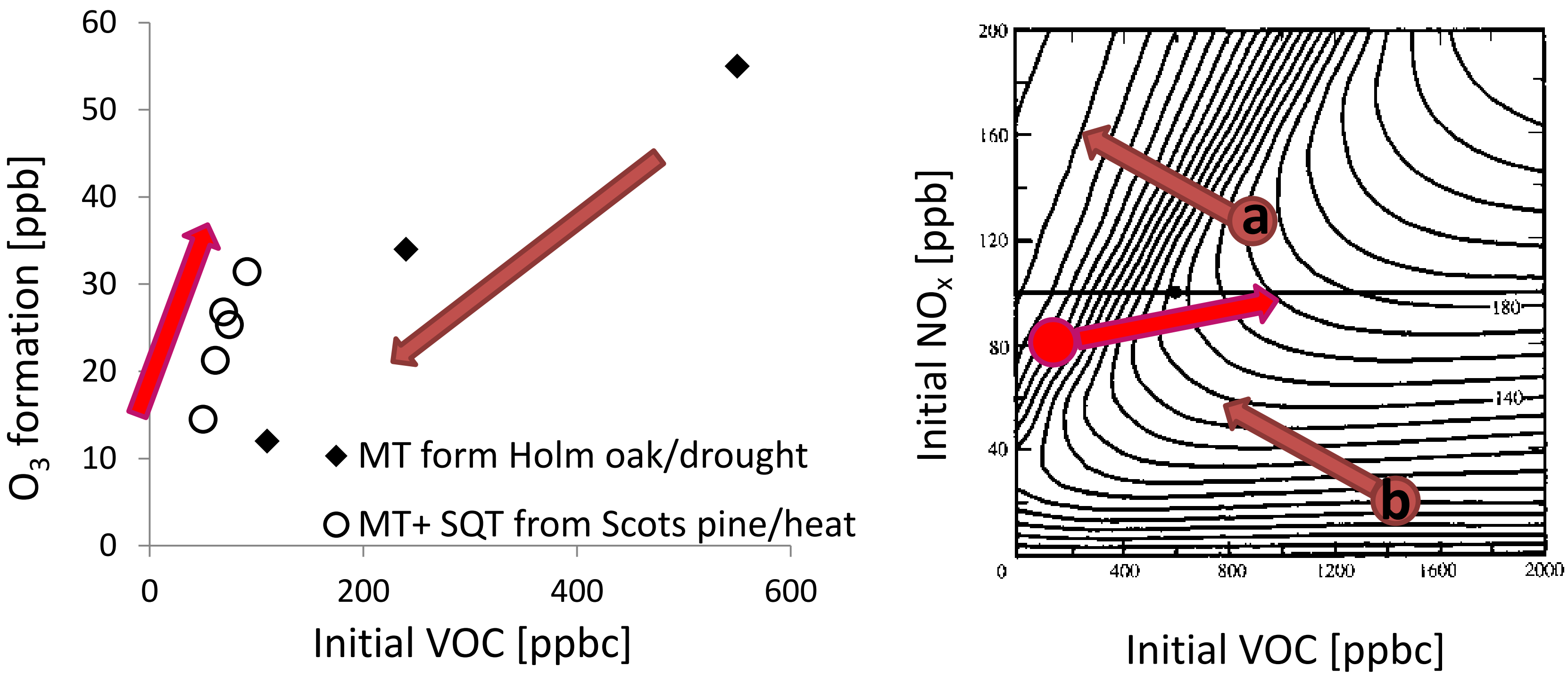


Fig. 2: Enhanced temperatures increased VOC emissions and the O_3 forming potential; Drought decreased VOC emissions and the O_3 forming potential. Depending on the starting point of the photochemical system, ozone formation potential is decreased (brown arrow (a)) or increased (brown arrow (b)).

Task 2.2: Assessment of NO emissions after rewetting events

Aim: Assessment of N2O and NO soil-atmosphere exchanges after drying-wetting events in agricultural areas; with special focus on effects of management practices (*i.e.* tillage and fertilization).

Experimental setup:

Incubation of agricultural soils, simulation of different precipitation patterns

	Day 0		Day 15		Day 30		Day 45
Decreasing	50 mm		30 mm		10 mm		end
Increasing	10 mm		30 mm		50 mm		end
Constant	2 mm / day						end

✓Automated sampling within two incubators for RH and T control
✓Temporal resolution → 8 times per day
✓NO → EcoPhysics CLD 88
✓CH_4, CO_2, N_2O → Quantum Cascade Laser (Aerodyne)

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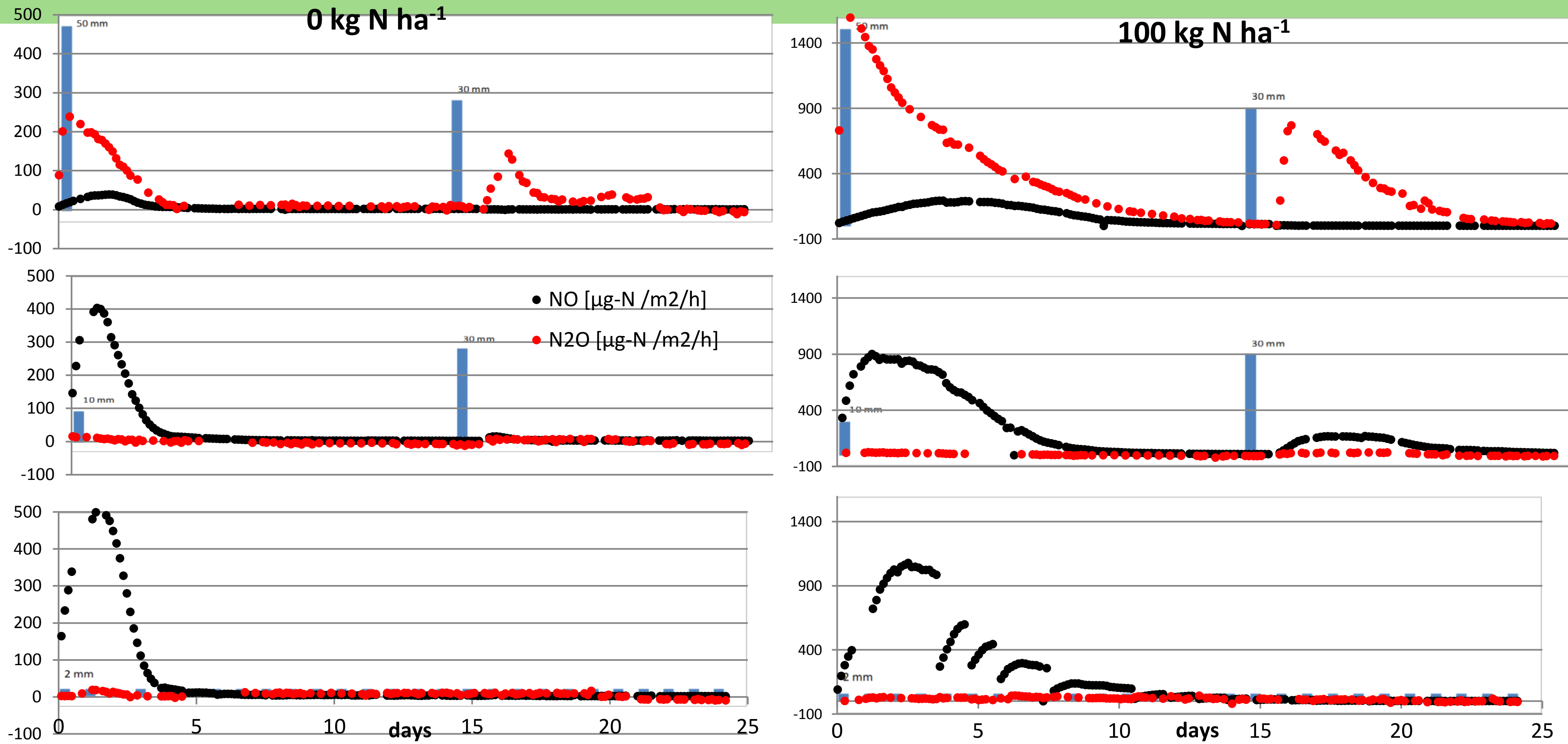
Task 2.2. Effects of precipitation distribution on soil NO & N_2O emissions



(preliminary) highlights:

- Strong precipitation events (50 mm) after drought lead to high N_2O emissions
- Moderate (10 mm) or even low (2 mm) precipitation events lead to high NO emissions
- Fertilizers increase magnitude and duration of the pulse, but at a higher extent for N_2O

System running, more results in the pipeline for the process / model evaluierung

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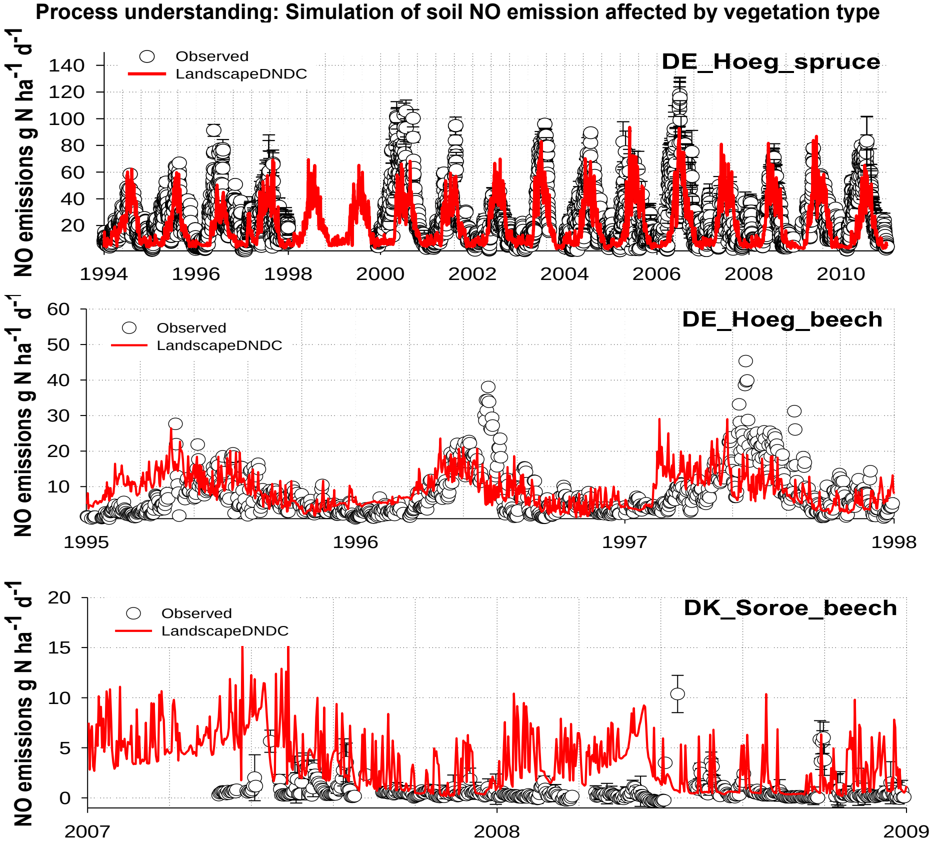
Task 3.3 Landscape DNDC NO emission simulations



LandscapeDNDC can reproduce NO emissions for some ecosystems, while it performs poor on others

Ongoing work:

- Identify the drivers for NO emissions
- Revise the processes in the model
- Evaluate LandscapeDNDC for many ecosstemsystems

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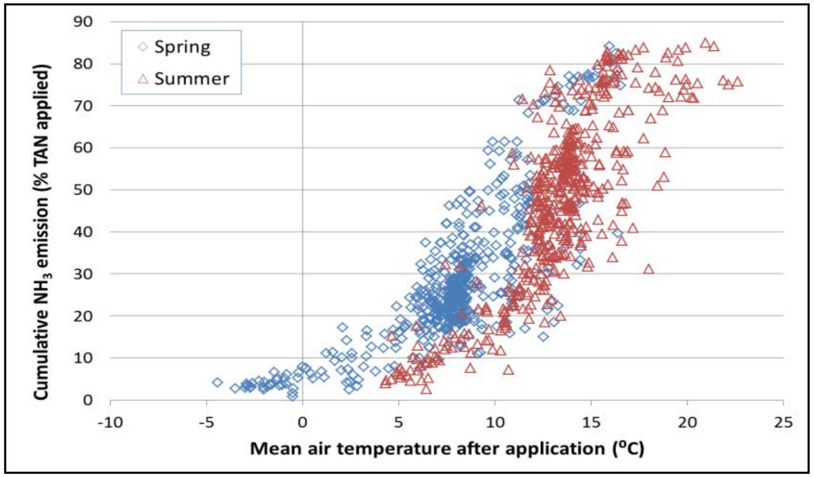
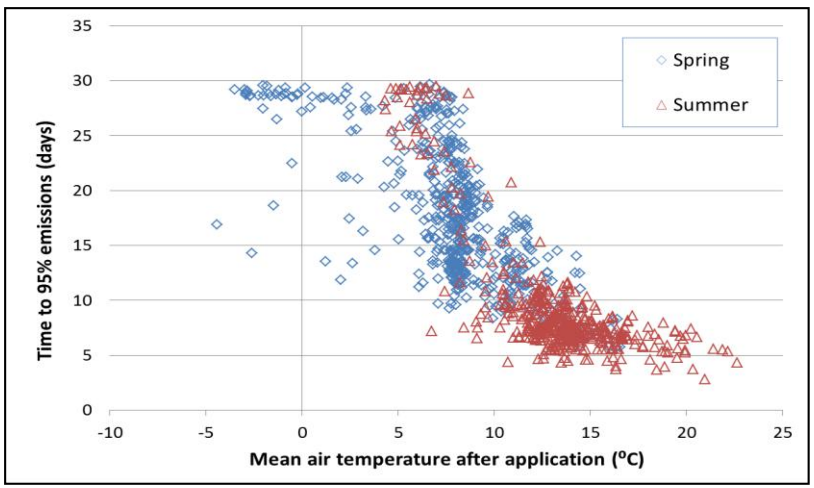
Task 3.1: Manure emission of NH_3 (Response to air temperature)



% NH_4-N Volatilised



No. of days to 95% of emissions

Task 3.1: Improve agricultural NH_3 emission modules in relation to meteorological drivers

Objective: *Develop an NH_3 emission model for agricultural management (specifically for manure / slurry / fertiliser applications)*

Approach chosen: *Develop a meta-model from the Volt'Air process model*

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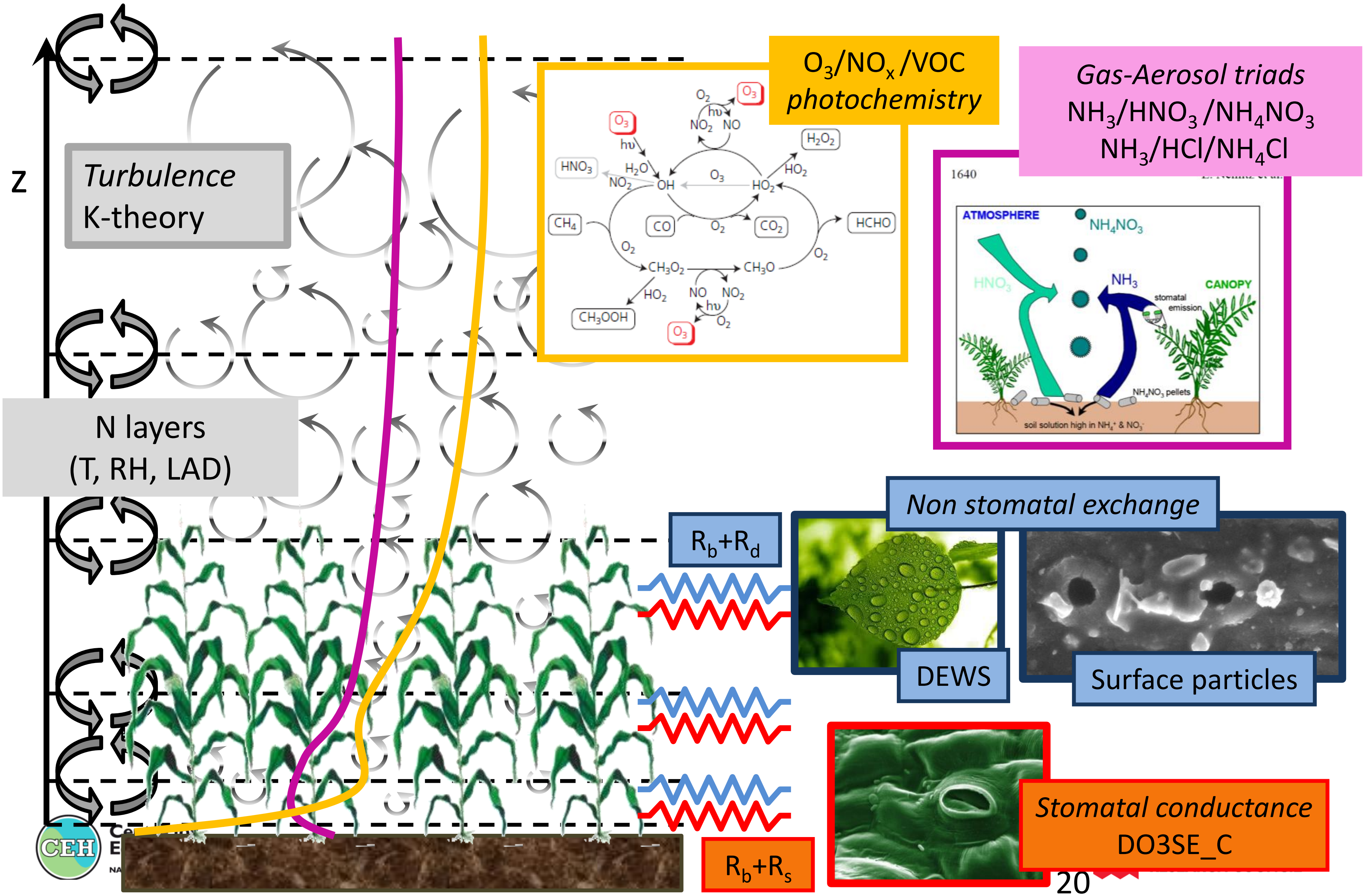
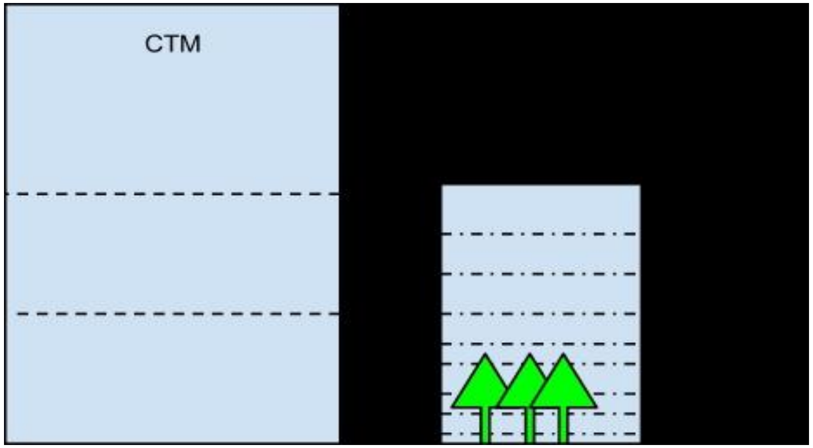
Task 4.1/4.4. ESX overview



Task 4.1/4.4: ECLAIRE Ecosystem Surface Exchange (ESX)

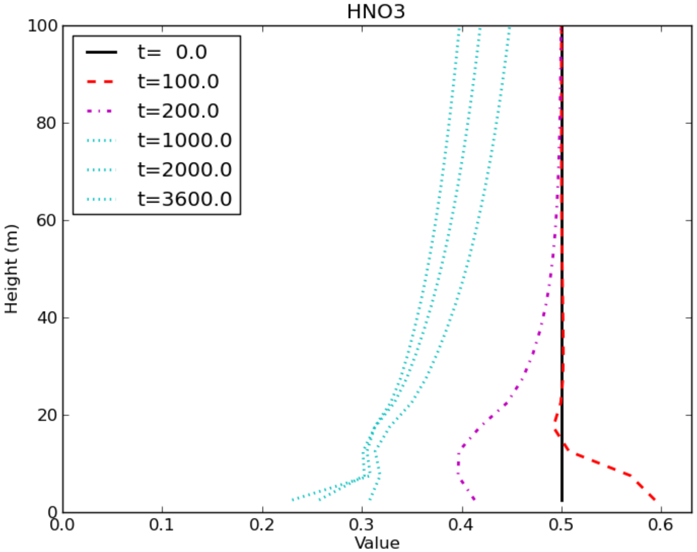
Basic scheme in place, for:

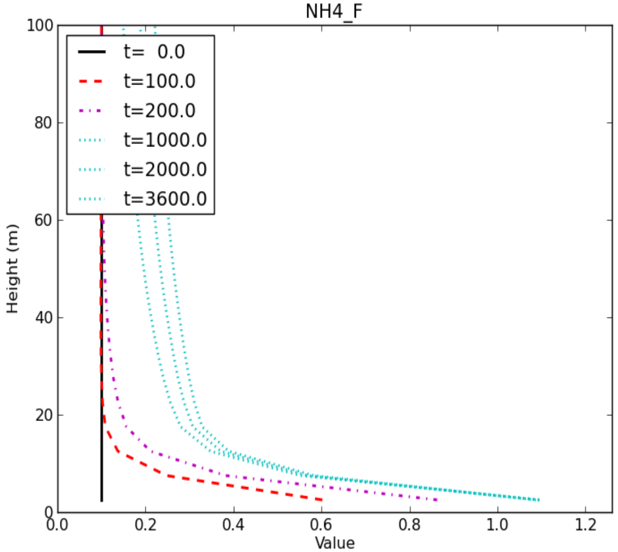
- Dispersion (3 schemes)
- Chemistry (2 schemes, including EMEP), including G/P partitioning NH_3-HNO_3 system
- Deposition (simple, EMEP/DO3SE, DO3SE-photosynthesis)
- Emissions



Next steps:

- Improved meteorology (PBL variations)
- DEWS





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