Quantification of C and N trace gas fluxes from a drained peatland forest in Finland using different measuring techniques

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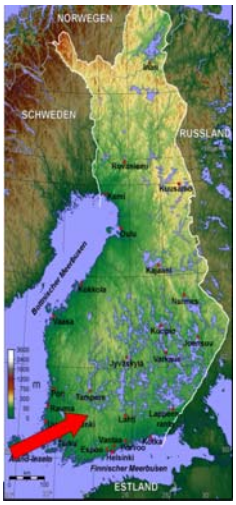
Background:

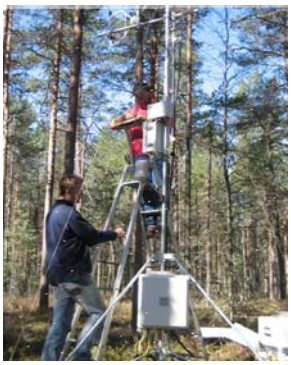
- 30% of Finnish timber production occurs on drained peatlands
- drainage of peatlands results in lowering of groundwater table (app. 40cm) and, thus, in a dramatic change of soil environmental conditions (e.g. soil water, aeration) with impacts on C and N turnover and associated GHG exchange

Hypothesis:

- drained peatland forests are high emitters of N_2O
- N_2O makes up an important part of the ecosystem GHG exchange
- N_2O fluxes measured by EC in the interstem section should be comparable to the N_2O fluxes measured by closed chamber method

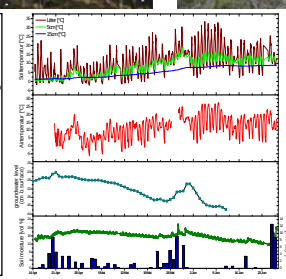


Site location



Location	60°38'N 24°21'E
Height above sea level (m)	130
Mean annual precipitation (mm)	686
Mean annual temperature (°C)	4.3
Soil type	drained peatland (1969)
	drainage distance 35m
Soil parent material	granite/ gneis
Vegetation (volume m³)	Pinus Silvestris 111.15
	Picea Abies 0.28
	Betula 4.46
Slope	flat
pH (CaCl2)	5.0
Bulk density 0-5 cm (g cm⁻³)	0.3
Soil C content (%)	49.16
Soil N content (%)	1.13
C-to-N ratio	43.5
Soil NO3-N conc. (mg l⁻¹)	<10
Soil NH4-N conc. (ml⁻¹)	3-5

Site characteristics



Climatic conditions 04-06 2007

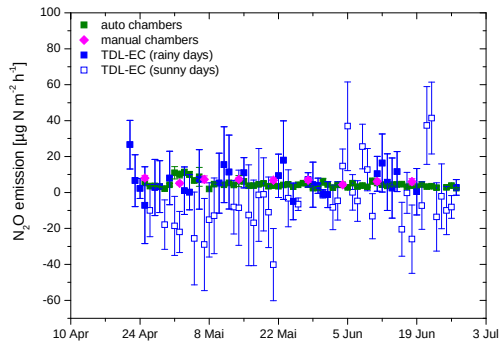
Measuring equipment:

Automatic chamber measurements

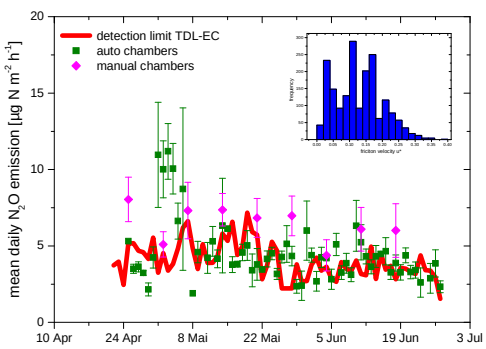
- Valve driven automatic sampling system, (IMK-IFU)
- 9 Measuring chambers (50x50x15cm), (IMK-IFU)
- Gaschrmomatograph equipped with ^{63}Ni ECD for N_2O, (SRI)
- GMD20D Infrared analyzer for CO_2, (Vaisala)

EC flux measurements

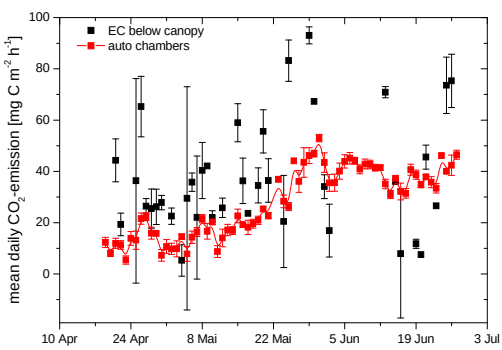
- CSAT3 Sonic Anemometer, (Campbell Sc.)
- Li-7500 Open-Path Infrared CO_2/H_2O Gas Analyzer, (Li-Cor Inc.)
- TDL-TGA100A for N_2O, (Campbell Sc.)



N_2O emissions with different measuring techniques



Chamber N_2O emissions and detection limit of TDL-EC



CO_2 emissions with different measuring techniques

Conlcusions:

- The drained peatland forest (app. after 40 years of drainage impact) was not a high source of N_2O, but frost thaw-event driven N_2O emissions can contribute to annual fluxes.
- At current stage N_2O is an insignificant component of the total GHG budget of this site and CO_2 is the main controlling component. However, this might be different by regarding a full cycle from drainage to first harvest of timber.
- Due to the combination of low N_2O emission levels and insufficient turbulent conditions EC-TDL based N_2O emission measurements are highly uncertain. However, EC based CO_2 emissions compared better with chamber based measurements

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