



Energy research Centre of the Netherlands

Greenhouse gases from peat areas

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Outline

- Background
- Objectives
- Measurement sites and instrumentation
- Results
- Conclusions

Background: Land-use change on peat land

Holland 2000 years ago ...



Background: Land-use change on peat land

Holland 2000 years ago ...



Holland now



Background: Land-use change on peat land



Land surface in 1848

CO₂ to atmosphere



Oxidation of peat

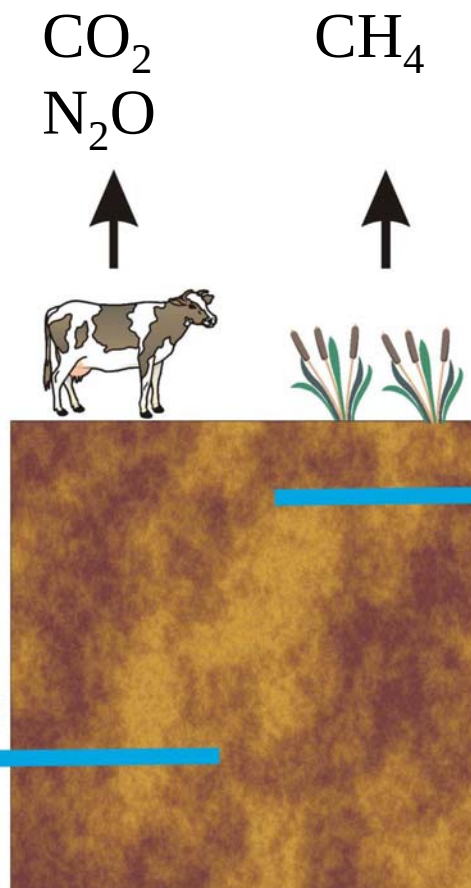
Drainage caused oxidation
and thus dramatic land
subsidence in East England

Land surface in 2000

Background: Land-use change on peat land

Agriculture:

CO₂ from peat decomposition
 N₂O from manure
 Stronger greenhouse effect
 Soil subsidence and rising sea level



Nature/wetland:

High water level

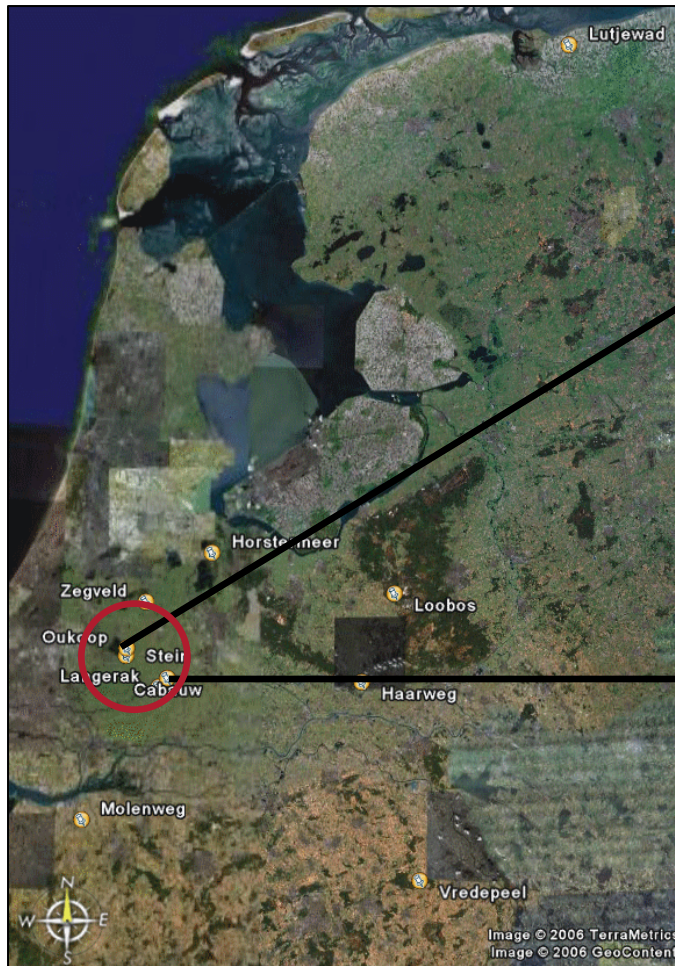
Wetland restoration:

Fixing CO₂ in new peat
 More CH₄
 Less agriculture

Objectives

1. To determine the greenhouse gas emissions of CH_4 and N_2O from a mainly agriculture used peat area
2. To determine the effect of water management on the greenhouse gas emissions of CH_4 and N_2O from a managed peat site
3. To investigate the distribution by turbulence and the chemical properties of the greenhouse gases CH_4 and N_2O
4. To validate the accuracy of eddy covariance measurements of CH_4 and N_2O

Measurement sites and instrumentation



Oukrop



Cabauw



Measurement sites and instrumentation



Sonic anemometer

Wind measurements

Temperature measurements

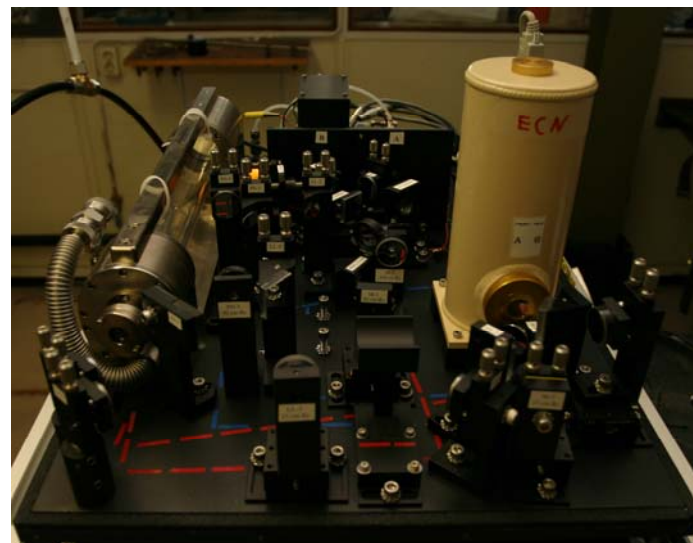
Tube connected to QCL

CH₄ measurements

N₂O measurements

Measurement sites and instrumentation

Quantum cascade laser

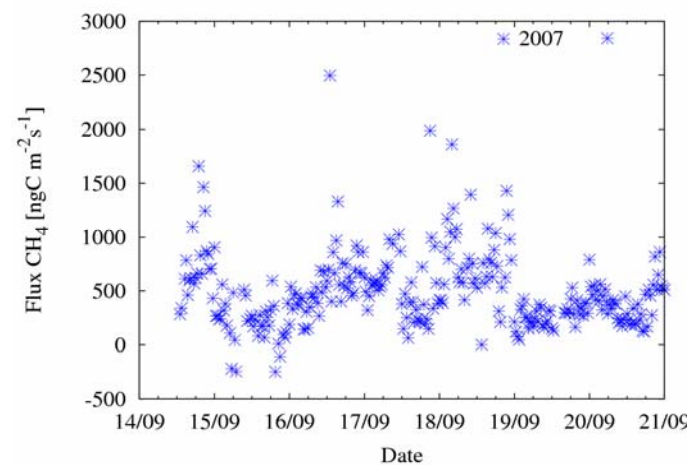
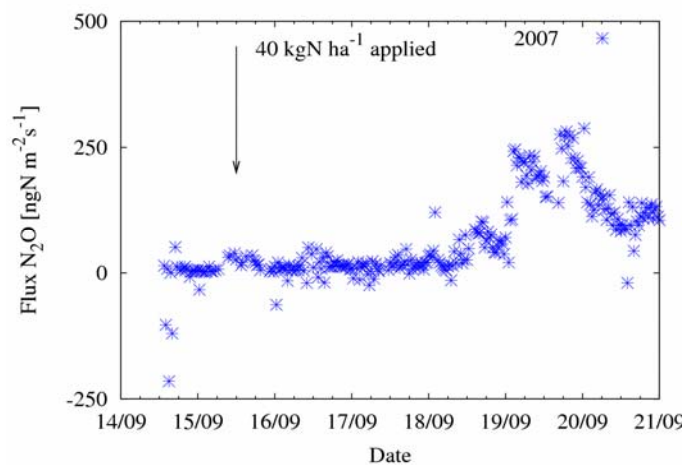
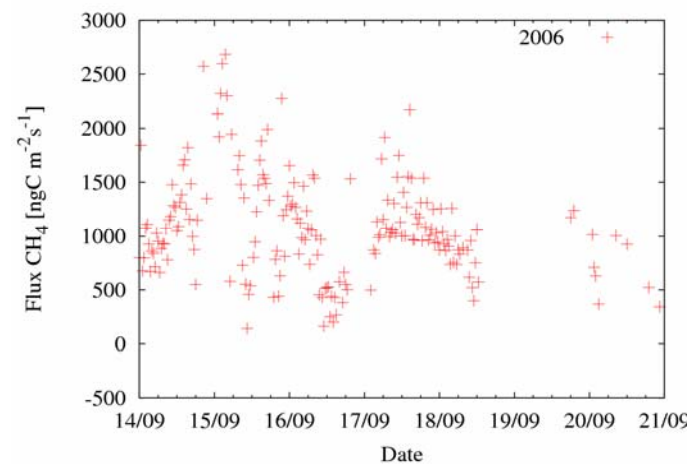
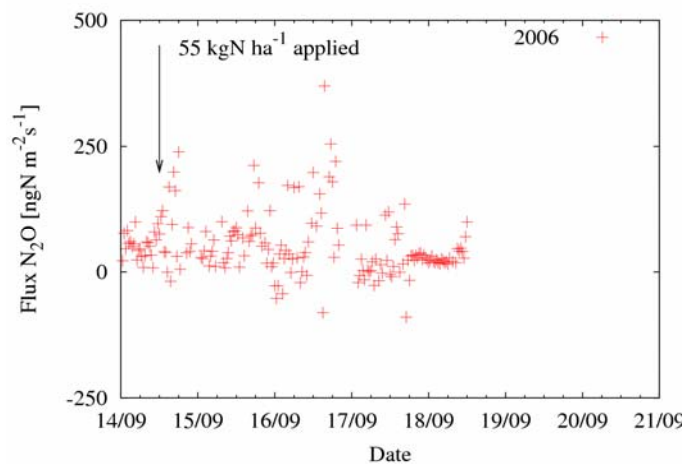


Requirements eddy covariance measurements:

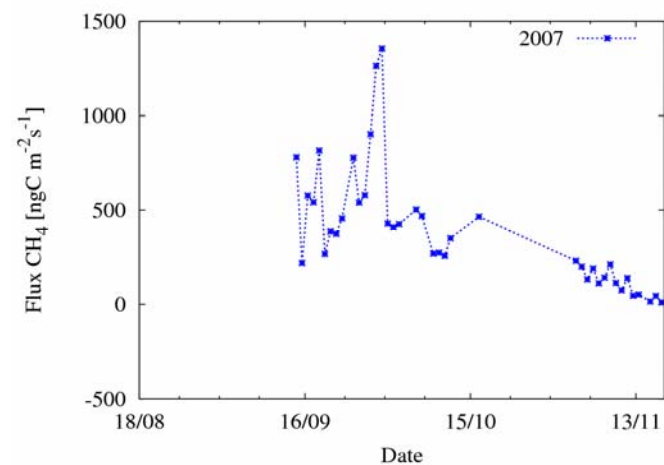
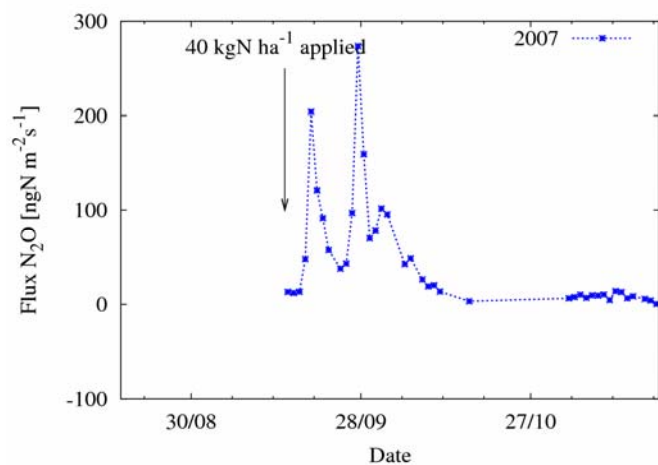
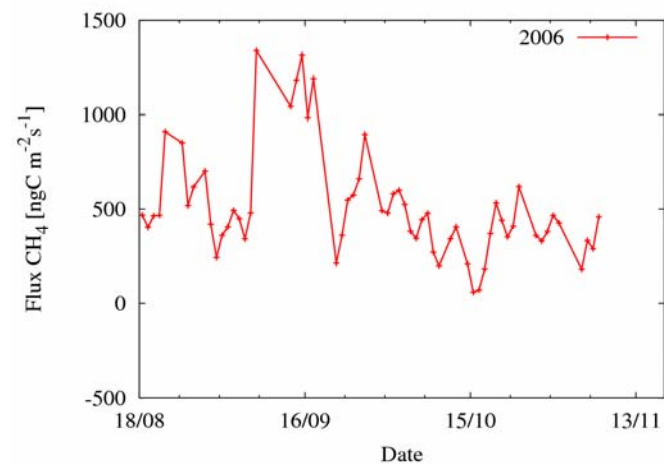
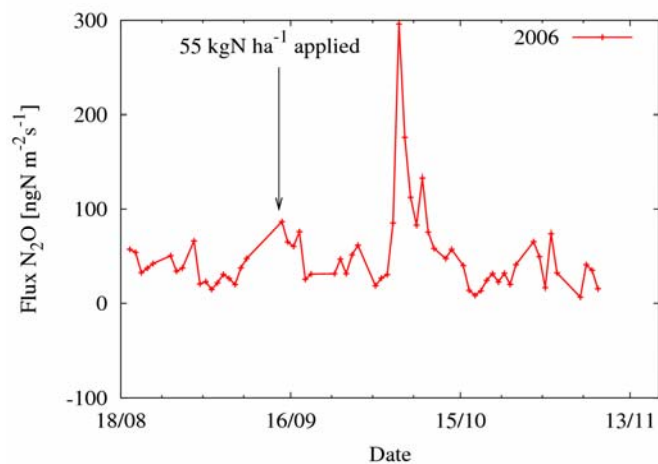
- Sampling frequency at least 10 Hz
- Stationair at least over 30 min
- Continuously running
- Sensitivity of 0.3 ppb and 1 ppb for N₂O (average 310 ppb) and CH₄ (average 1800 ppb)

Kroon et al., BG, 2007

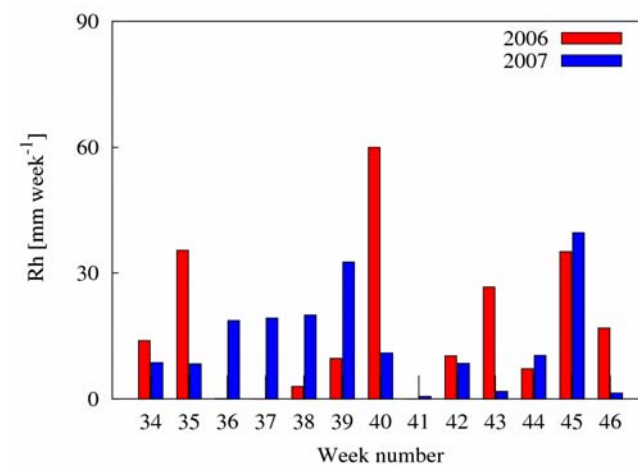
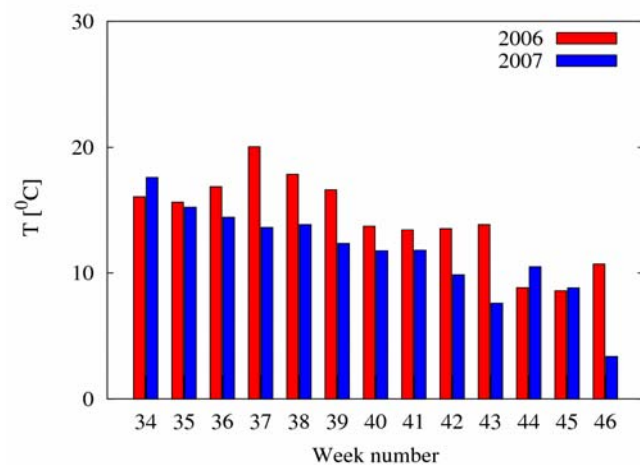
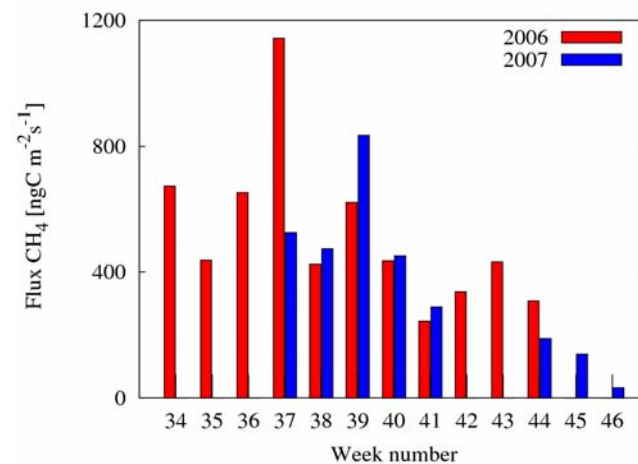
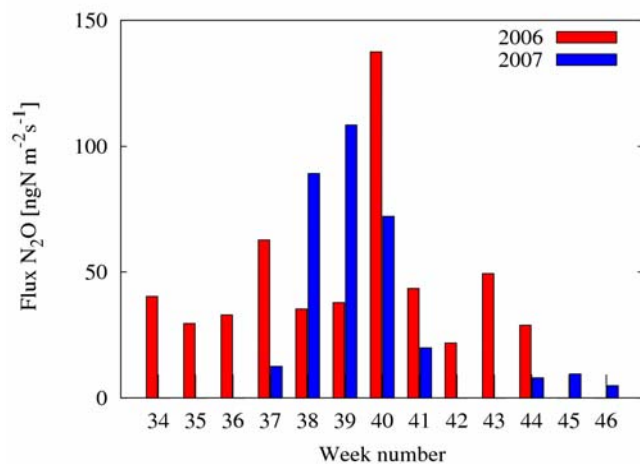
Results



Results



Results



Conclusions

- Quantum cascade laser spectrometry is suitable for EC-measurements of CH₄ and N₂O
- About 40% of the total N₂O emission was due to a fertilizing event
- About 5% and 3% of fertilized N is emitted in 2006 and 2007
- The time of the N₂O emission peak is strongly related to precipitation

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