Seasonal and diurnal patterns of CH_4 and CO_2 fluxes from a reed-vegetated fen in South-West Germany

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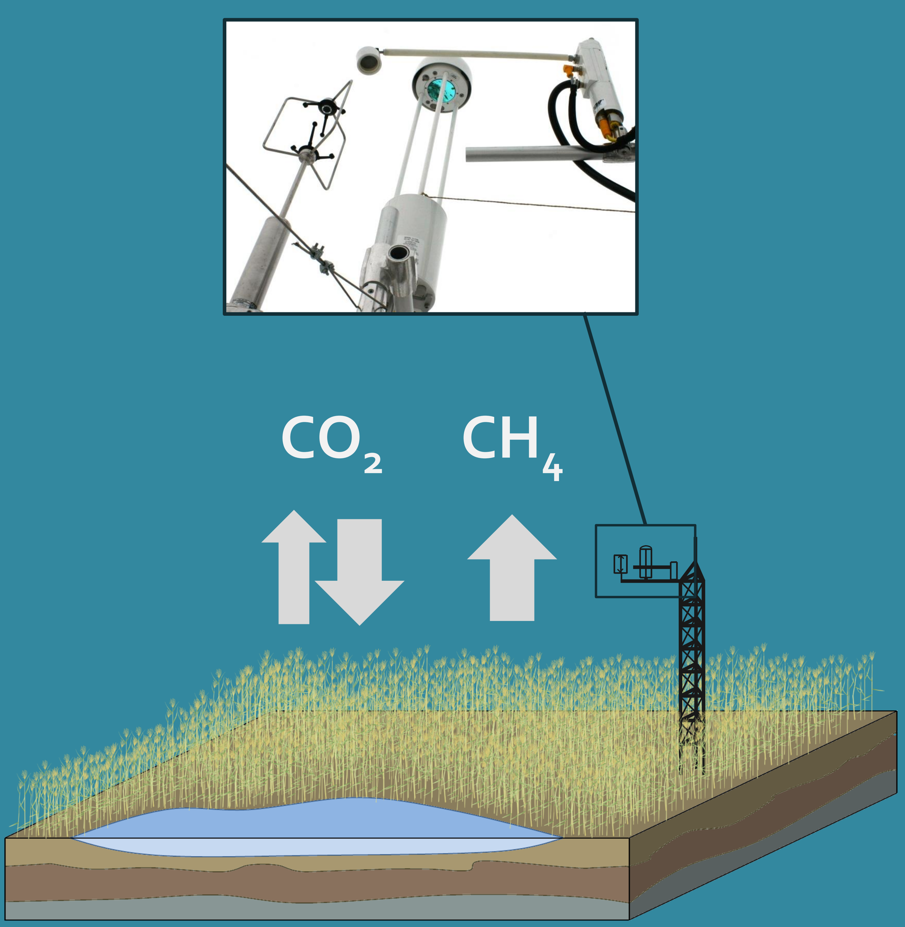
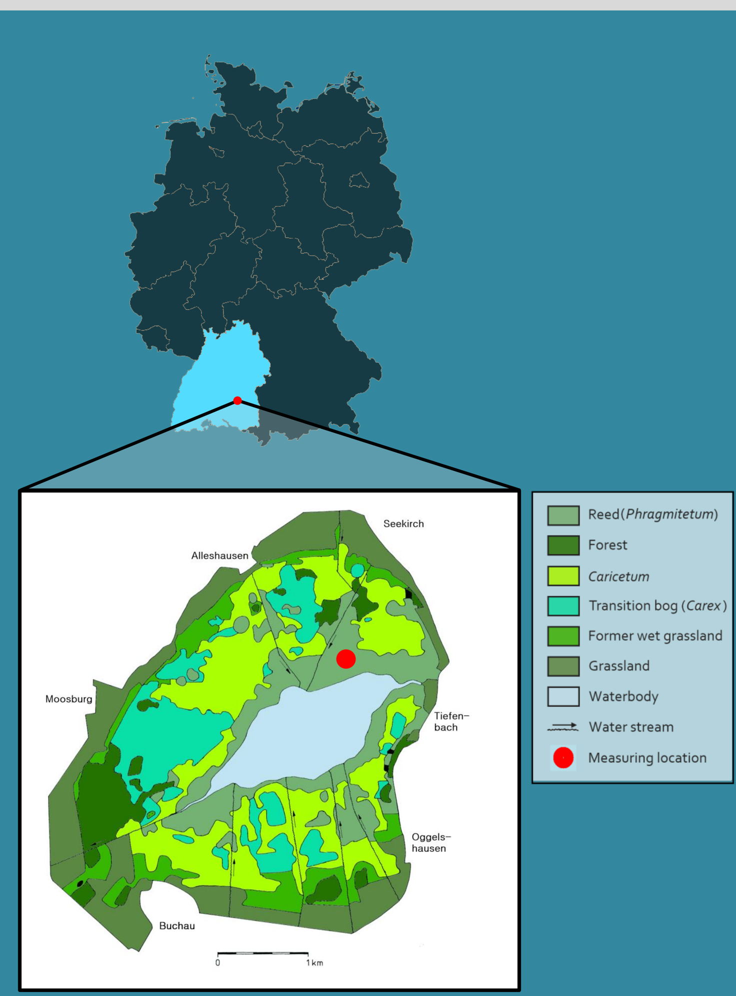
Measuring fluxes



The aim of this research is to capture seasonal and daily patterns of CO_2 and CH_4 fluxes from the reed area of the 'Federseemoor' by means of eddy covariance method (see figure left). The results will give a better understanding of factors that influence these fluxes, like vegetation and other environmental conditions.
Further, a carbon and greenhouse gas (GHG) budget is made for this system, for climate mitigating options.

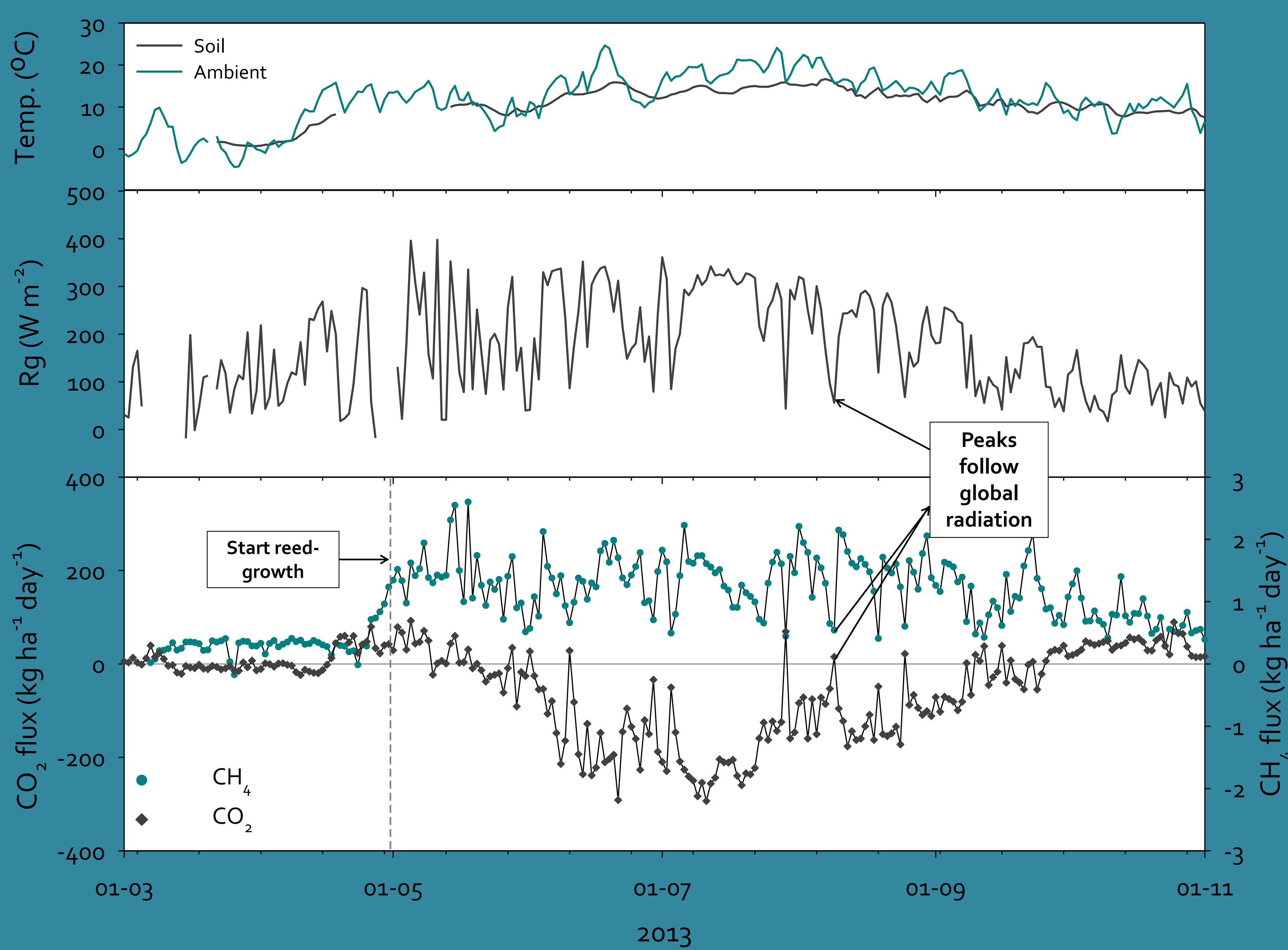
Research area

The 'Federseemoor' is a minerotrophic peatland, located in the region Upper Swabia in Germany (see figure right). The total peat area is 3500 ha, with in the center a lake of 140 ha. The lake is surrounded by 1400 ha of natural vegetation, including 230 ha of reed (*Phragmites australis*).
An eddy covariance tower was setup in such a way that only fluxes from the reed are captured (see figures left and right).



Seasonal pattern

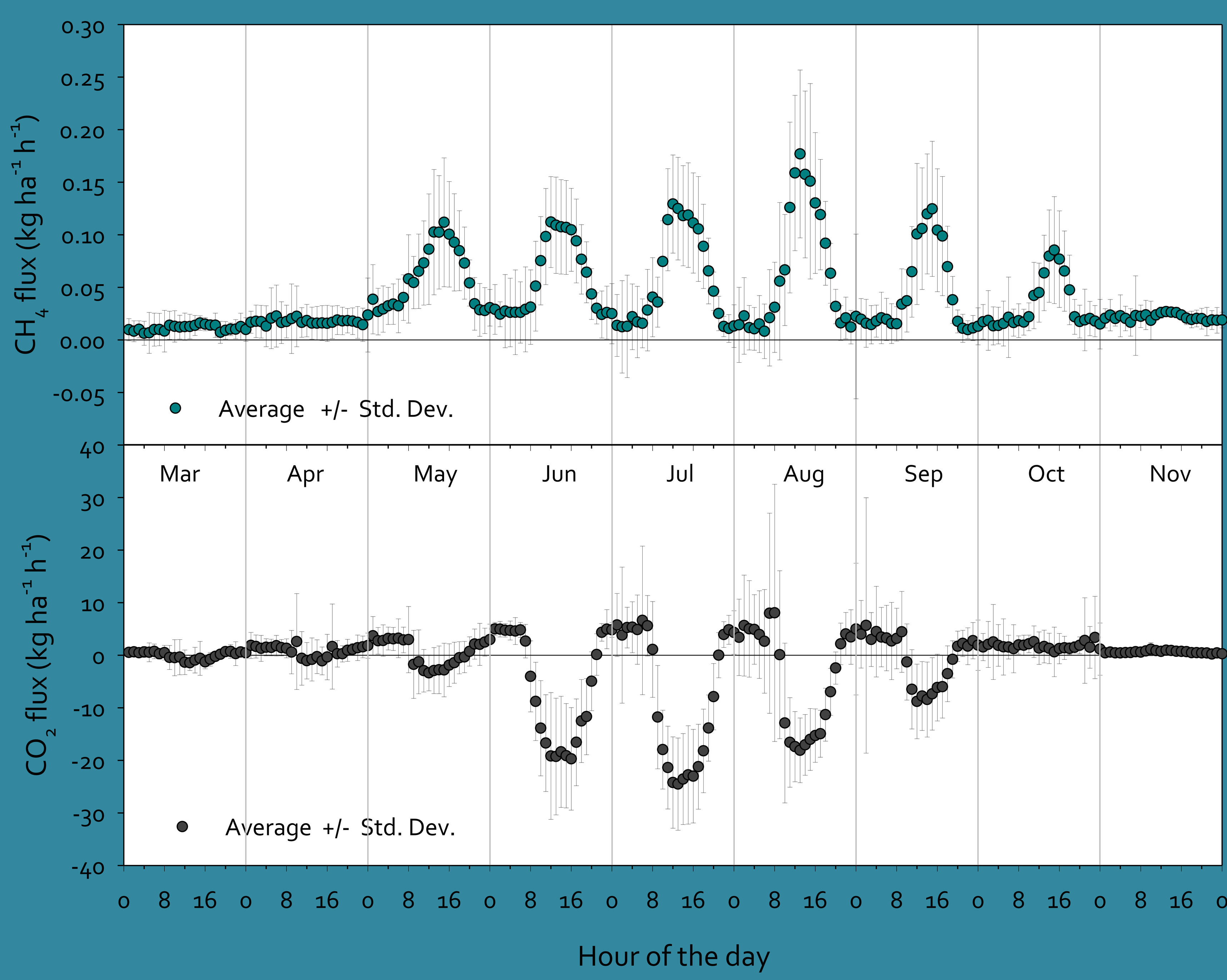
Daily averages



Over the whole season, both CO_2 and CH_4 fluxes follow the fluctuation in temperature and global radiation (Rg). The day to day differences for both gases are mostly synchronous with global radiation, which suggest a plant influence on the CH_4 fluxes as well.

Diurnal pattern

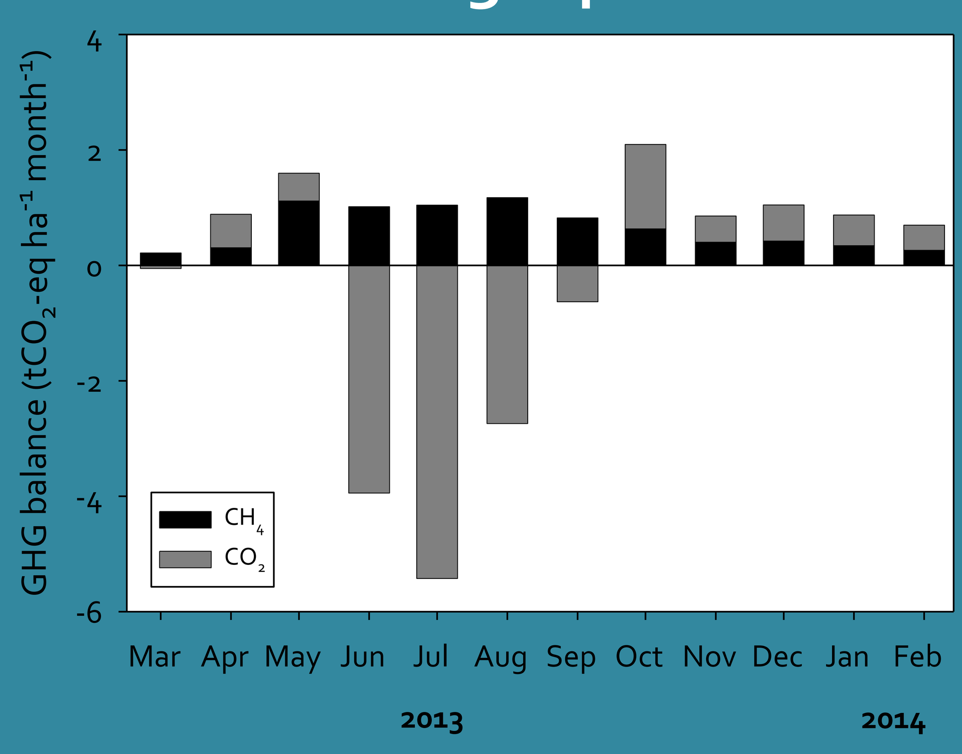
Hourly averages per month



The diurnal cycle of CH_4 during the growth period, with the highest fluxes around noon and the lowest during the night, supports the assumption of plant influence on the CH_4 fluxes. Reed is able to transport O_2 from the atmosphere to the soil and CO_2 and CH_4 in the other direction, with a humidity induced convective flow within the stem[1,2].

Greenhouse gas balance

GHG budget per month



Although a large amount of CH_4 is released from this fen, the system is still a sink for both carbon (-2.01 tC ha^{-1} yr^{-1}) and greenhouse gases (-0.48 tCO_2-eq ha^{-1} yr^{-1}), considering CH_4 as a 25 times stronger greenhouse gas than CO_2 [3], and neglecting N_2O.

Conclusions

Diurnal and day to day fluctuations of both CO_2 and CH_4 fluxes are following global radiation during the growth season. This suggests an influence of the vegetation on the fluxes. The influence on CH_4 can be explained by the gas transport mechanism of reed plants.
Respiration of plant residues in the soil is inhibited due to the almost continuous submerged conditions. Therefore this system is a carbon sink. During the whole year, there are positive CH_4 fluxes, but nevertheless the large amount of CO_2 storage makes this system a greenhouse gas sink.
Statistical analyses and field experiments will be done to better understand the influence of the vegetation and other environmental factors on the fluxes.

References: [1]Armstrong & Armstrong (1991) A convective through-flow of gases in *Phragmites australis* (Cav.) Trin. ex Steud. *Aquatic botany.* **39** 75-88; [2]van der Nat *et al.* (1998) Diel methane emission patterns from *Scirpus lacustris* and *Pragmites australis*. *Biogeochemistry* **41** 1-22; [3] IPCC (2007) Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge (United Kingdom) and New York (USA)