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Reed-induced seasonal and diurnal patterns of CH4 and CO_2 fluxes from a fen in South-West Germany: A multi-method analysis

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About one third of all the soil carbon is stored in peatlands, even though they cover only 3% of earth's land surface. Therefore, peatland conservation or restoration as a climate mitigation option has gained much attention. Apart from the positive effect of carbon storage in peatlands, there is also the effect of the natural production of CH4, which is a 28 times stronger greenhouse gas than CO_2 over a 100 year time period. Therefore the question is how much peatlands can contribute to climate change mitigation. To gain more knowledge about this subject, a measurement campaign was set up in the reed (Phragmites australis) area of the minerotrophic peatland 'Federseemoor' (3500 ha). It was suspected that this reed area could release high quantities of CH4 due to the anoxic conditions in general and the capacity of reed vegetation to transport gas actively between soil and atmosphere in particular.
Against this background, CO_2 and CH4 fluxes have been measured by means of the eddy covariance method since March 2013. From these data it became clear that a strong diurnal pattern of CO_2 and CH4 fluxes starts when reed vegetation starts to grow. The pattern disappears after the growth season. The highest emissions of CH4 are measured during the day, around noon. This seems to be linked to humidity-induced pressure flow, caused by the ability of reed plants to exchange gases between the soil and atmosphere during the day. Therefore, our findings suggest that the fluctuation in CH4 fluxes during the growth season largely depends on the reed vegetation.
To investigate how much the gas transport mechanism of reed contributes to the total CH4 flux, a field experiment was set up in October 2014. Plots were made with cut reed and cut + sealed reed to exclude gas transport through the plants. Gas fluxes from these and control plots were measured with chambers. Additionally, pore water samples from the plots were analyzed for possible changes in soil chemistry due to the reduction of oxygen transport into the soil.
In our presentation, we will show the eddy covariance results from the last 2 years, give the first results of the field experiment and evaluate the main environmental factors influencing the CO_2 and CH4 fluxes.