Effects of rewetting on greenhouse gas emissions of cultivated fens

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Questions

• Which greenhouse gas mitigation potentials can be achieved for extensively cultivated fens with different duration of rewetting (6 and 18 years)?

• Which control factors affect the fluxes of the greenhouse gases?

Study Sites

Fig. 1: Sedge fen nearby Körzin, 50 km south of Berlin.
Fig. 2: Flood lawn with bentgrass and spike-rush nearby Krielow, 50 km west of Berlin.

Material and Methods

• Biennial measurement (05.14 - 04.16) of CO₂, CH₄ and N₂O in 2 to 3 week intervals with the chamber method (n = 3) after DRÖSLER (2005):
  - CO₂: dynamic mode, transparent chamber for NEE, opaque chamber for respiration, Licor 820
  - CH₄ und N₂O: static mode, 1 h duration, opaque chambers, intervals of 10 min.

• Recording of the control factors:
  - precipitation, air temperature, PAR \rightarrow weather station
  - water level \rightarrow piezometer, diver in groundwater pipe
  - DOC, NH₄-N, NO₃-N (n = 3) \rightarrow sampling of soil pore water and groundwater with suction cups and piezometers
  - soil temperature, soil moisture \rightarrow FDR-sensor in -5, -10 und -20 cm depth

• Once-only soil sampling (n = 4) and analysing of Cₚ, Corg, Nt, Norg, Cmic, Nmic, pH, bulk density and plant biomass after mowing

First Results

Fig. 5: CH₄-fluxes (means and standard deviation, n = 3) according to the groundwater level and soil temperature (-5 cm) from 01.05.14 to 01.06.15.

Fig. 6: N₂O-fluxes (means and standard deviation, n = 3) according to the groundwater level, ammonium- and nitrate-concentration in the soil pore water (-15 cm) from 01.05.14 to 01.06.15.

First Conclusions

• CH₄-fluxes seasonal controlled by groundwater level: increasing CH₄-emissions with increasing groundwater level and reverse

• CH₄-fluxes year-round dependent on soil temperature

• DOC-concentration of the soil pore water affects the CH₄-emissions: high DOC-concentrations (> 200 mg*l⁻¹) after 6 years of rewetting with high CH₄-emissions, lower DOC-concentrations (<100 mg*l⁻¹) after 18 years of rewetting with lower CH₄-emissions

• N₂O-fluxes controlled by groundwater level:
  - N₂O-uptake at high water levels, N₂O-emission at low water levels

• Low N₂O-emissions caused by year-round low ammonium- und nitrate-concentrations

• No effect of rewetting duration on ammonium- and nitrate-concentration