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The switching of a mid-European temperate mire from carbon sink to source in extreme climate conditions


Krzysztof Fortuniak


Włodzimierz Pawlak


Mariusz Siedlecki

FACULTY OF GEOGRAPHICAL SCIENCES

University of Lodz
Poland

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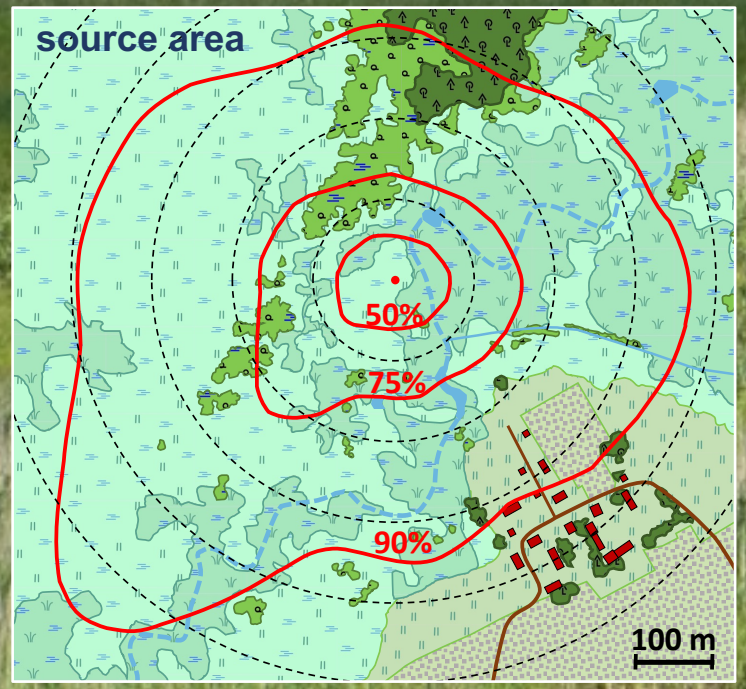
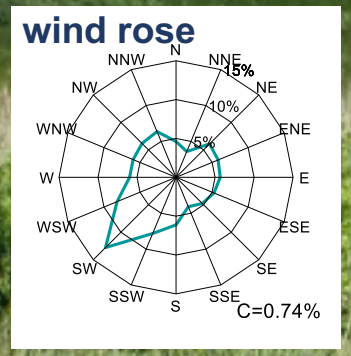
Eddy-covariance site in Kopytkowo (since 2013)

Biebrza National Park, northeastern Poland - the largest complex of coherent wetlands in Central Europe





sonic anemometer: RMYoung 81000
gas analyzers:
CO_2/H_2O Li-cor 7500
CH_4 Li-cor 7700

Measurements height 3.7m

The CO_2 and CH_4 fluxes are calculated for 1 hour intervals with the aid of EddyPro software

Data are gap-filled with different methods (NEE separation, look-up tables, artificial neural networks etc.)

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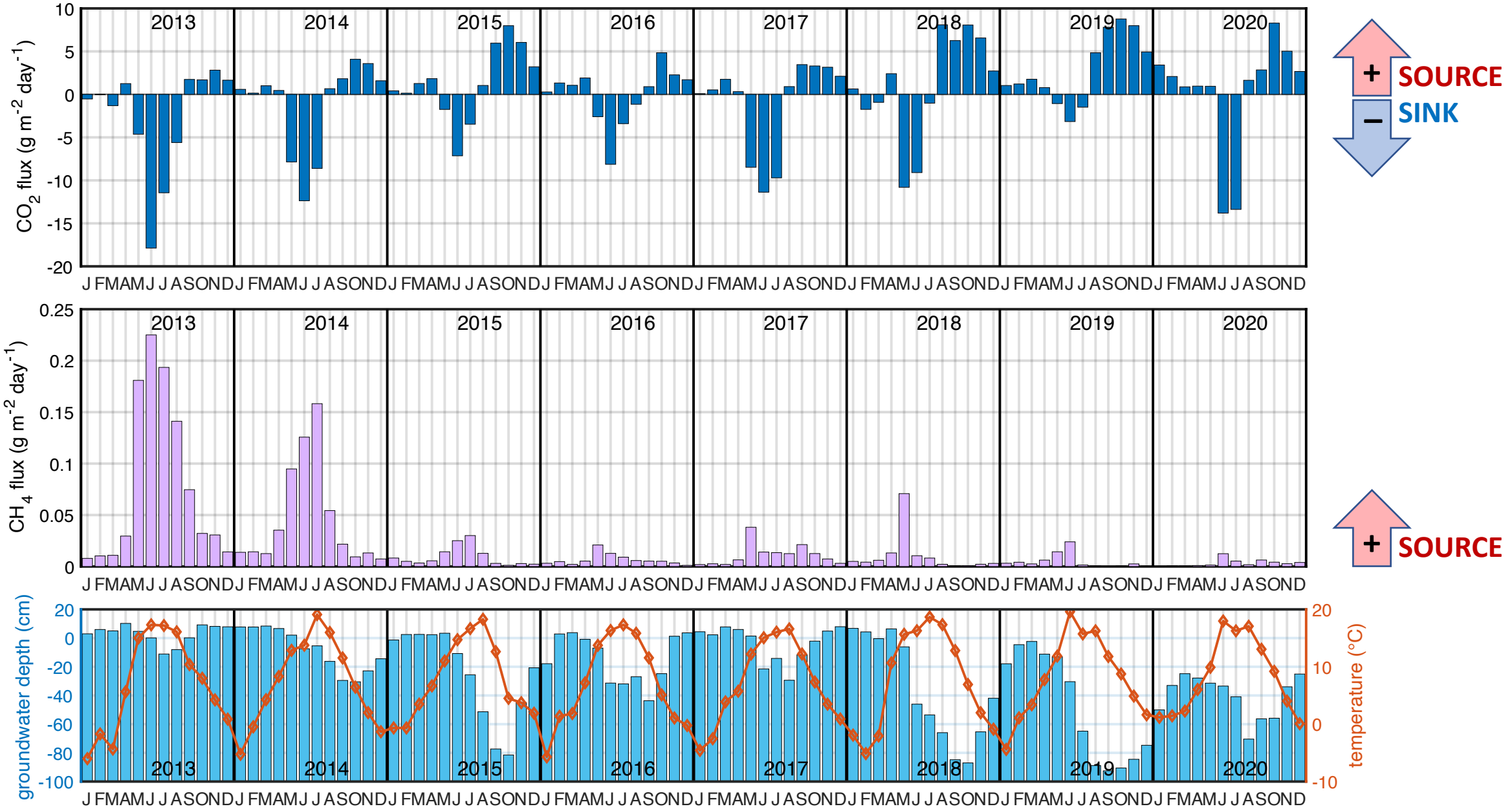
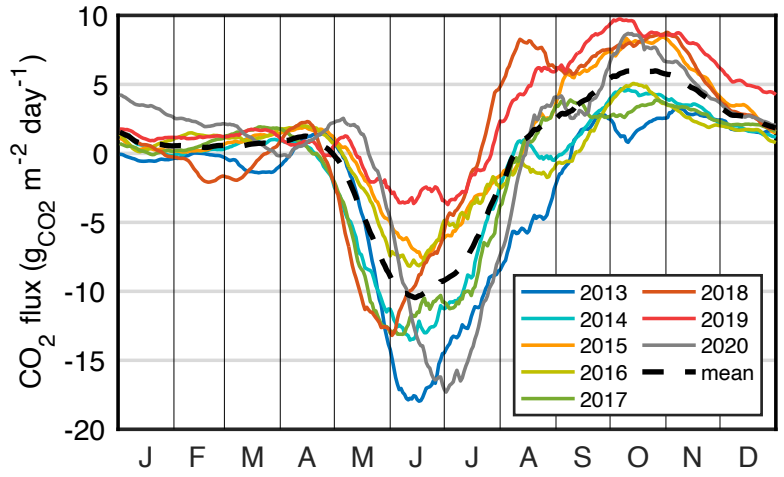
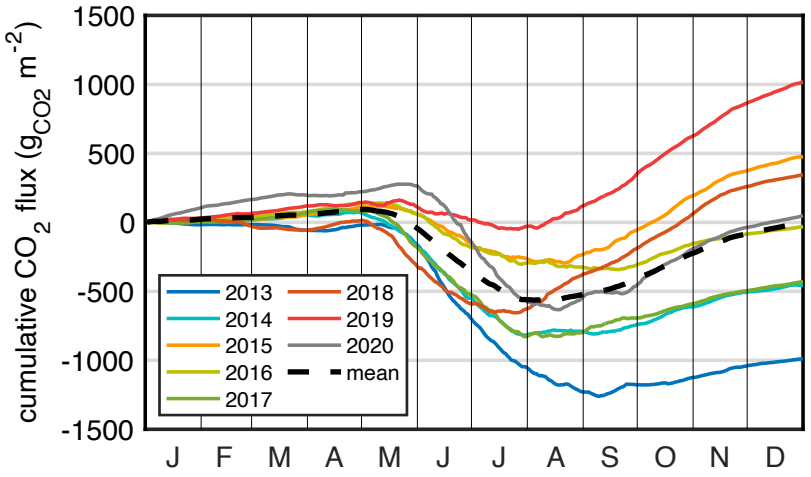
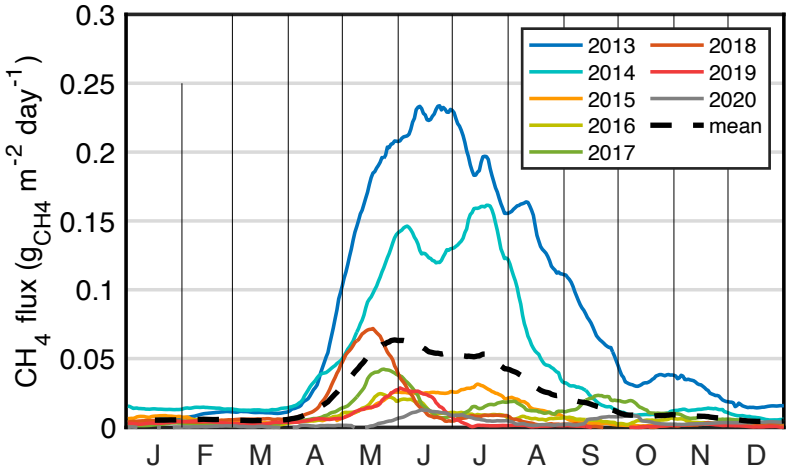
Mean daily flux by month

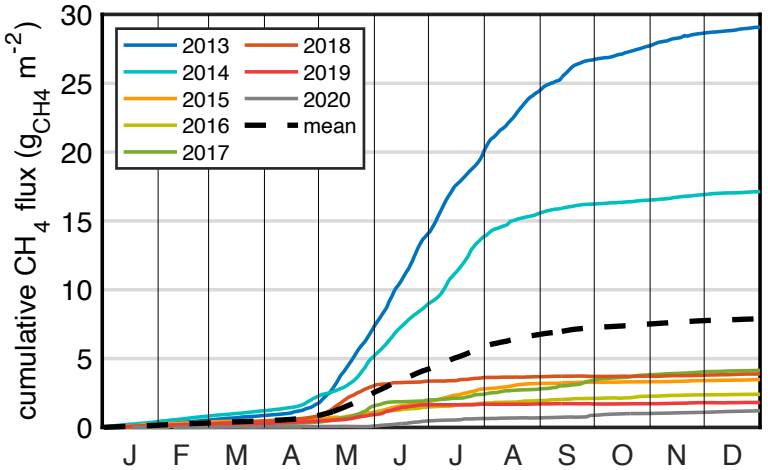


Mean and cumulative annual courses of CO_2 and CH_4 fluxes





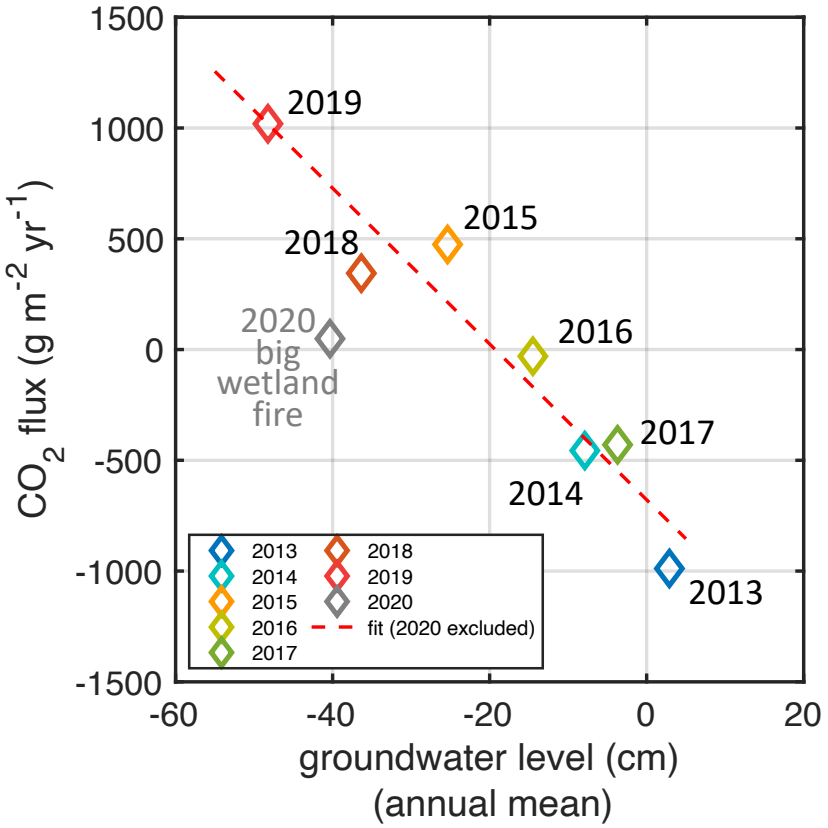


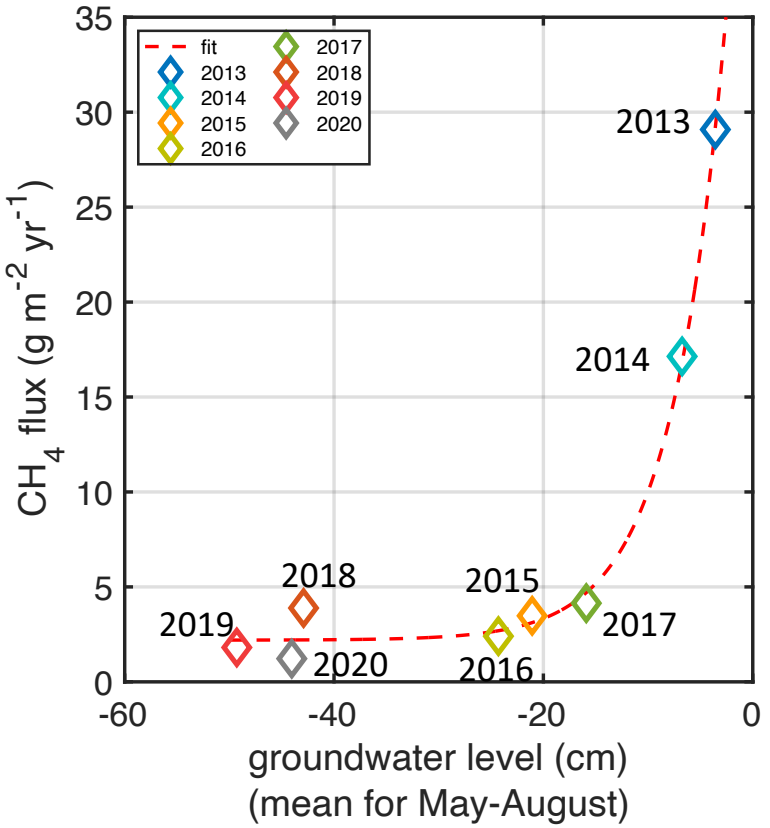


Annual totals of fluxes ($g\ m^{-2}\ yr^{-1}$)

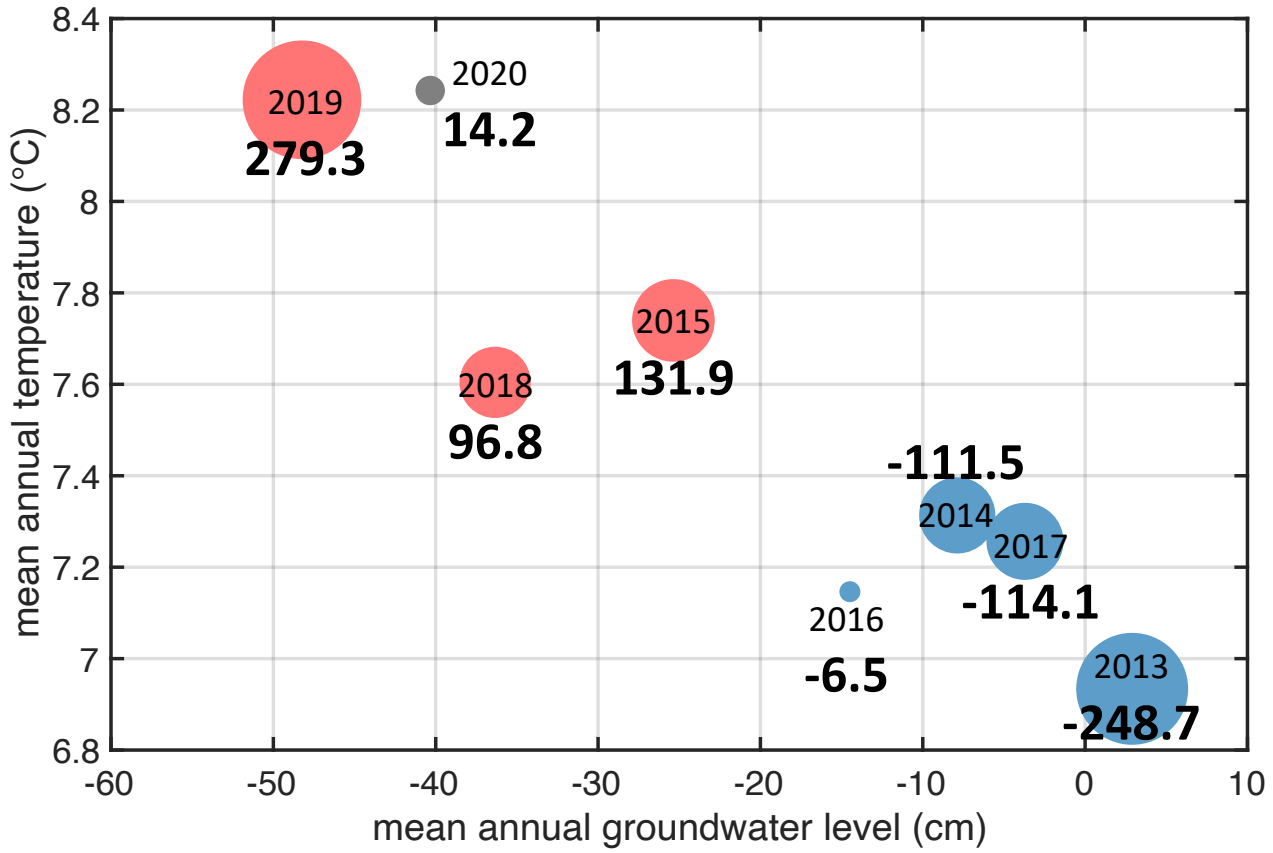
rok	F_{CO2}	F_{CH4}
2013	-990	29.1
2014	-460	17.1
2015	470	3.5
2016	-30	2.4
2017	-430	4.1
2018	340	3.9
2019	1020	1.8
2020	50	1.2
mean	-3	7.9

Annual totals of CO_2 and CH_4 vs. ground water level

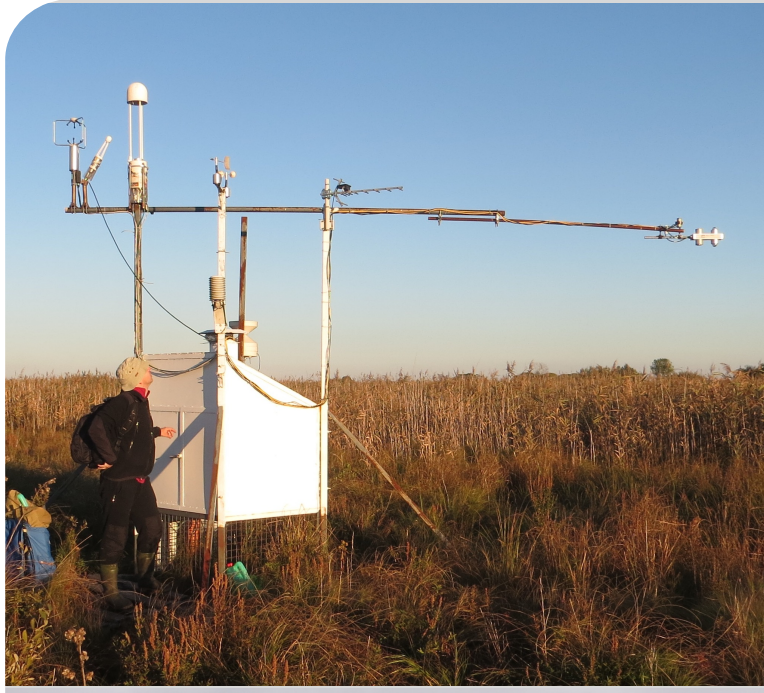




Total annual C-CO_2 + C-CH_4 carbon flux on temperature vs. groundwater level plot



The flux values in gC-(CO2 + CH4) m^{-2} yr^{-1}.
The area of symbols corresponds to the net annual carbon flux



Conclusions

- In wet and cold years natural wetlands in Biebrza National Park are sink of CO_2 with annual capture up to 1000 g_{CO2} m^{-2} y^{-1} (and are also a sink of total atmospheric carbon C-CH_4 + C-CO_2). In dry and hot years (or if artificially drained) they becomes a source of CO_2 with emission up to 1000 g_{CO2} m^{-2} y^{-1}
- The reduction of CH_4 emissions in dry and hot years does not compensate for the increased release of CO_2.
- In the changing (non-stationary) climate conditions it is difficult even to assess whether the mid-European wetlands act as carbon source of carbon sink – because of the high inter-annual variability of net annual carbon flux, the multi-year average flux estimates can depend strongly on the chosen analysis period; specifically, the number of droughts episodes.
  Long term observations needed!

Thank you for your attention !