Wetland processes in LPJ-GUESS -new possibilities

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A little bit of history...

- Wetland processes have previously been included in the special WhyMe-version of LPJ-GUESS (**W**etland **Hy**drology and **Me**thane)

- New PFTs for the high latitudes were parameterised and incorporated by Wolff et al. (2008, 2010)

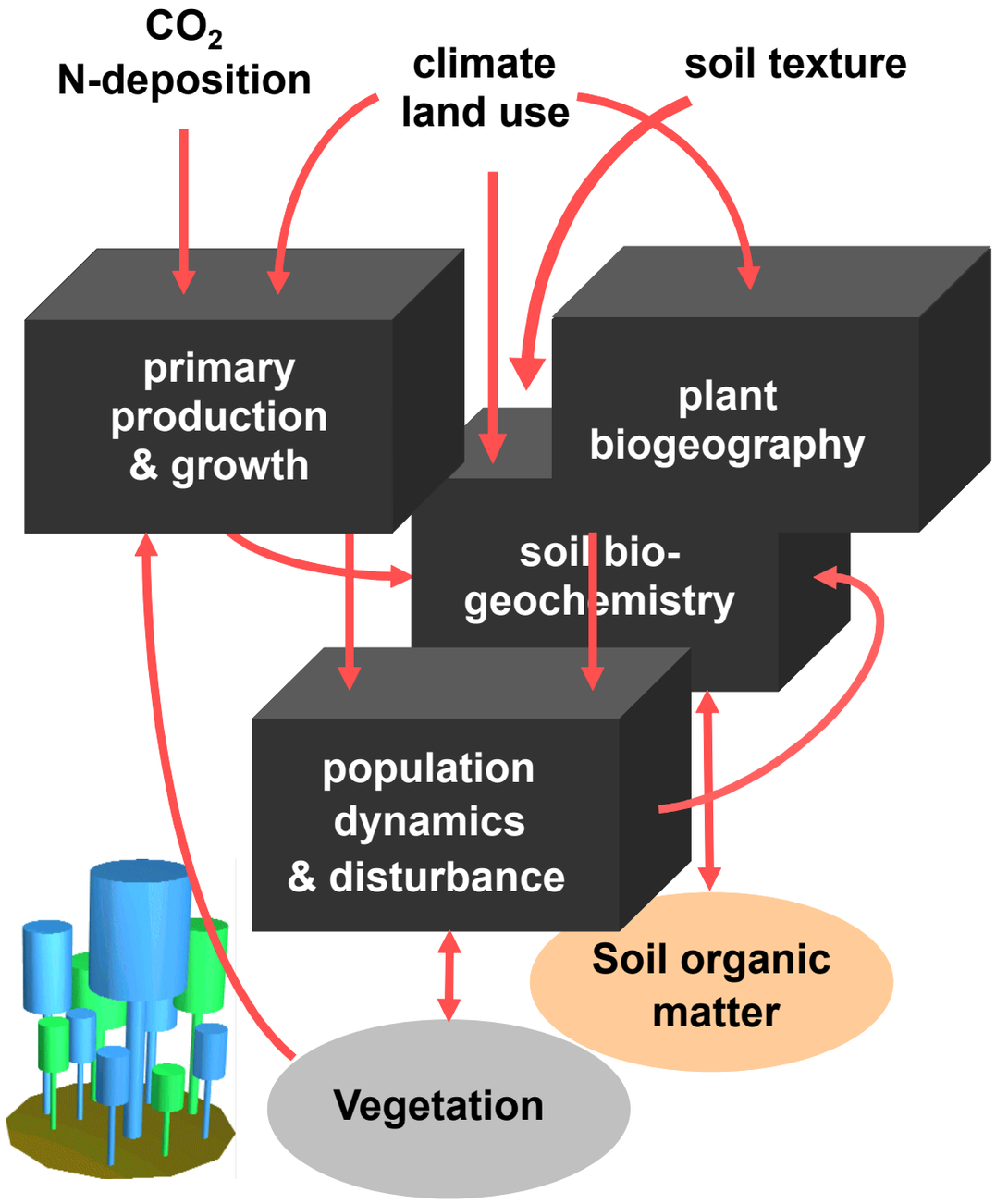
- N-cycling was incorporated with large implications on C-cycling and vegetation distribution

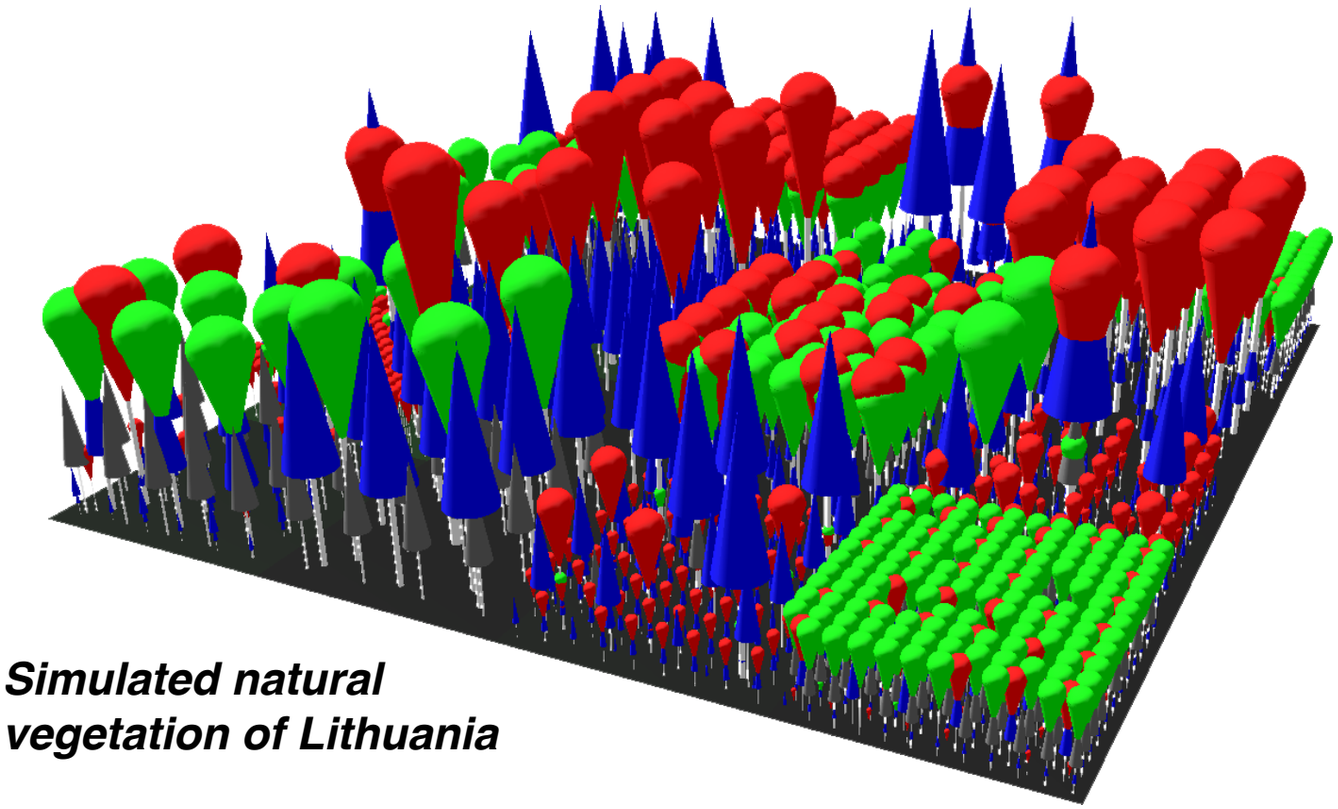
- These features have been incorporated into the framework of LPJ-GUESS, where also land use and land use change is modelled.

- Peatland heterogeneity have been investigated, where water was allowed to move from one patch to another

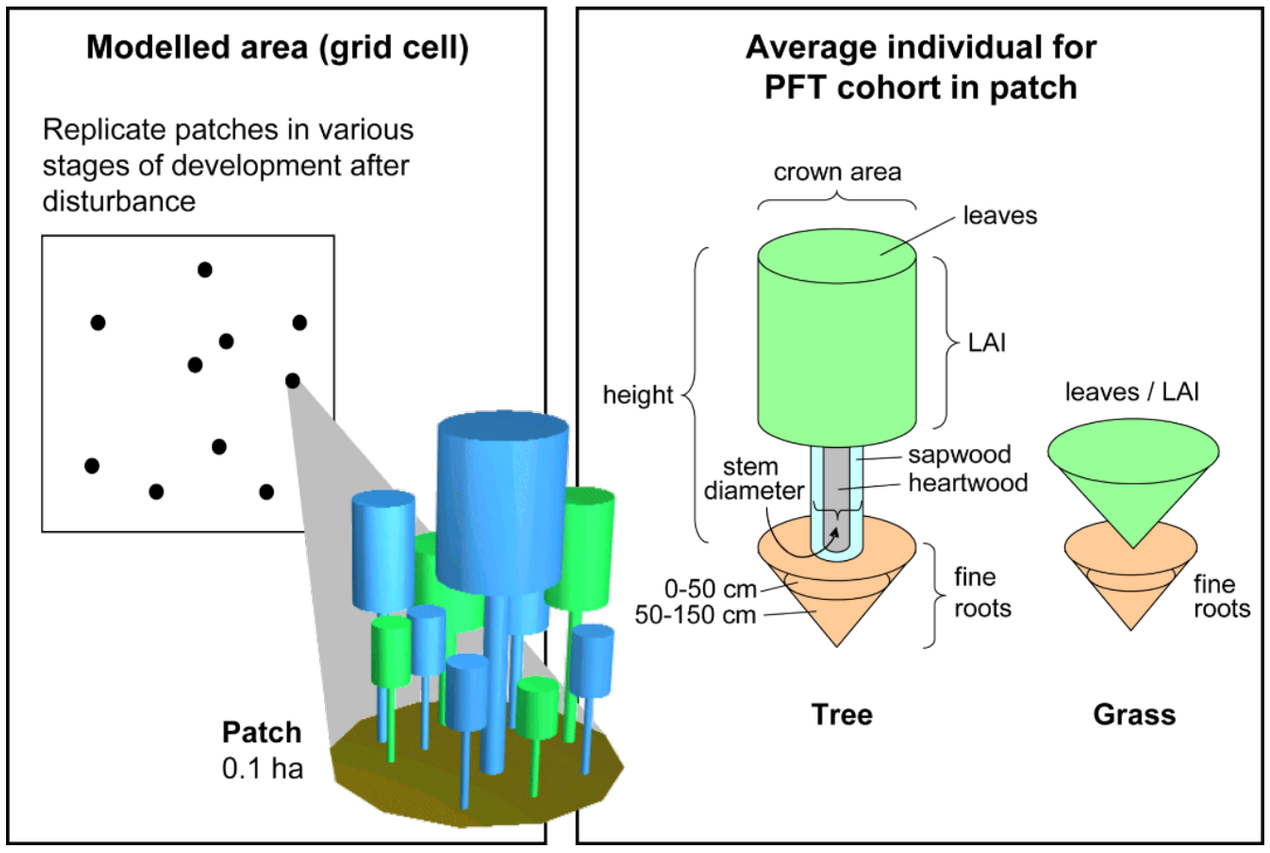
- DOC have been explored more recently

LPJ-GUESS – a global vegetation-ecosystem model



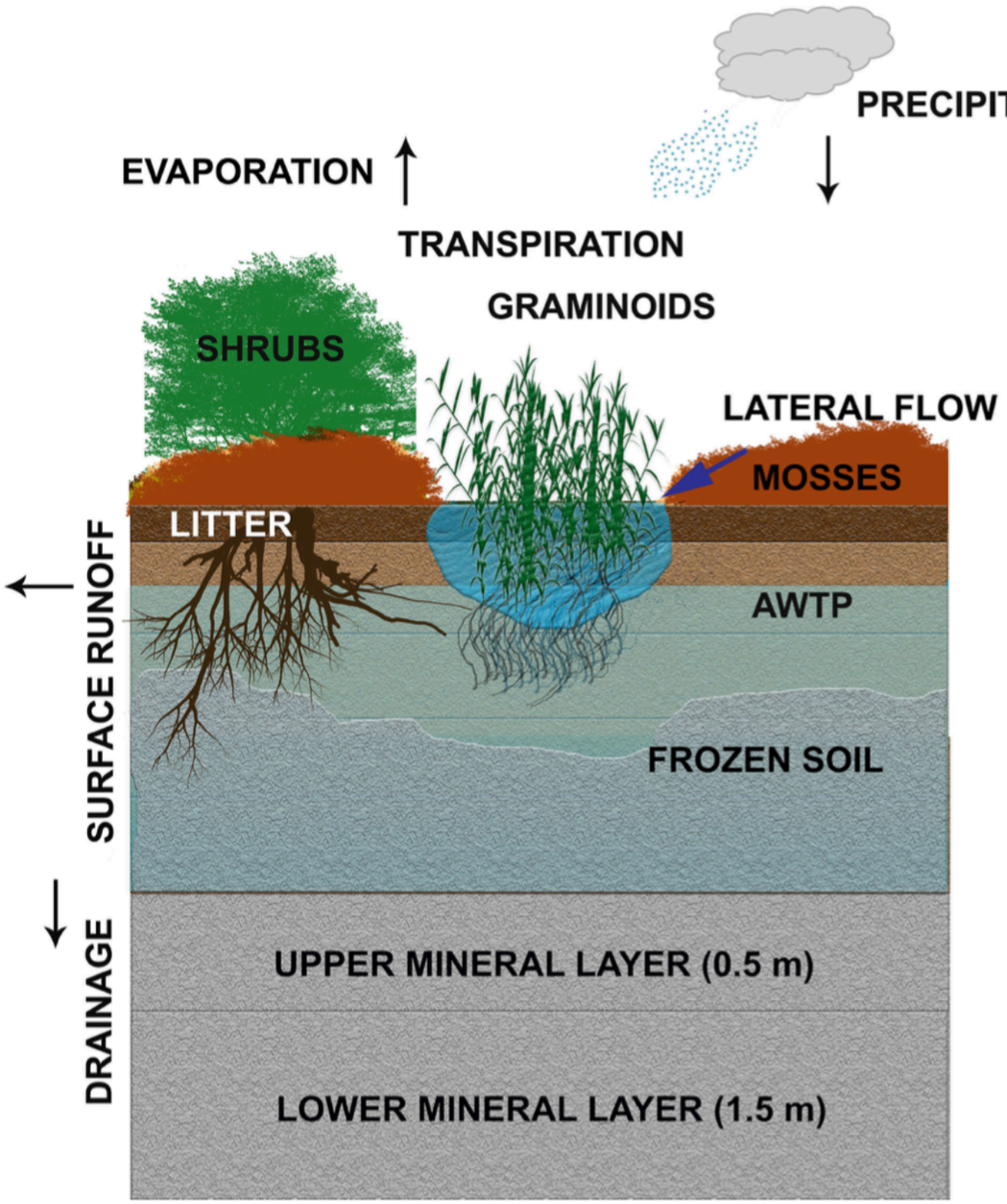


Simulated natural vegetation of Lithuania

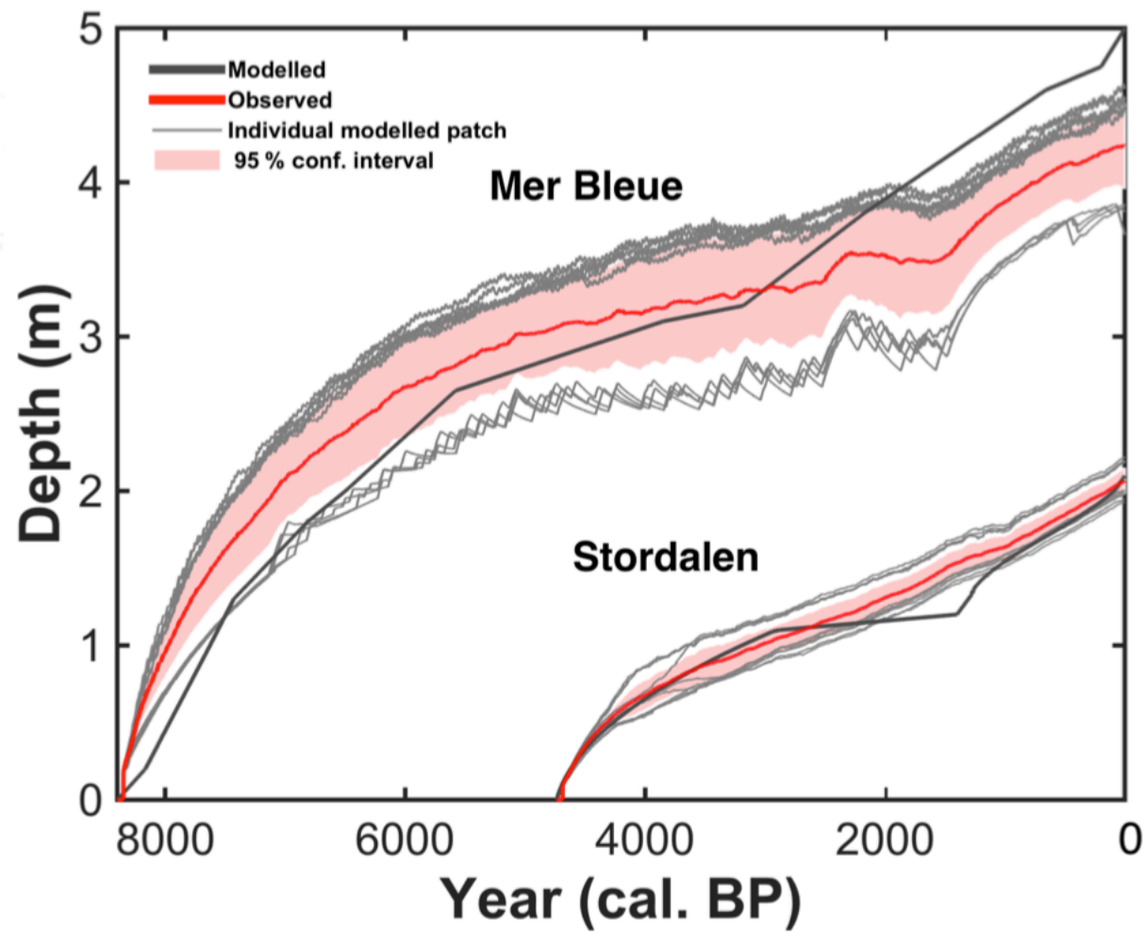


Smith et al. 2001, 2014

Representing peatland heterogeneity



Simulating peat build-up

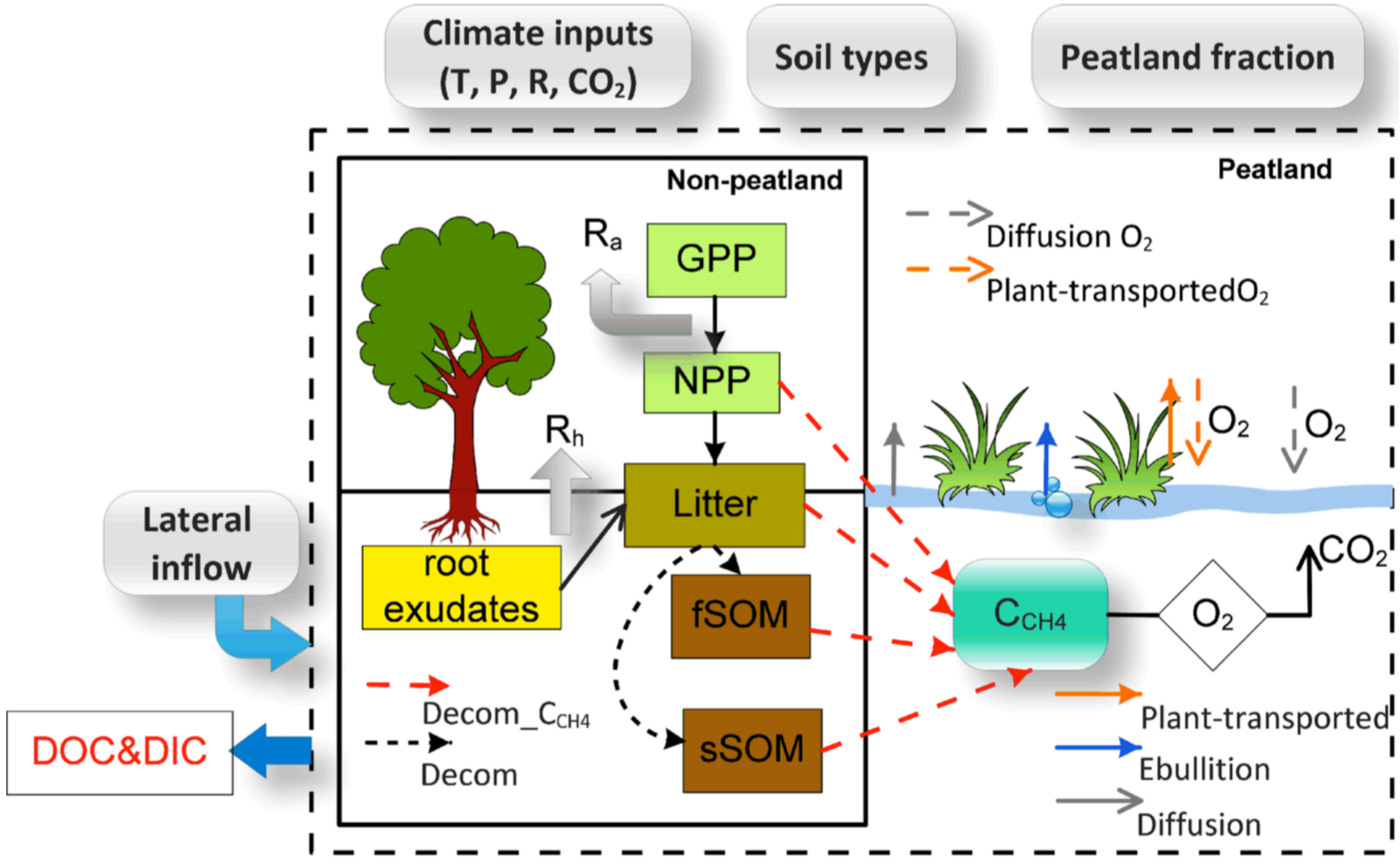


Chaudhary et al., 2017. Biogeosciences

Wetland hydrology

- A separate hydrology scheme for wetlands
- Soil is divided into acrotelm (sequentially inundated) and catotelm (permanently inundated)
- Water table position (WTP) in the acrotelm is modelled dynamically over time given climate input
- Evapotranspiration and runoff is dependent on the height of the WTP
- Wetland decomposition is reduced, which causes a larger buildup of peat/SOM.
- Plants become stressed if the water table position is too high, and PFTs tolerate inundation to a varying degree

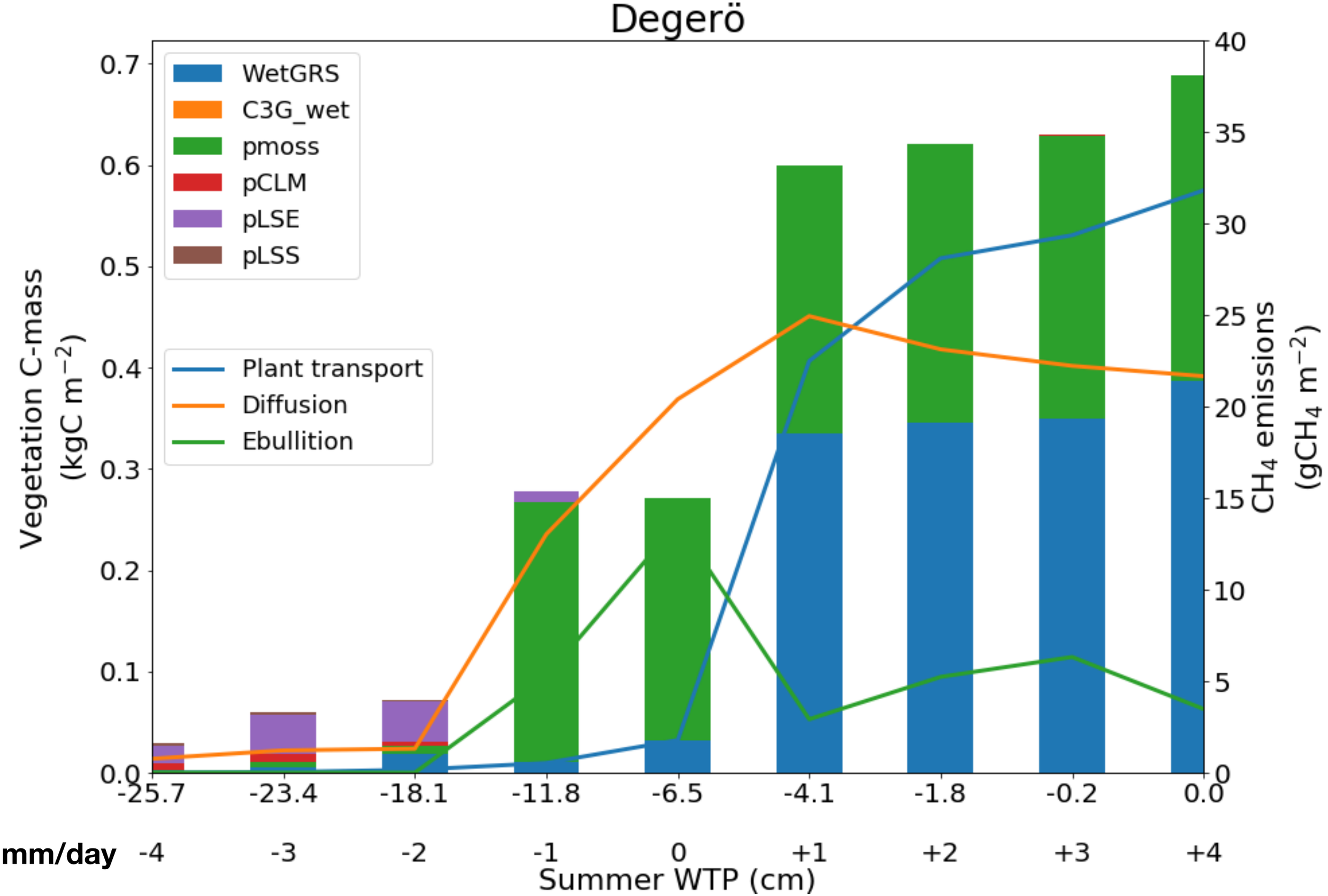
Methane



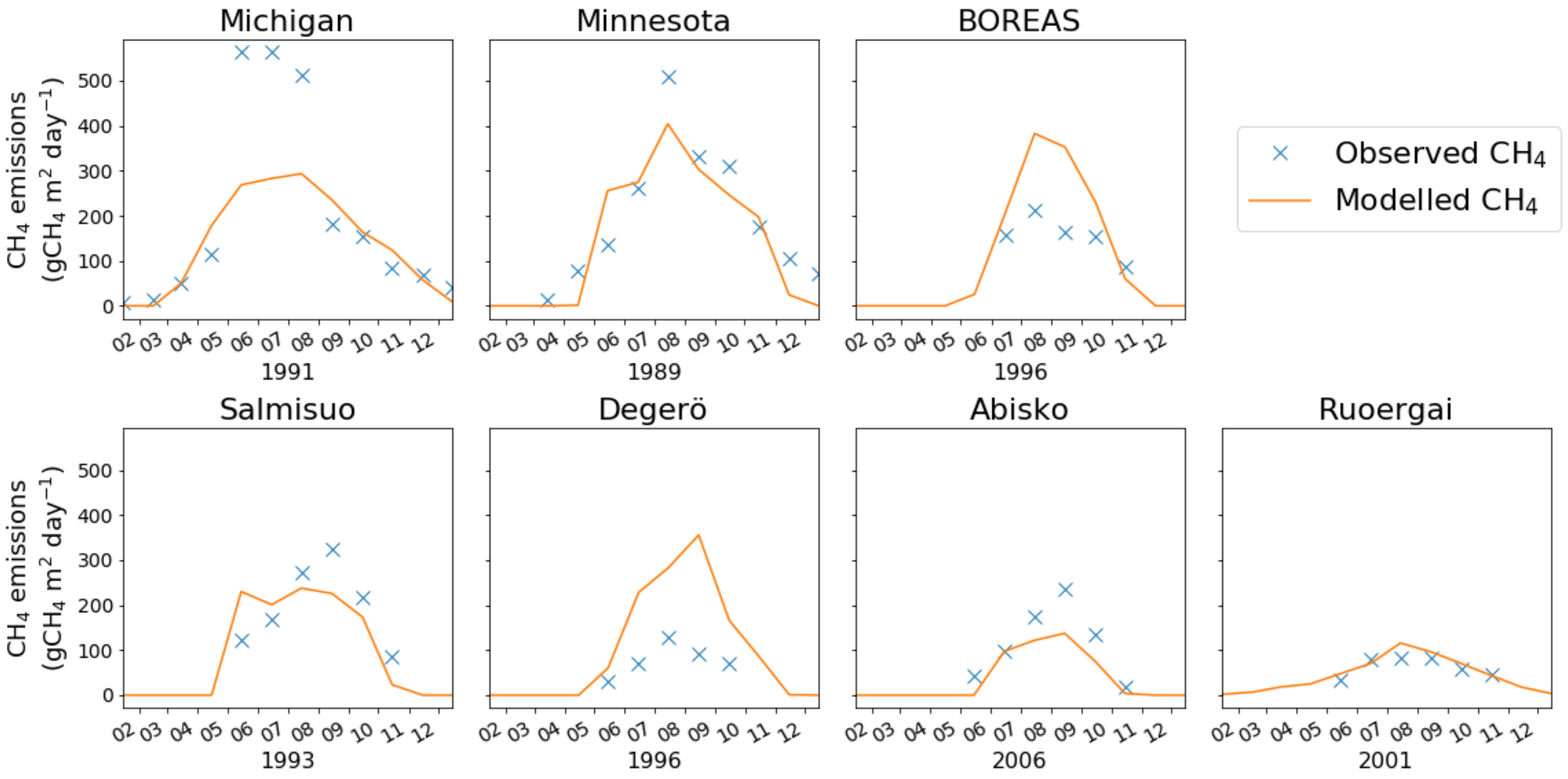
Wania et a., 2010. Global Biogeochemical Cycles

An example from Degerö

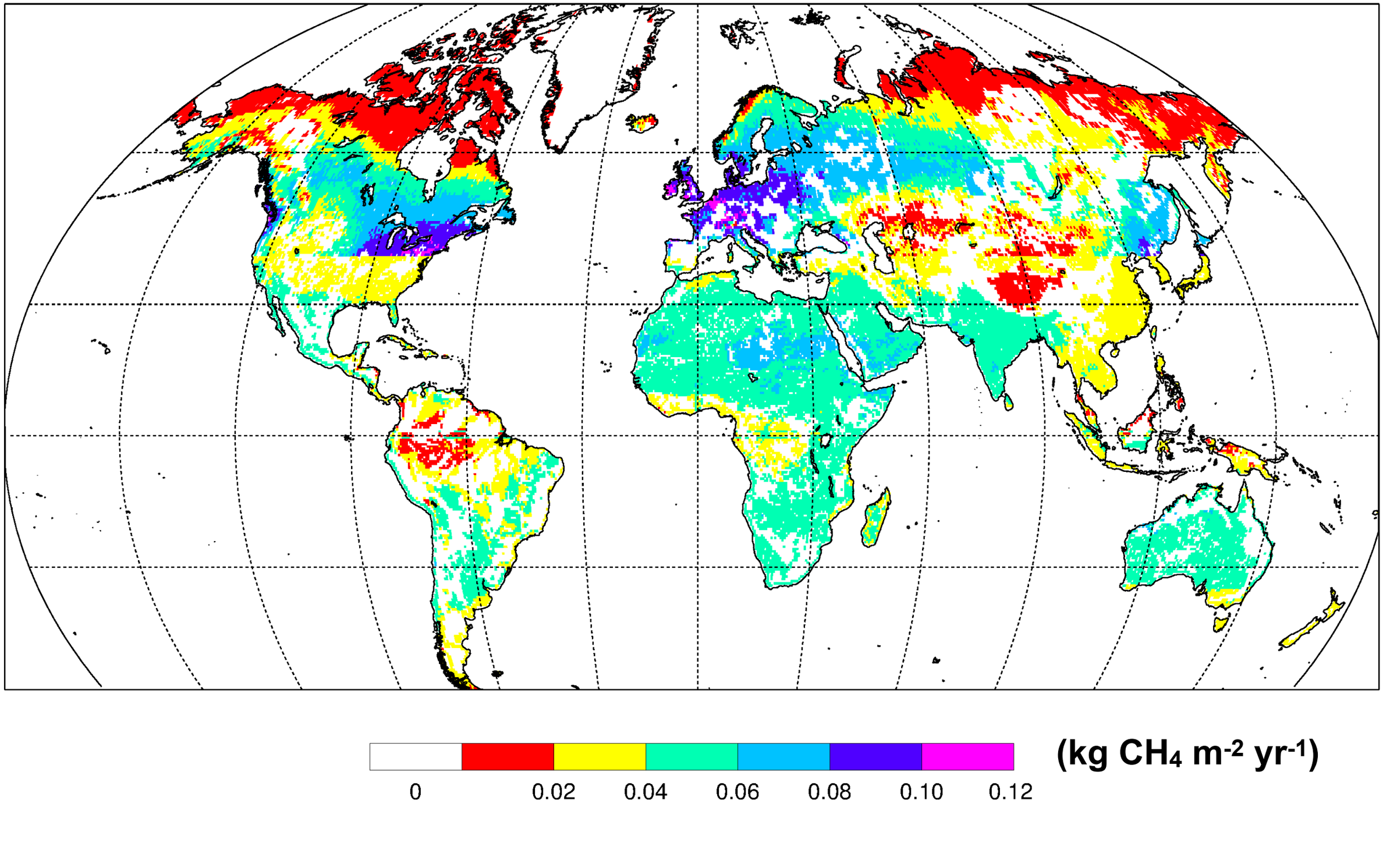
WTP drives plant composition and CH_4 emissions



Wetland emissions from sites

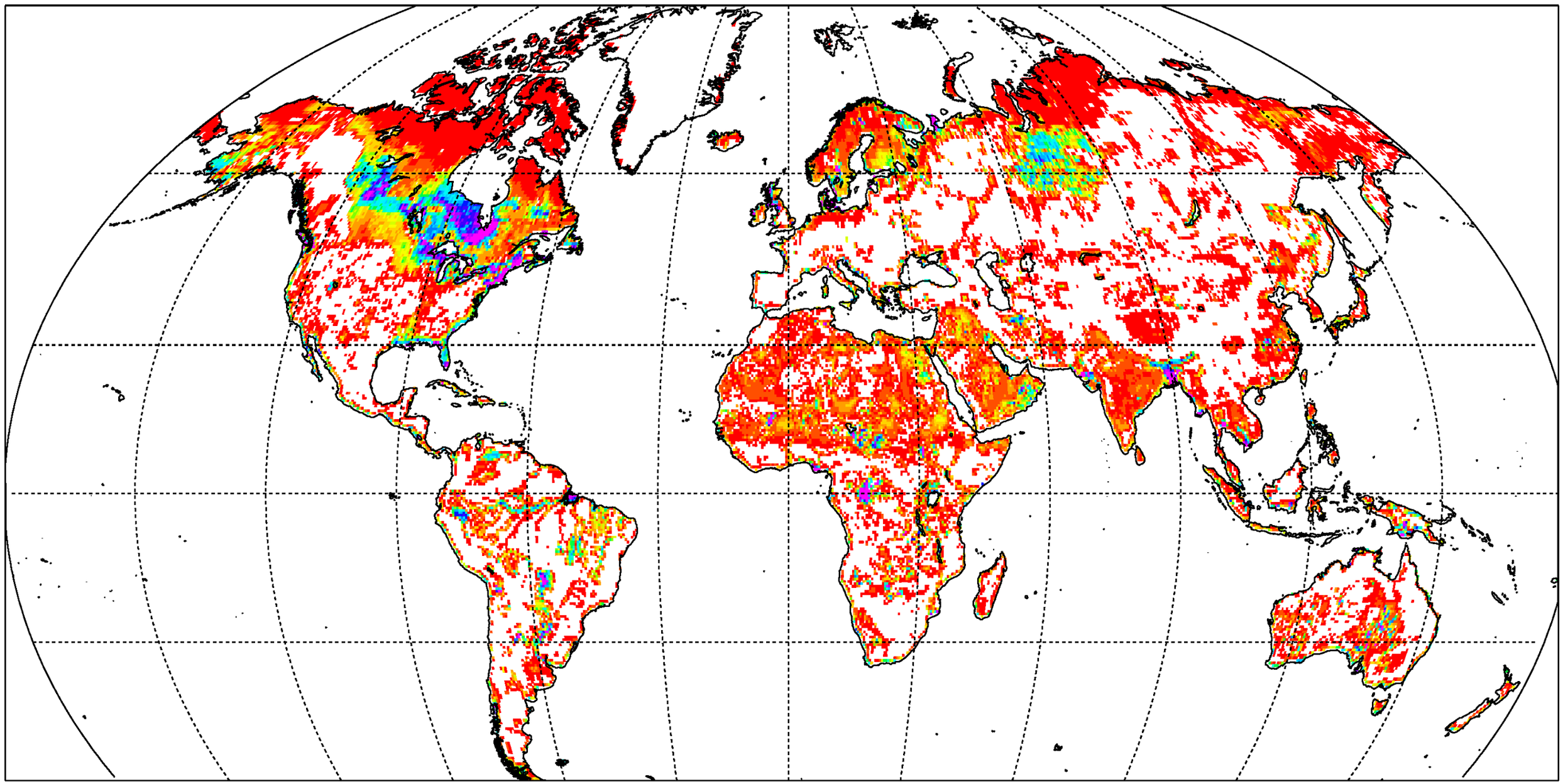


Global CH_4 emissions from wetlands



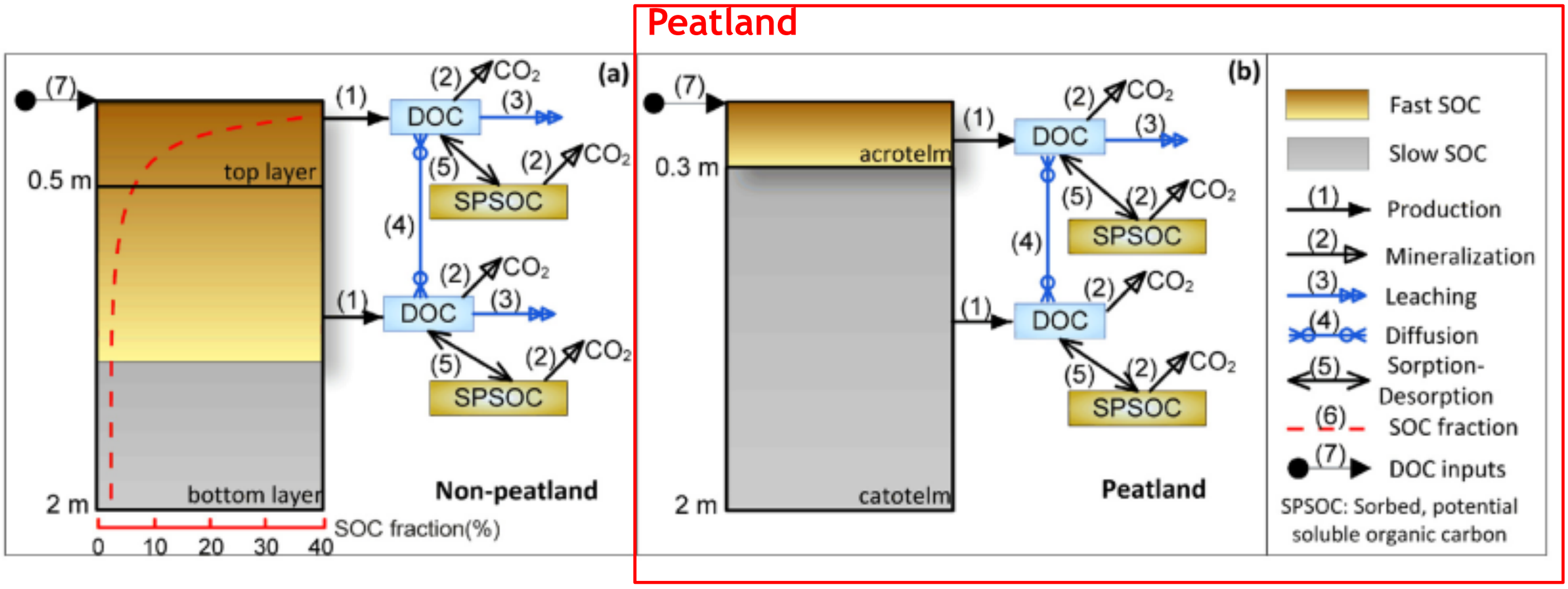
Mean annual CH_4 emissions per grid

2000 - 2012



Thanks for listening!

DOC processes added into the customized arctic version of LPJ-GUESS



- For both peatland and mineral soils, the model considered processes include: DOC production, mineralization, diffusion, sorption-desorption, leaching.
- At catchment scale, the model also considers lateral transport of DOC based on runoff.
- The developed model has been applied in a subarctic catchment. (Tang et al., 2018)

Peatland

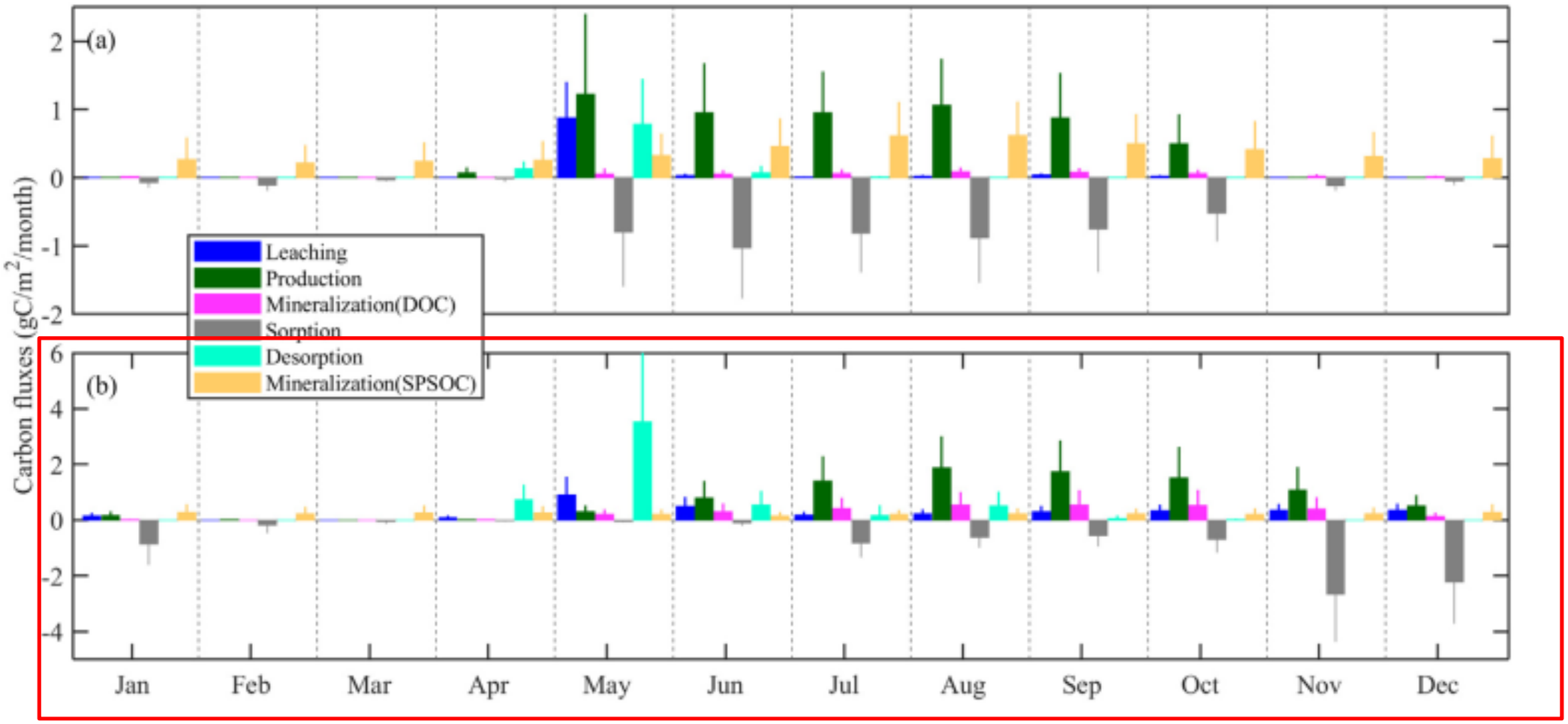


Fig. 4. The mean (thick bars) and one standard deviation (thin bars) of monthly carbon fluxes based on 52,000 simulations for mineral (a) and 32,000 simulations peatland soils (b) at the grid cell-level sensitivity analysis for 2007–2009, using a representative low elevation grid cell (A1).

- **For peatland soils, DOC exports in snowmelt season is less dominant compared to mineral soils in the same region.**
- **Desorption is strongest in May (snow melt water adding in) and the sorption occurs mainly in winter months;**
- **DOC production peaks in August**