Peat accumulation in JULES

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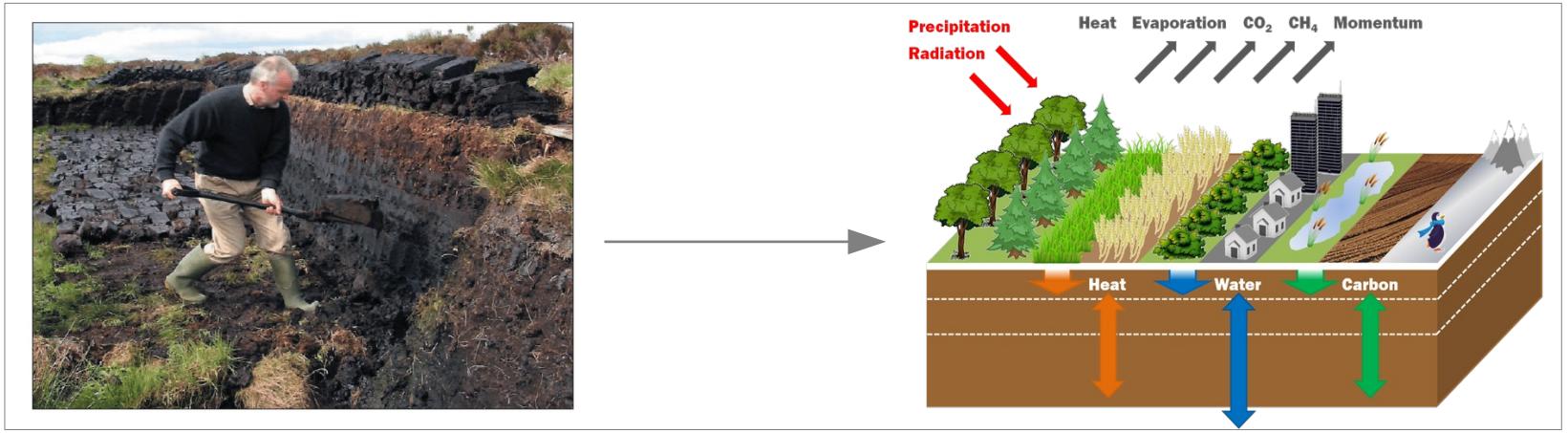
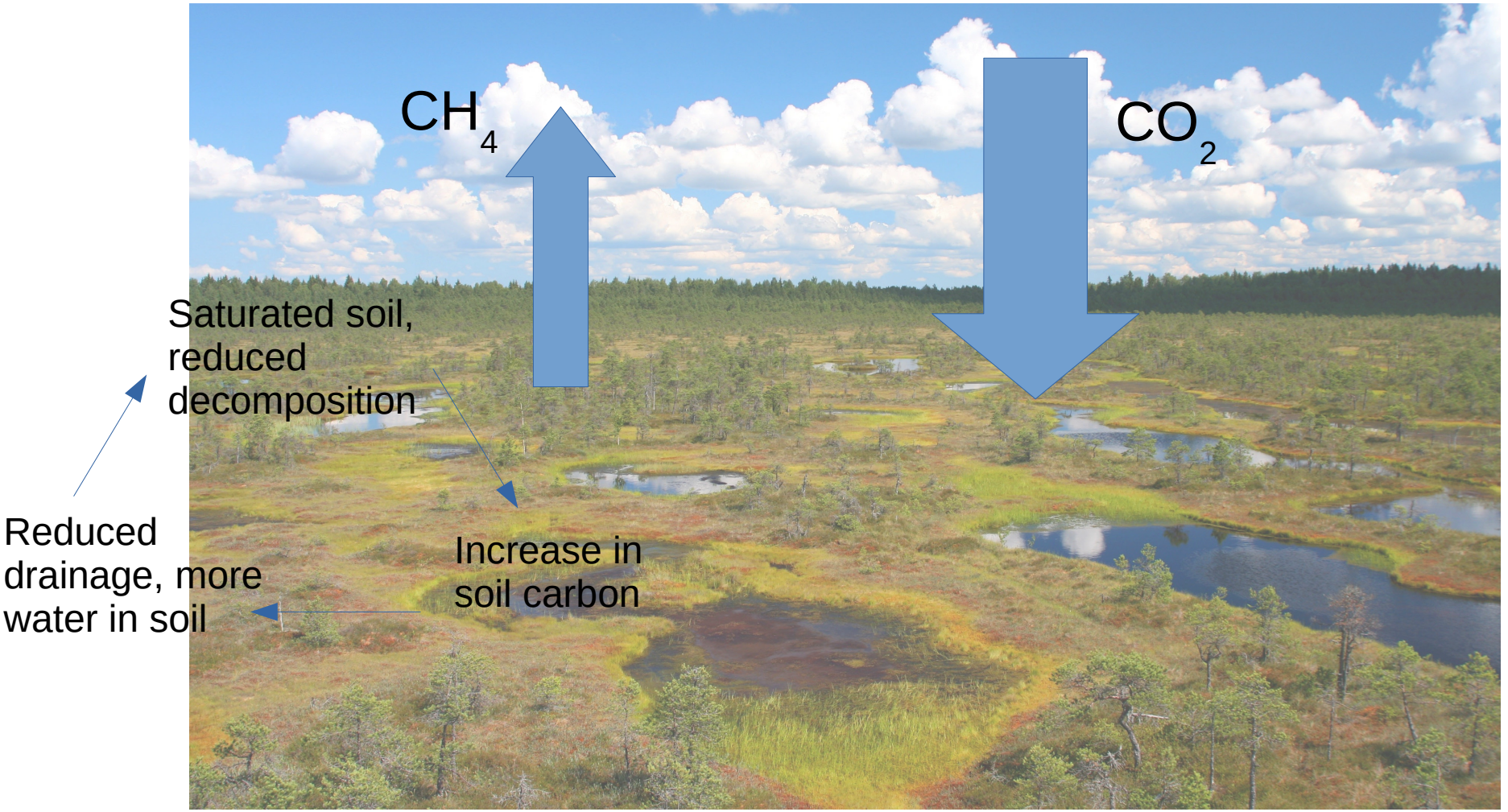


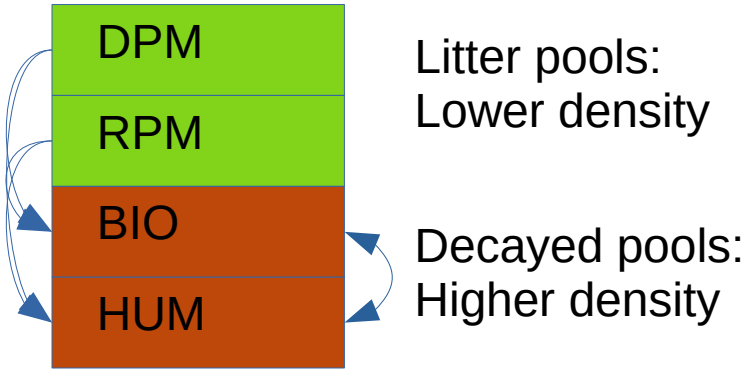
Why peat?

Peatlands cover ~ 3% of the land surface, but store ~ 30% of the world's soil organic carbon (**500+ GtC**)



Simple scheme to improve soil carbon profiles - account for volume

- Assume different **bulk density** for different carbon pools



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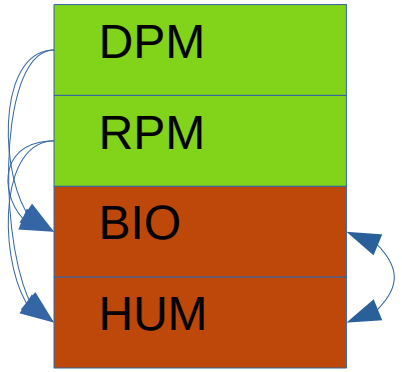
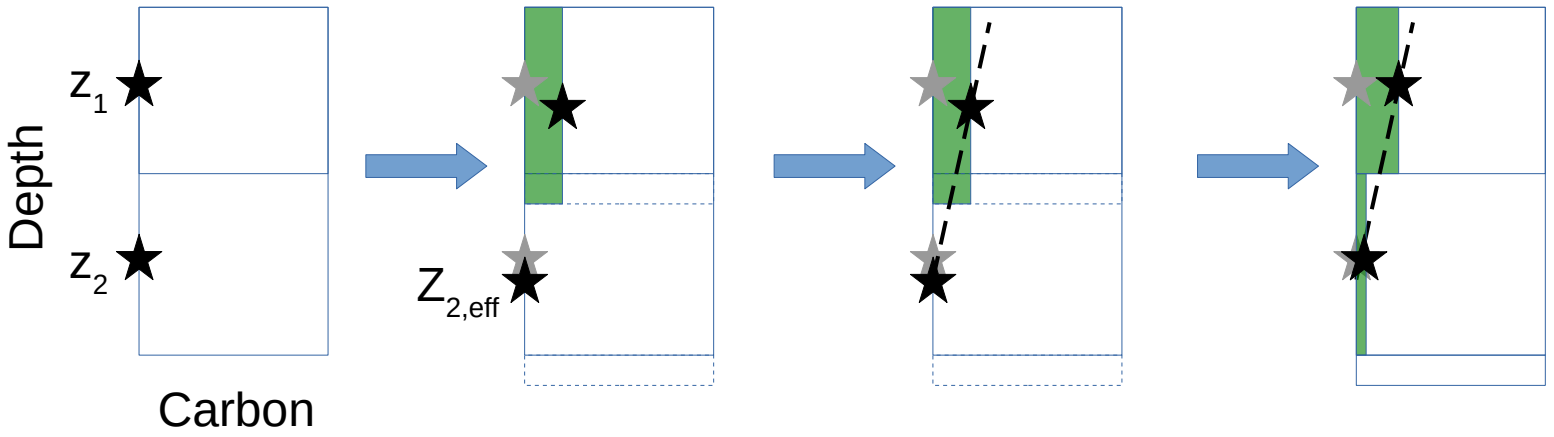


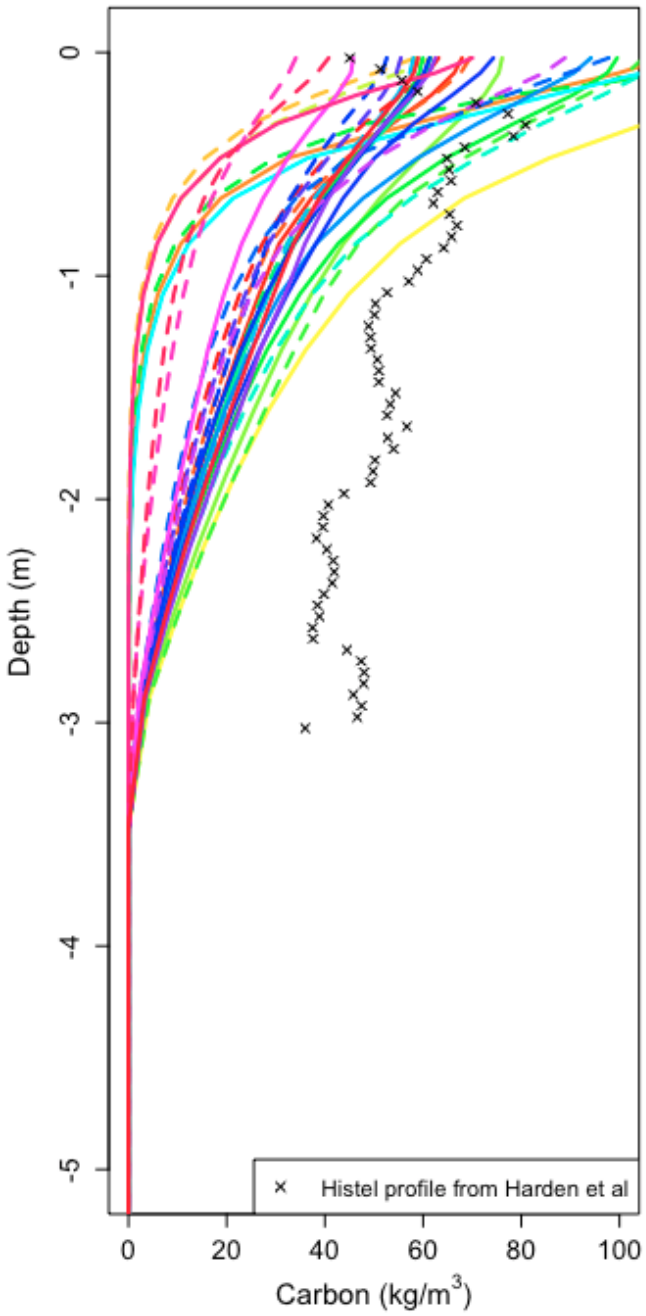
Litter pools:
Lower density

Decayed pools:
Higher density

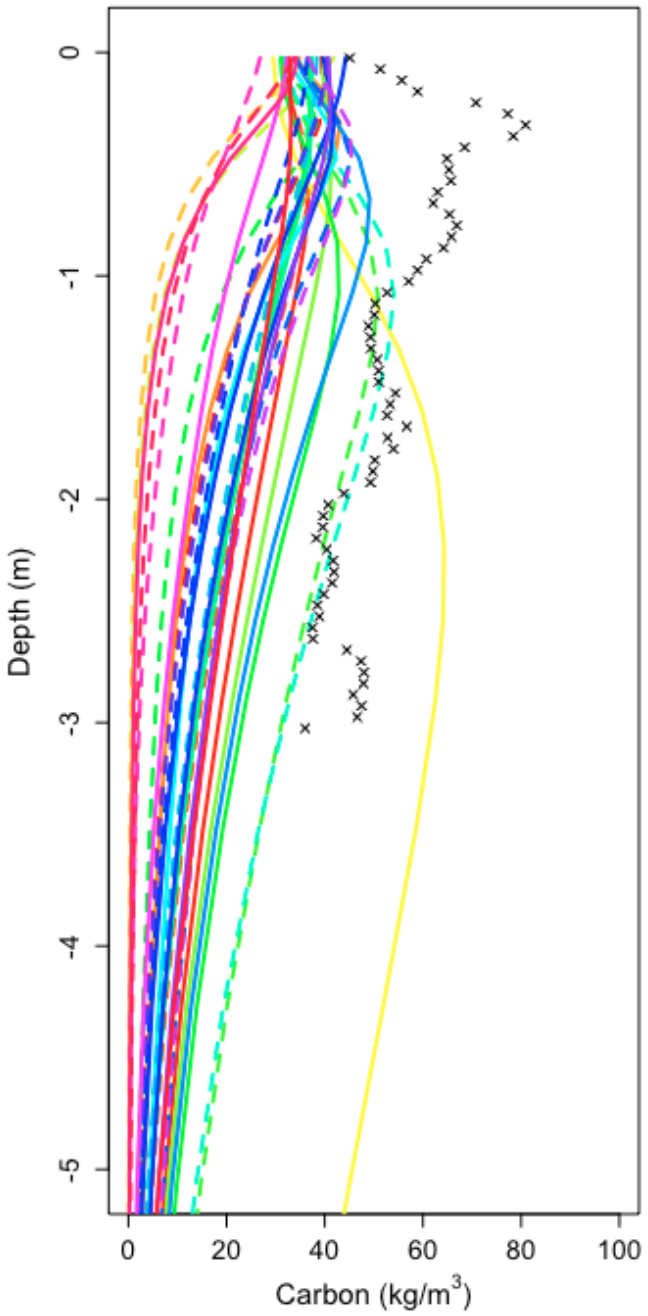


Results: Carbon density profiles

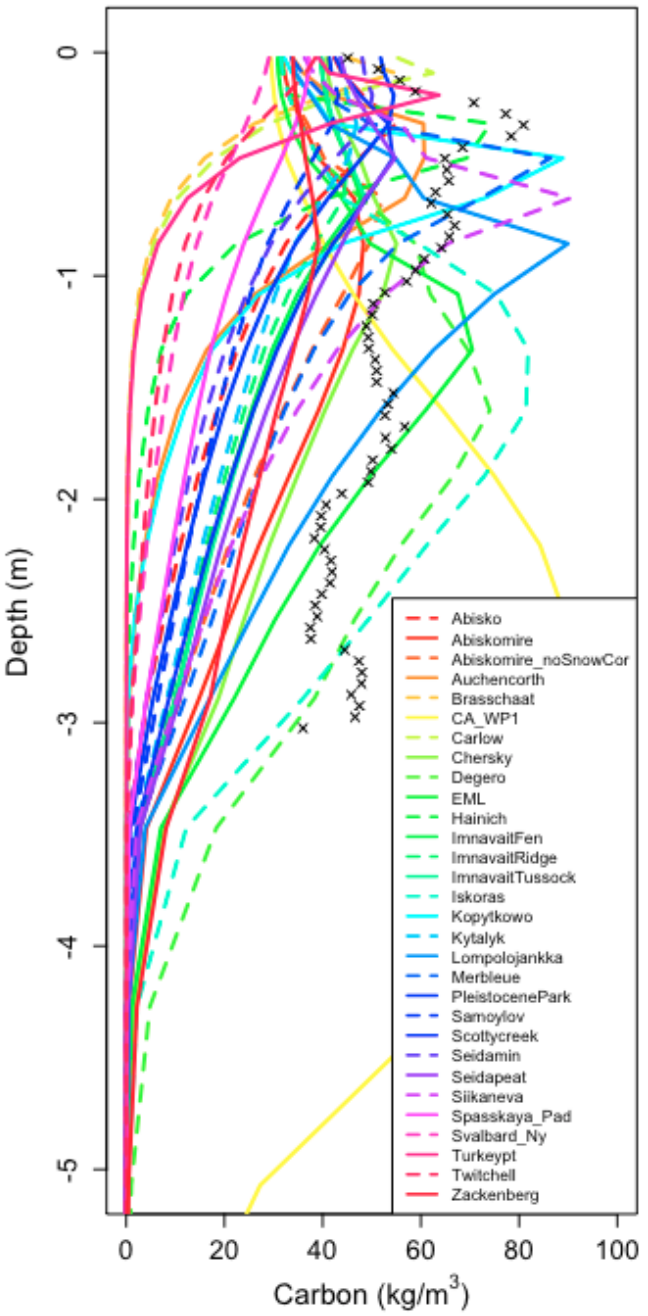
Original



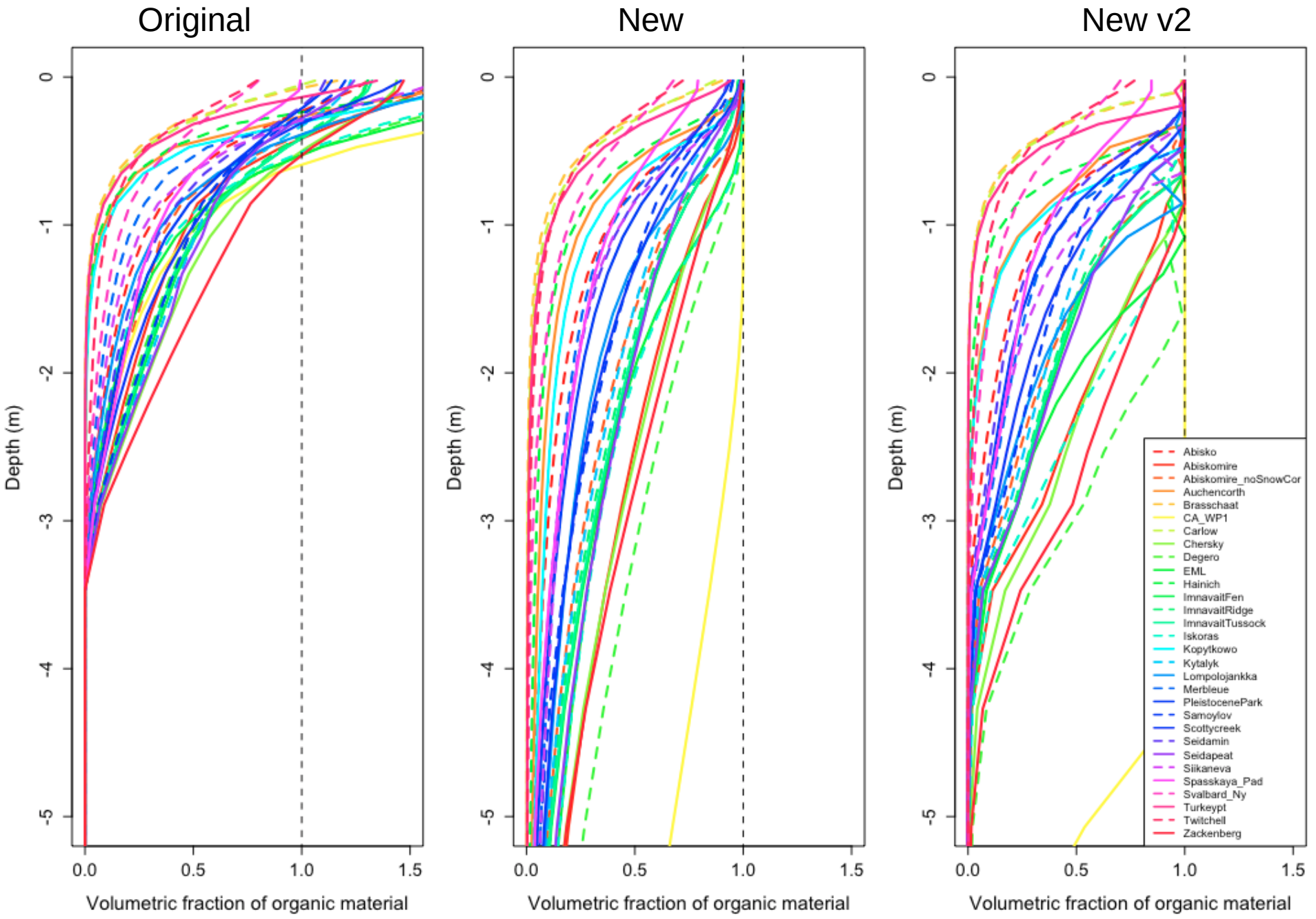
New



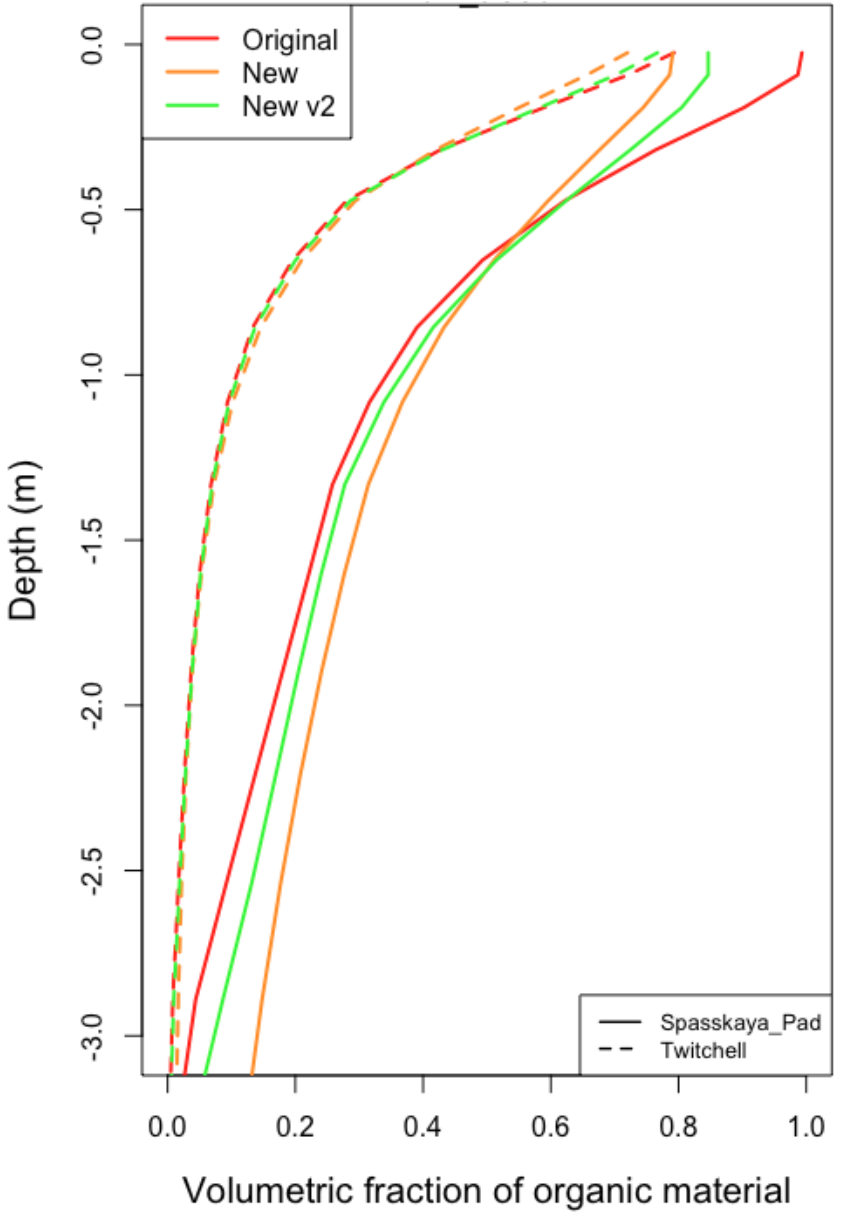
New v2

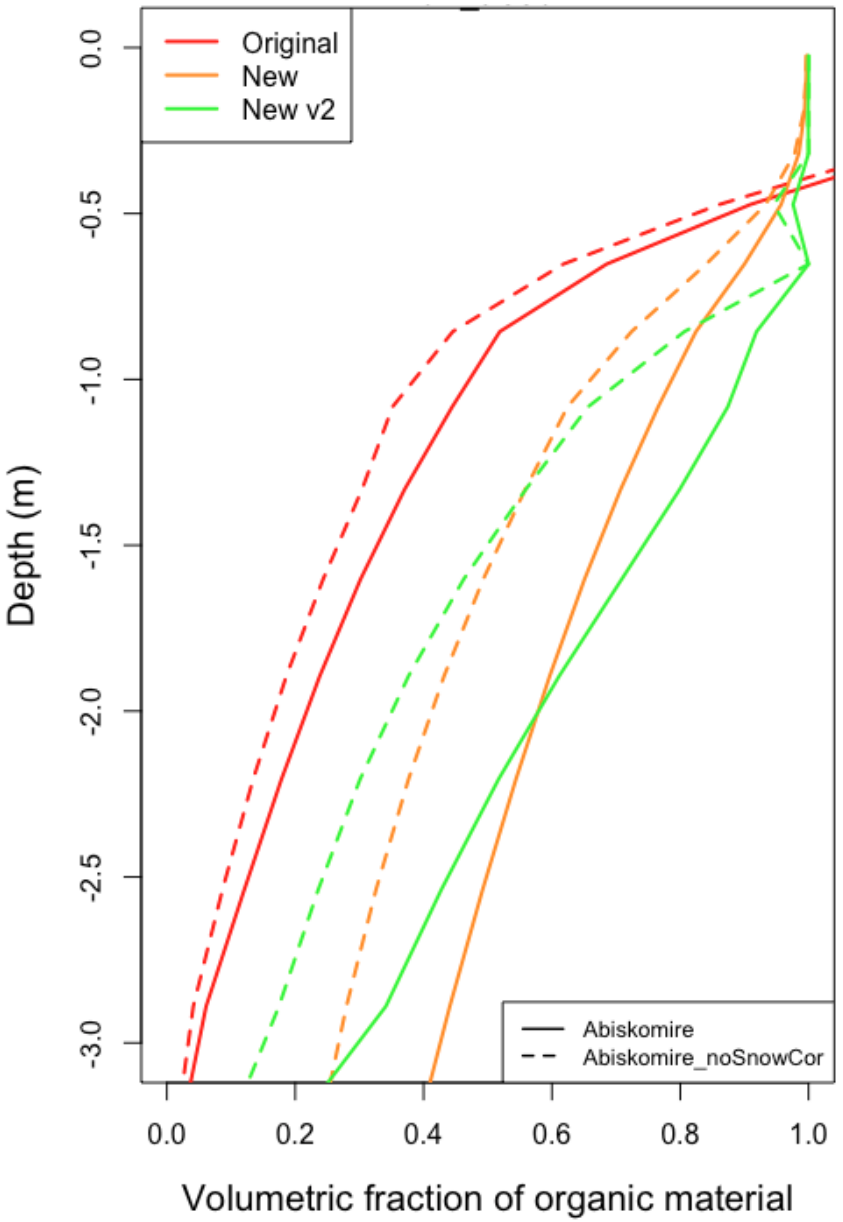


Results: volume profiles



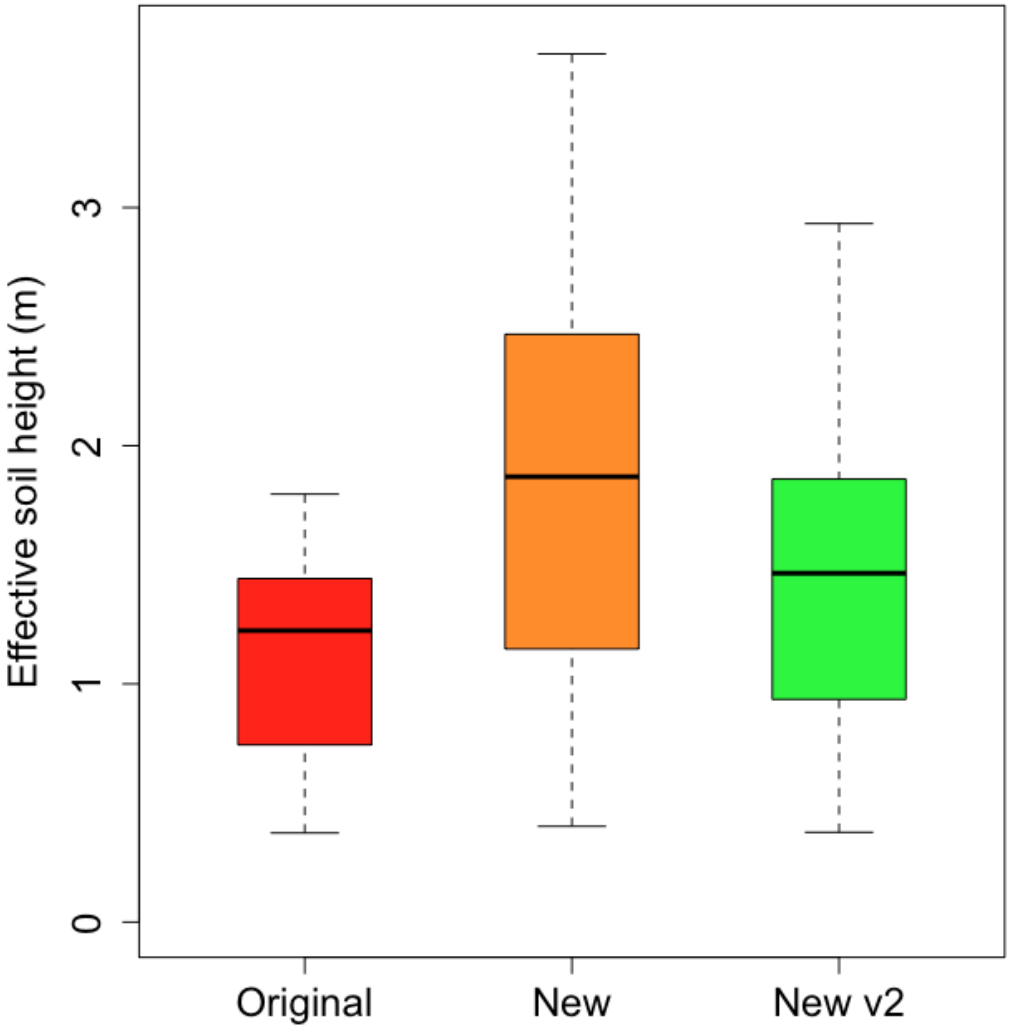
Volume profiles at specific sites





Effective soil heights

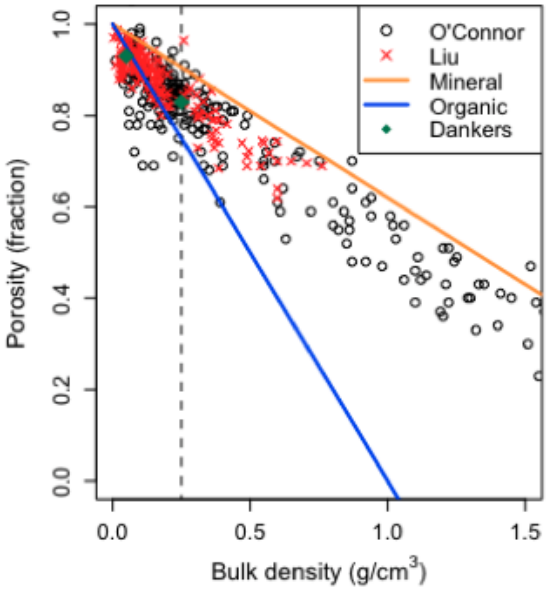
May be useful for permafrost microtopography as well

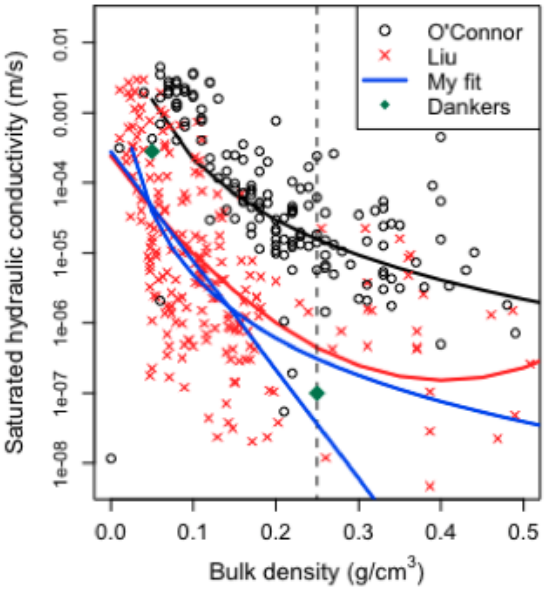


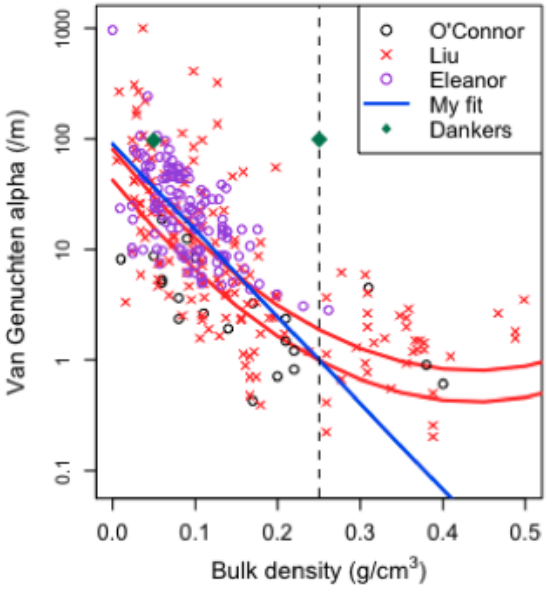
Coupling to thermal and hydraulic properties

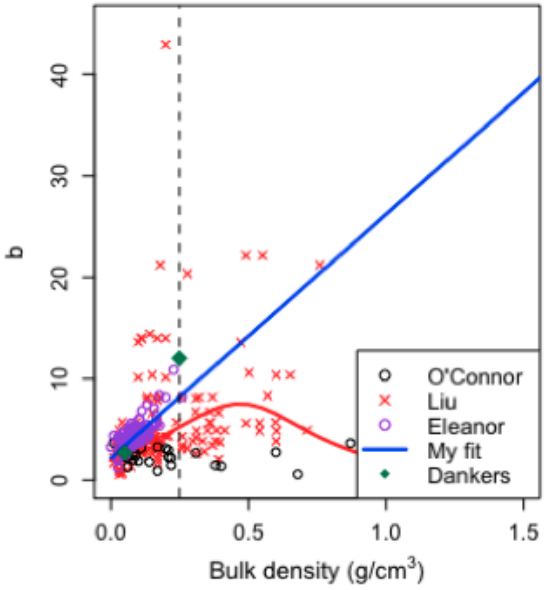
Soil properties relationships with bulk density

Model now simulates bulk density so can use these relationships to dynamically adjust soil properties







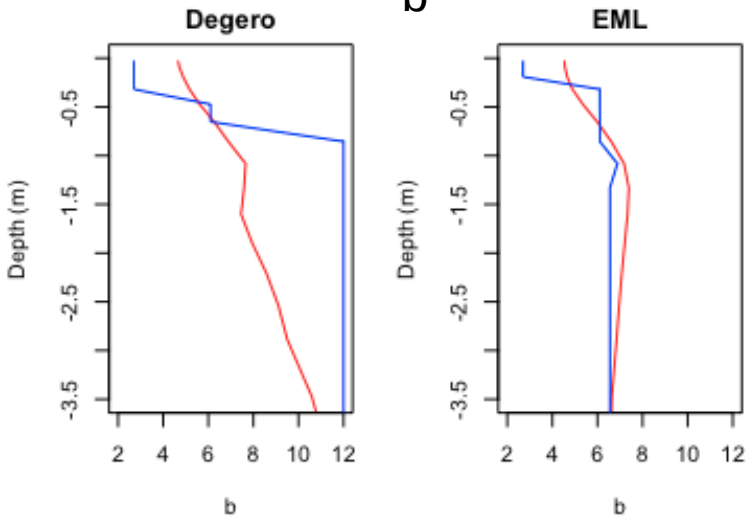


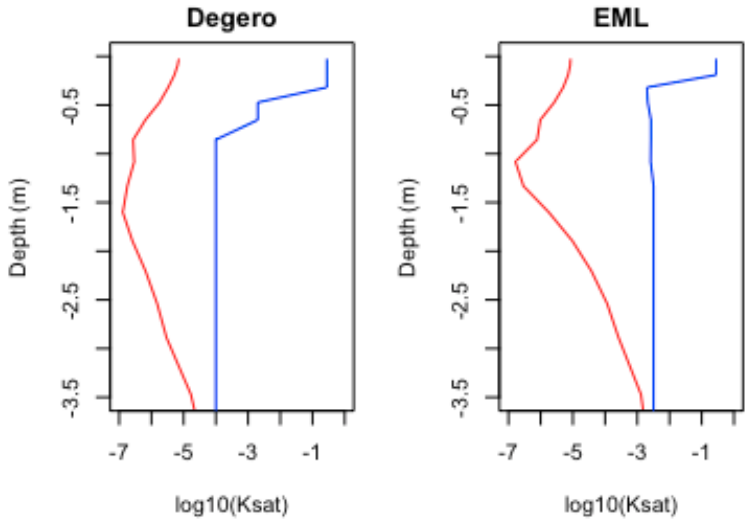
Comparison of modelled vs prescribed soil properties

Coupling to follow...

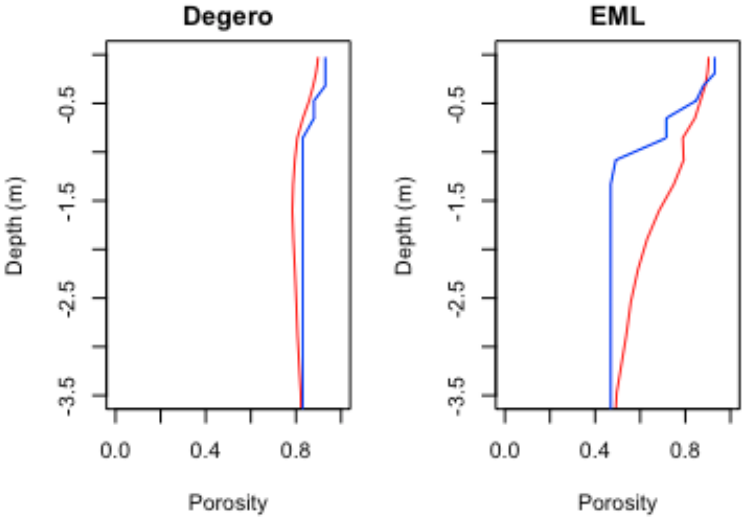
Very low hydraulic conductivity is modelled everywhere, I am not happy!

b

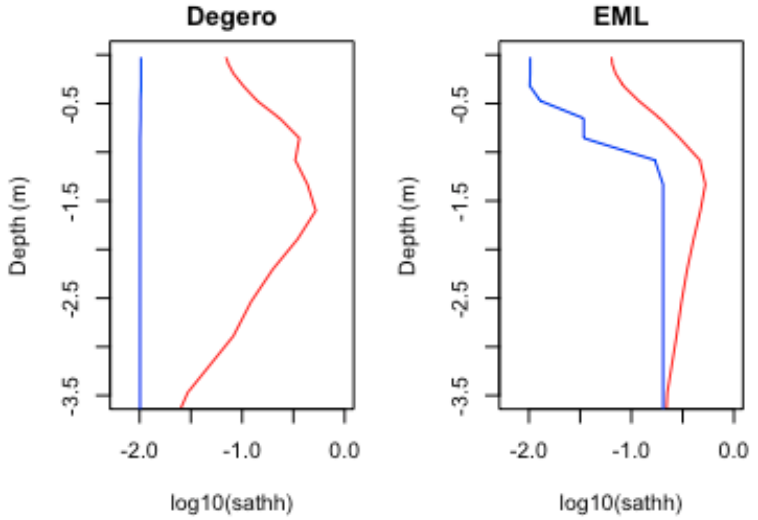




Porosity



Suction



Red = JULES simulated soil properties; Blue = Prescribed soil properties

Microbial methane scheme

Microbial methane scheme

In review for Global Biogeochemical Cycles, minor revisions

- Microbes go dormant in winter
- Improved seasonal temperature dynamics (Q_{10} ~ 4)
- *Long-term temperature response equivalent to $Q_{10} = 2$*

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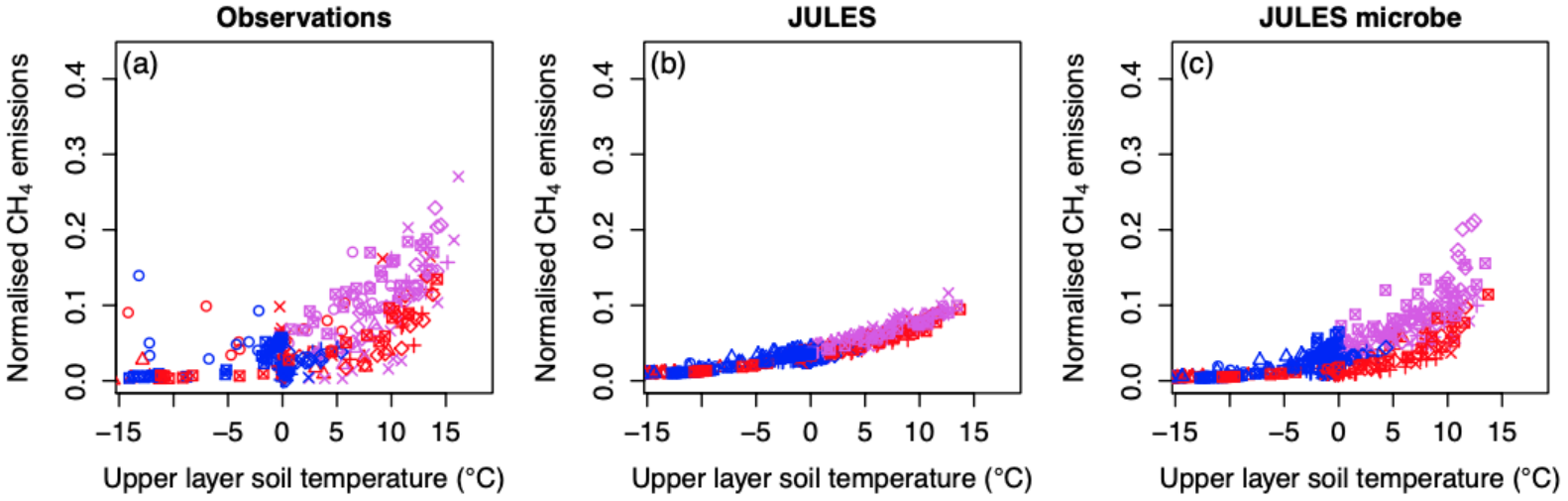
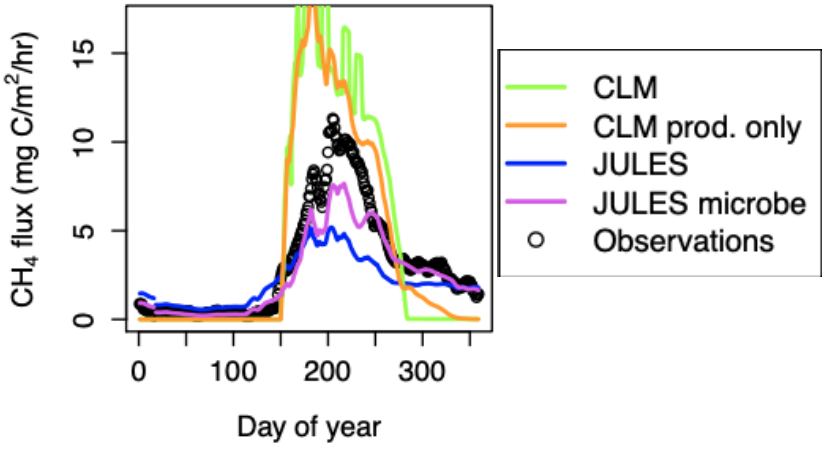


Direct comparison to observations (Chersky site)



Conclusion and outlook

- Peat profiles in JULES look reasonable and coupling is imminent.
- Methane is looking pretty good too.
- Hydrology is important: Noah working on this, can now get saturated soils! (thanks to a mixture of saturation correction, ponding and evaporation correction)
- Tiling will be key… (dynamic landscape fractions, saturated areas, lateral water flow between tiles etc)