JULES-Peat: A new approach to simulate peat accumulation, degradation and stability

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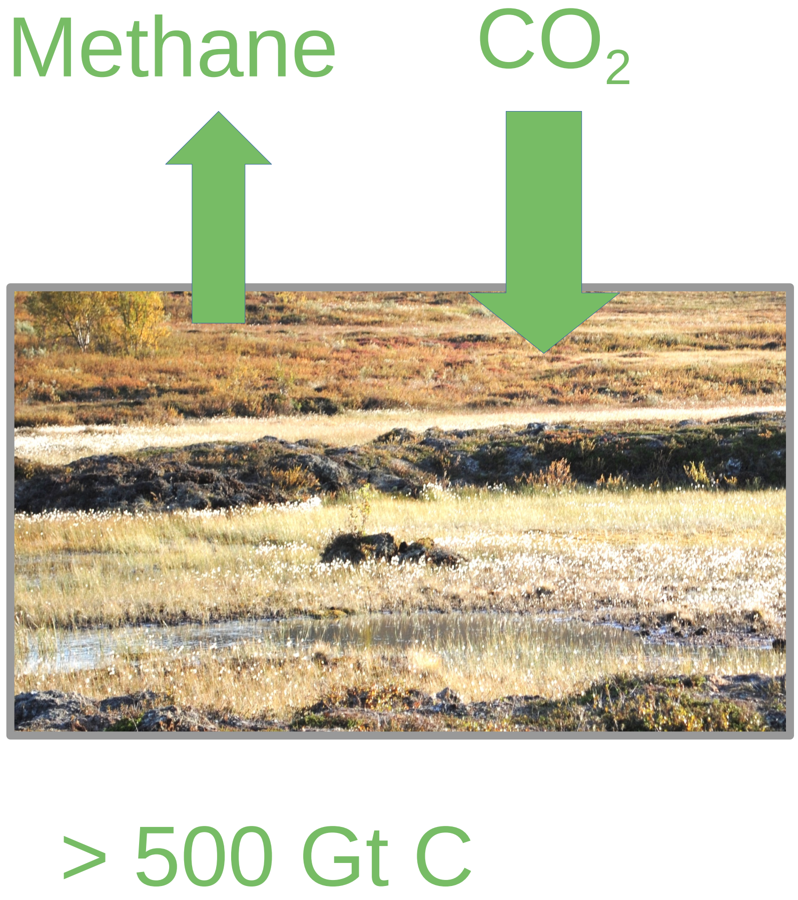
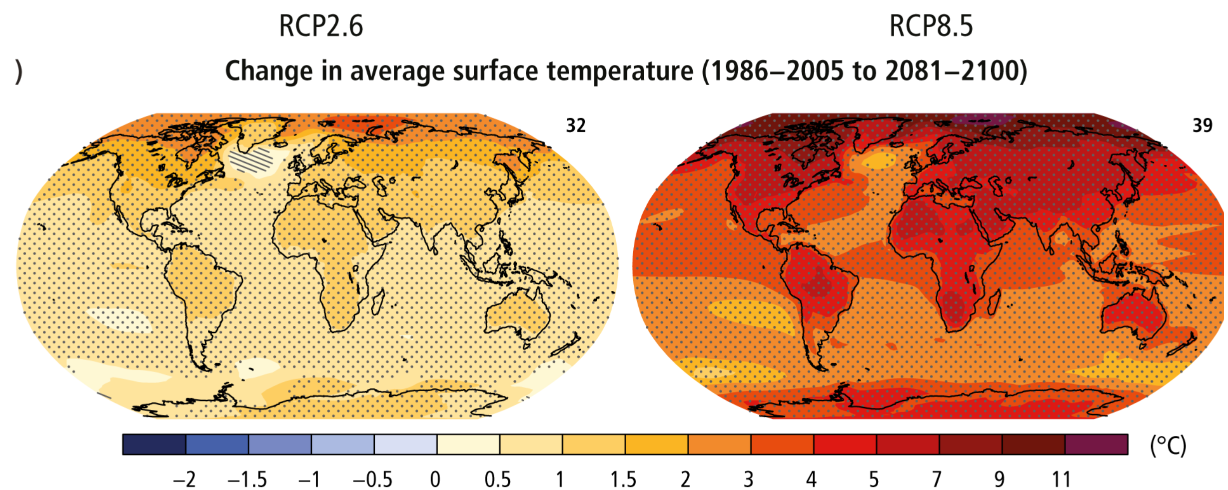


Peatlands: an important and potentially unstable carbon store

CO_2

> 500 Gt C

Earth System Models



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Problem number 1

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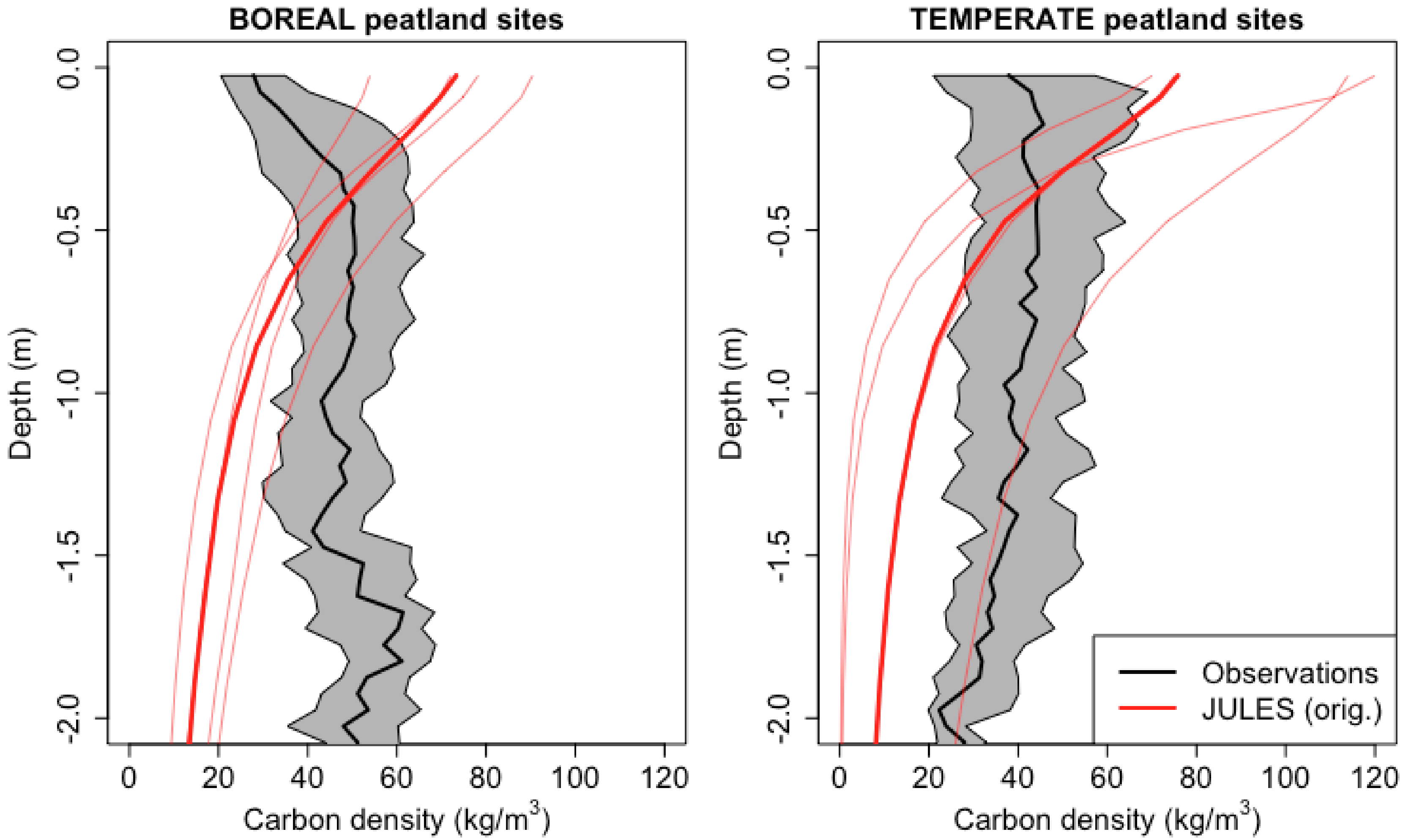
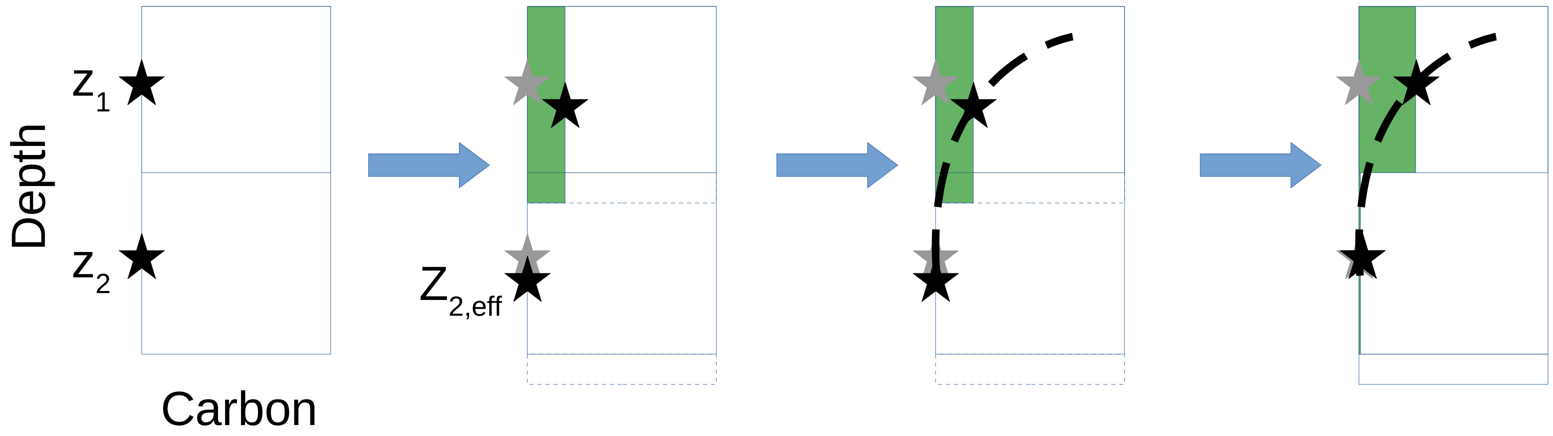


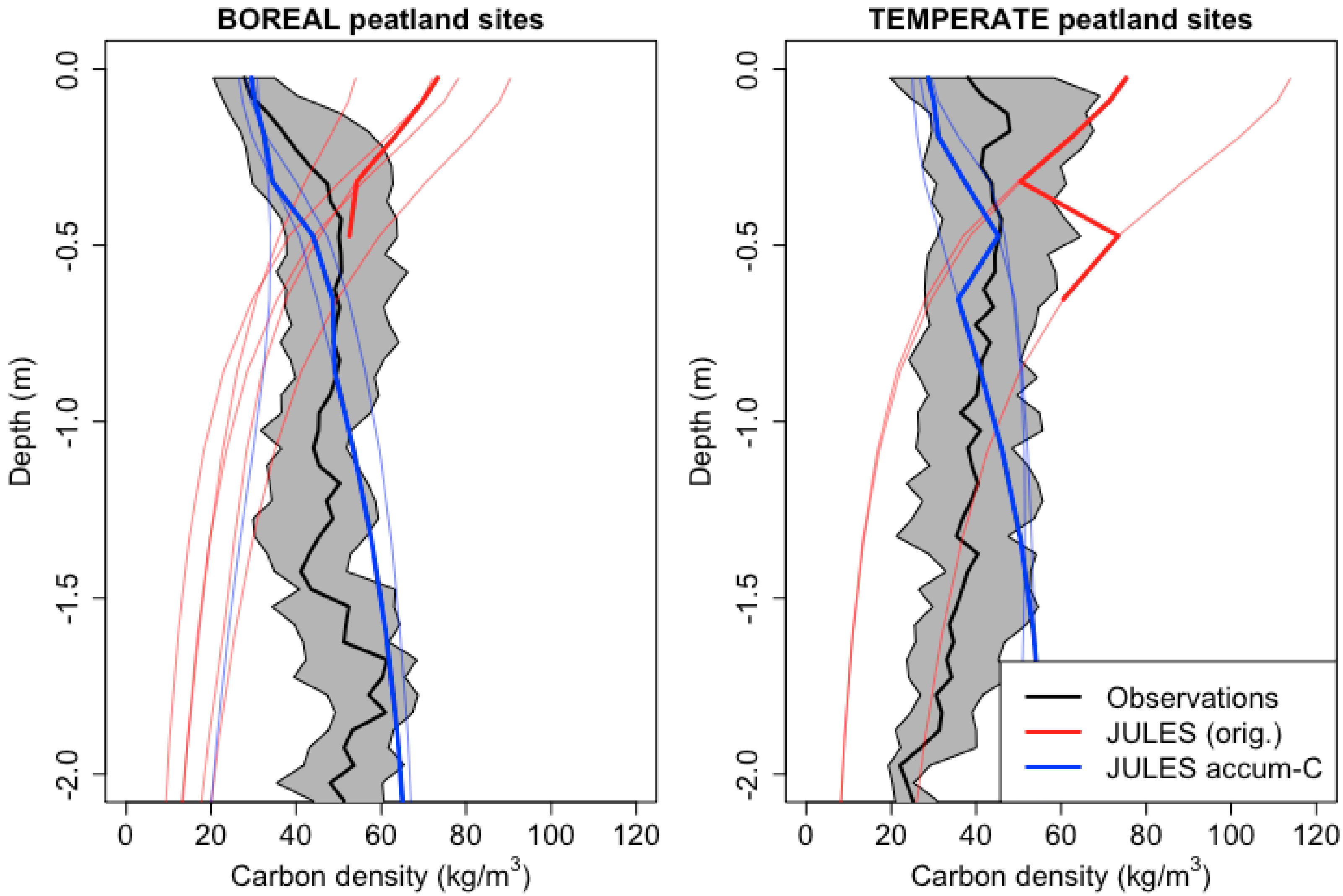
Observations: Gallego-Sala et al., 2018 *Nat Clim Change* **8** 907-913

Problem number 1: Solution

- *Effective layer thickness* during update of soil carbon
- Interpolate back onto original soil layers: scheme that preserves vertical structure



Problem number 1: Solution



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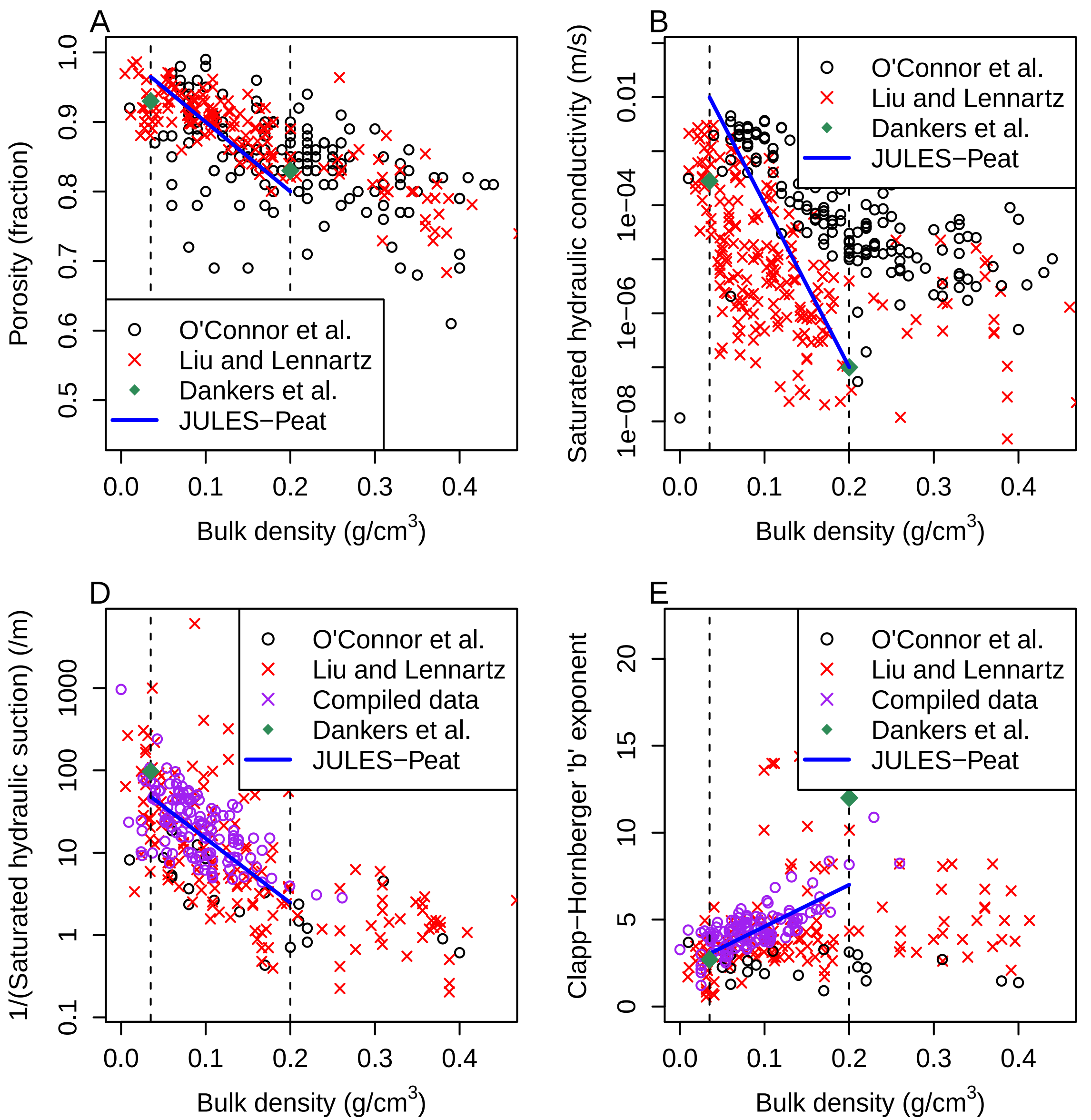
Problem number 2: Stability and resilience

- Peatland ‘function’ can restore water table to surface when it drops
- Carbon loss/gain can be self-reinforcing → instability

Solution: Hydraulic properties of peat vary with decomposition status and control its dynamics

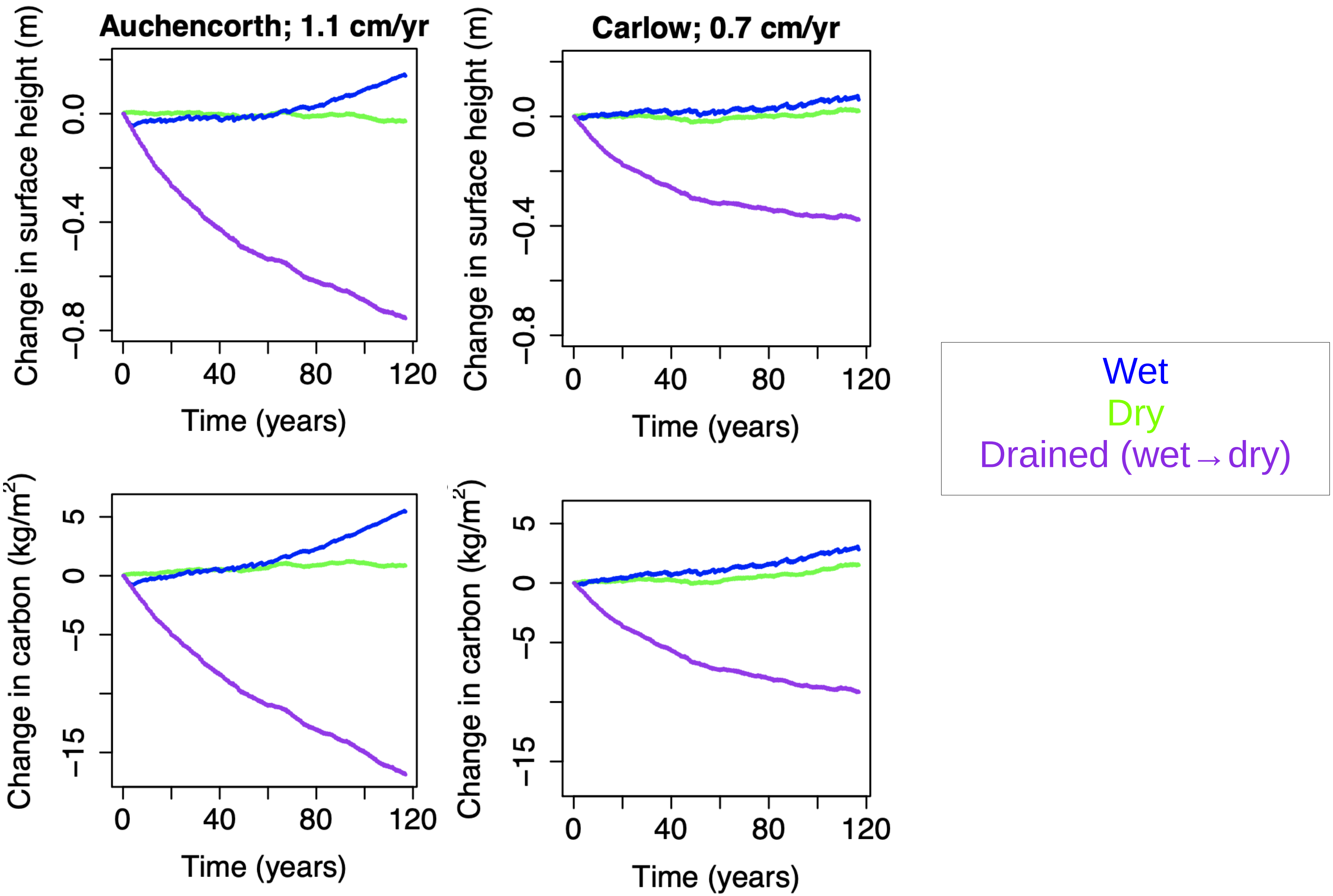


- Prescribe bulk density of carbon pools in JULES:

  Higher bulk density for more decomposed organic matter

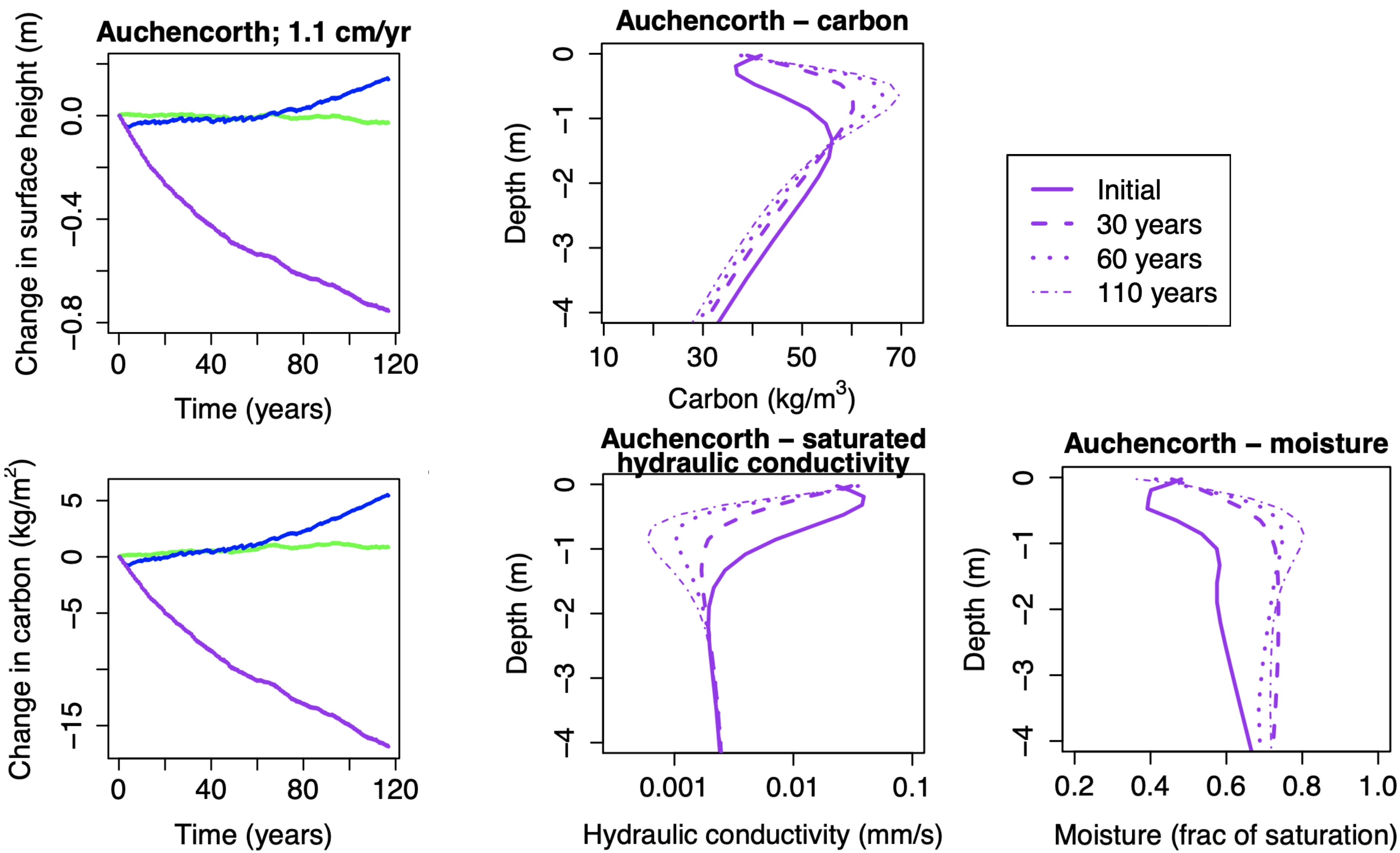
- Use relationships ← to update soil properties

Dynamics of drained peatland



Water table drops. Peat decomposes and becomes compacted…
(water table can sometimes re-form on top of compacted layer)

Dynamics of drained peatland



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Remaining challenges for modelling

- **Hydrology:** Can be simulated for individual peatland if not groundwater fed (Bechtold et al., 2019). Challenge to integrate seamlessly in large-scale model and to simulate lateral flow.
- **Vegetation:** New plant functional types needed. Interactions with water table → instability.

Bechtold., et al 2019 *J. Adv. Model. Earth Syst*. **11** 2130-2162

For JULES users

- vn6.1_accumulate_soil (thanks Eleanor)
- Switches (in jules_soil_biogeochem namelist, note you must also have l_layeredc=.true.)
  - *l_accumulate_soil*
  - *l_dynamic_soilprops*

- Calculates age of soil carbon in each layer/pool:
  - *l_soilage = .true.*

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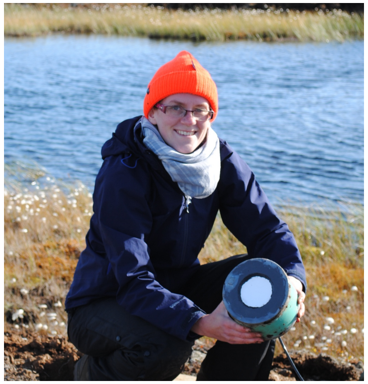

Thanks for listening :)