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)

CH$_4$ CO$_2$

Saturated soil, reduced decomposition

Reduced drainage, more water in soil

Increase in soil carbon
Simple scheme to improve soil carbon profiles - account for volume

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

![Diagram showing different carbon pools with varying densities](image-url)
Simple scheme to improve soil carbon profiles - account for volume

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

- Carbon pools:
  - Litter pools: Lower density
  - Decayed pools: Higher density

- Depth
  - $Z_1$
  - $Z_2$
  - $Z_{2,\text{eff}}$
Results: Carbon density profiles

Original

New

New v2
Results: volume profiles

Original

New

New v2

Volumetric fraction of organic material

Depth (m)
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!

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 ($Q_{10} \sim 4$)
• *Long-term temperature response equivalent to $Q_{10} = 2$*
Microbial methane scheme

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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)