Modelling Eocene carbon cycle tipping points

What can hyperthermal events teach us about our future climate?

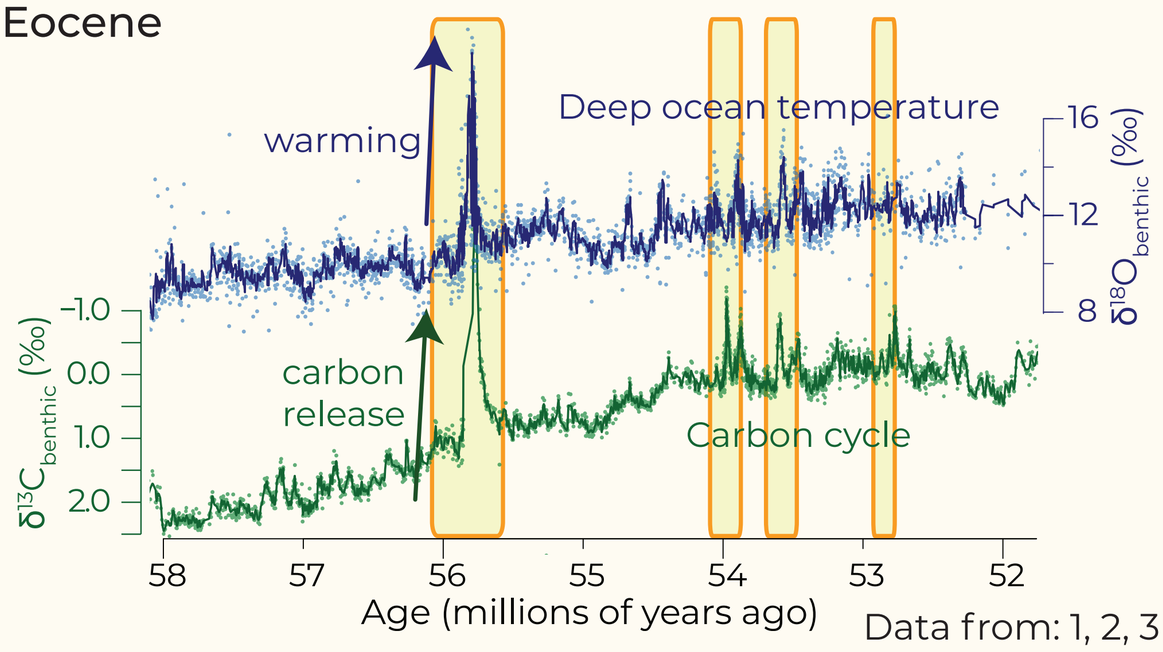
Studying potential tipping behaviour of methane hydrate, permafrost, and peat reservoirs during past short-time warming events to help us understand their future.

Eocene hyperthermals

Past short-term warming events as future analogues

During the Early Eocene (56 to 48 Ma), several short-term warming episodes occurred, associated with significant changes in the carbon cycle. However, the precise mechanisms behind these changes remain unclear.

Warming events and carbon release during the early Eocene



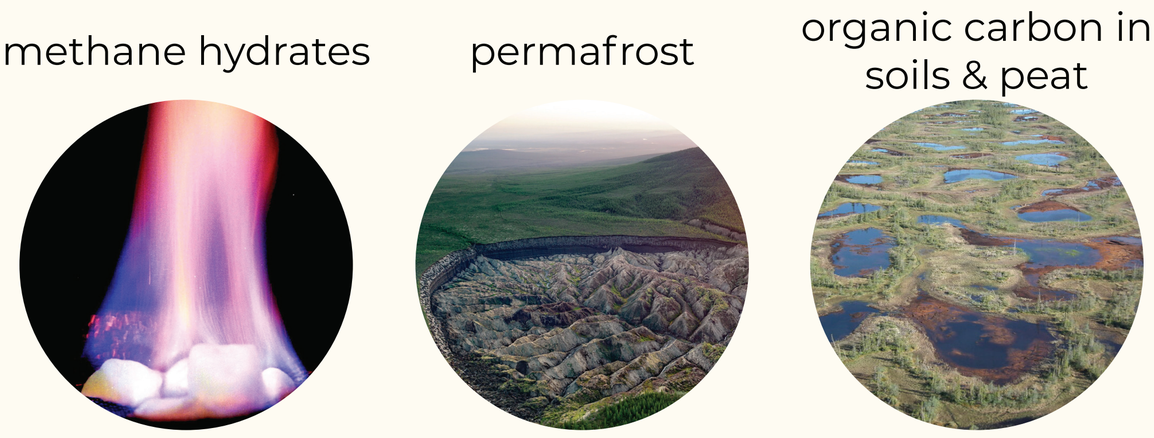
Data from: 1, 2, 3

Carbon reservoirs

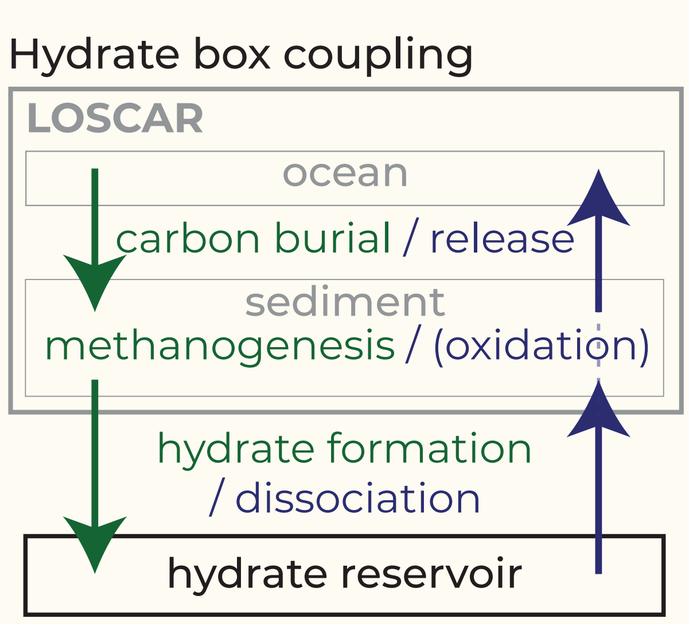
Tipping behaviour in methane hydrates, permafrost and peat?

The release of carbon from methane hydrates, permafrost, and/or peat likely played a role, but how do these reservoirs react? Can we identify temperature thresholds? Do they show tipping behaviour?

Long-term carbon reservoirs



Hydrate box coupling



Project steps

1. Expand LOSCAR[4] model with boxes for hydrate, peat and permafrost reservoirs.
2. Run simulations for Eocene hyperthermals.
3. Analyse output using early warning and causality indicators.

References

1. Barnet et al. (2019). Paleoceanography & Paleoclimatology, 34.
2. Laurentano et al. (2016). Newsletters on Stratigraphy, 49.
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4. Zeebe (2012). Goescientific Model Development, 5.

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