CLUSTER OF EXCELLENCE
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Effects of temperature overshoot scenarions in the high northern latitudes

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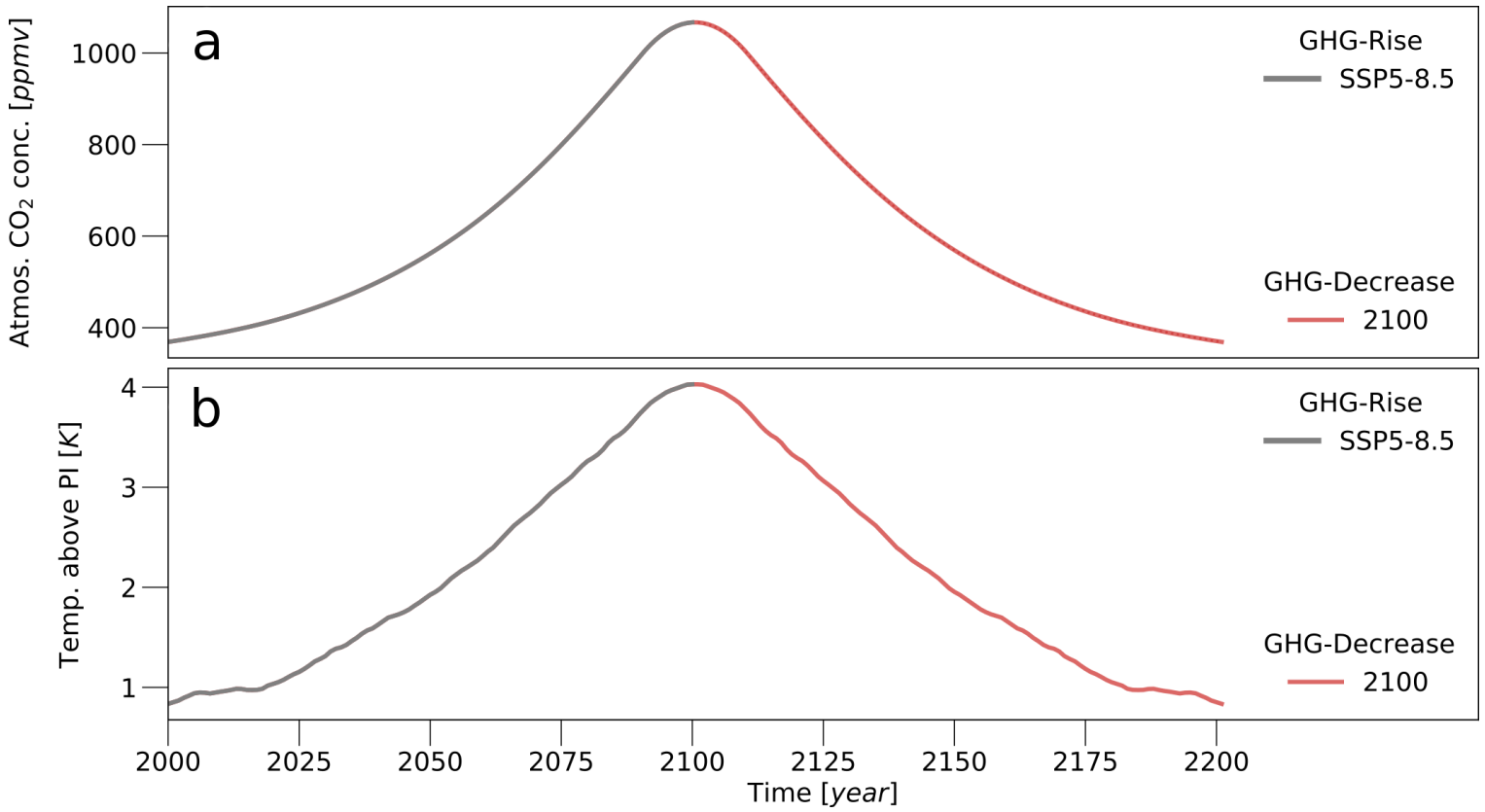
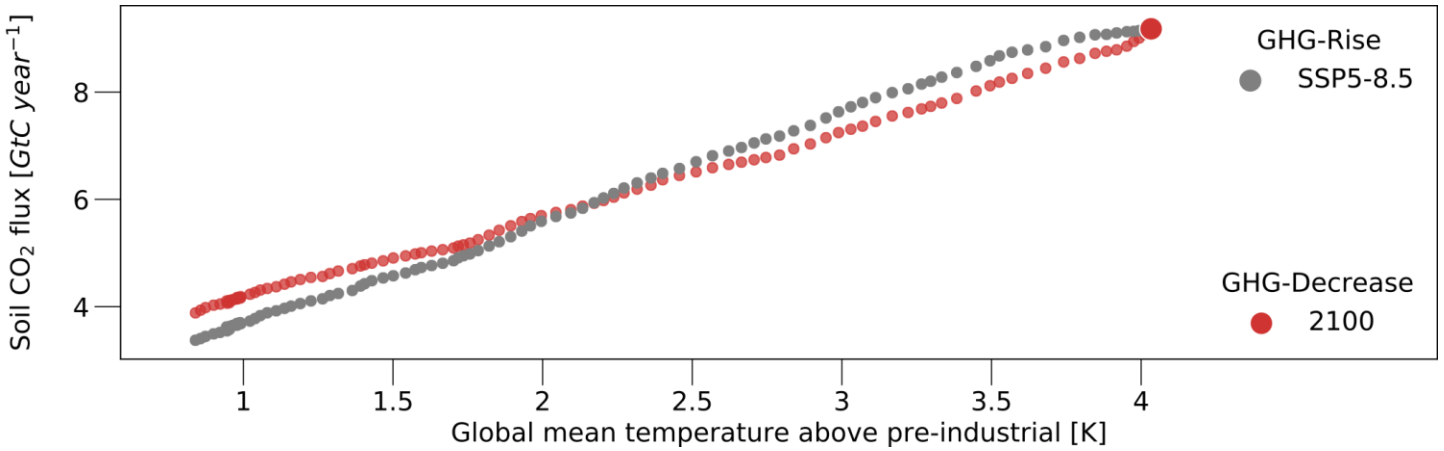
- Research questions
  - How do Arctic CO_2 & CH_4 emissions respond to temperature overshoot scenarios?
  - Does steady-state of high-latitude ecosystems depend on preceding trajectory?
- Setup
  - JSBACH – offline; forced with CMIP6 output
  - Adapted version (KoPf)

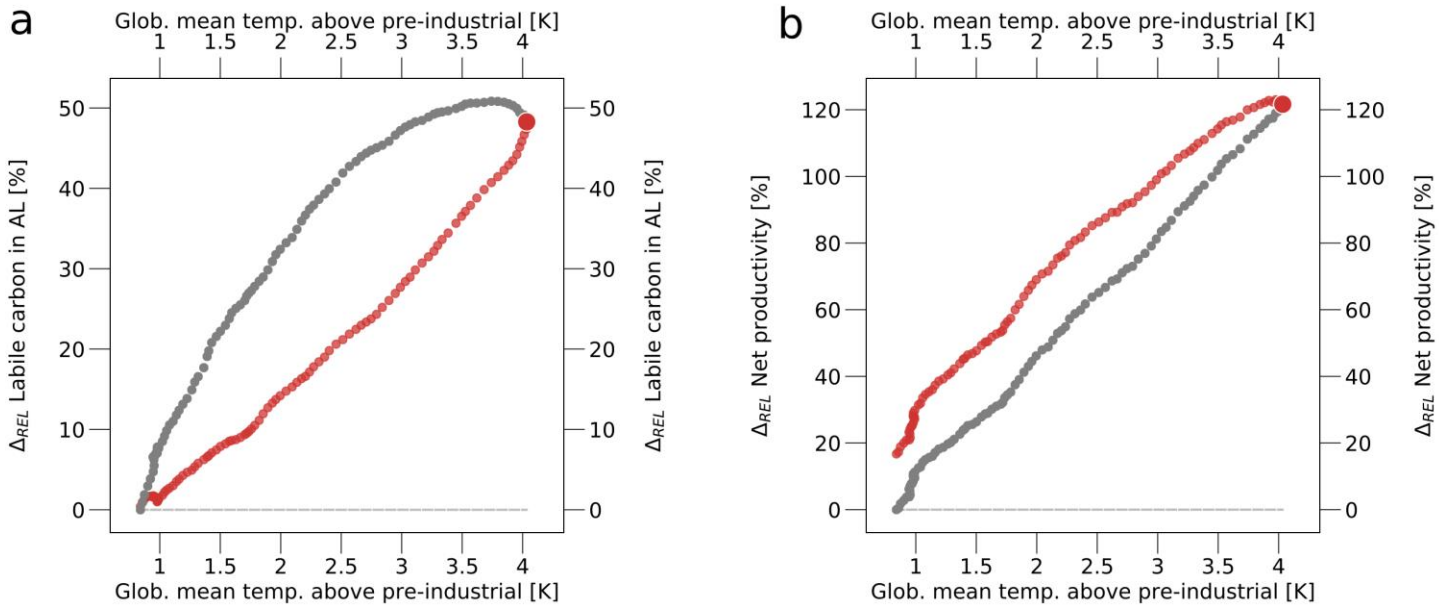
Overshoot scenarios



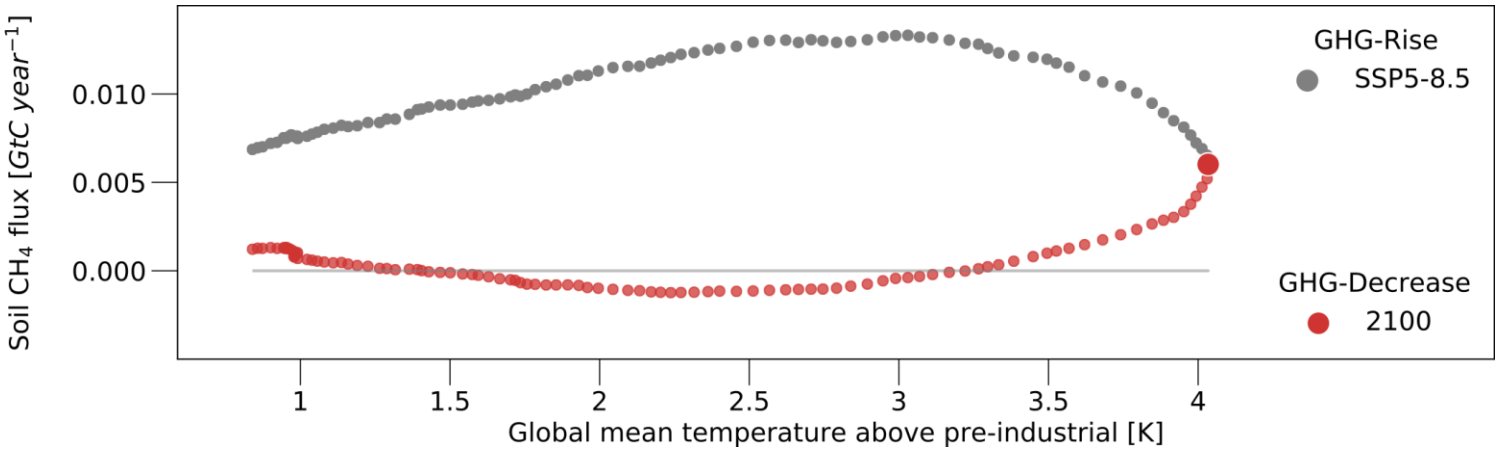
Soil CO_2 emission



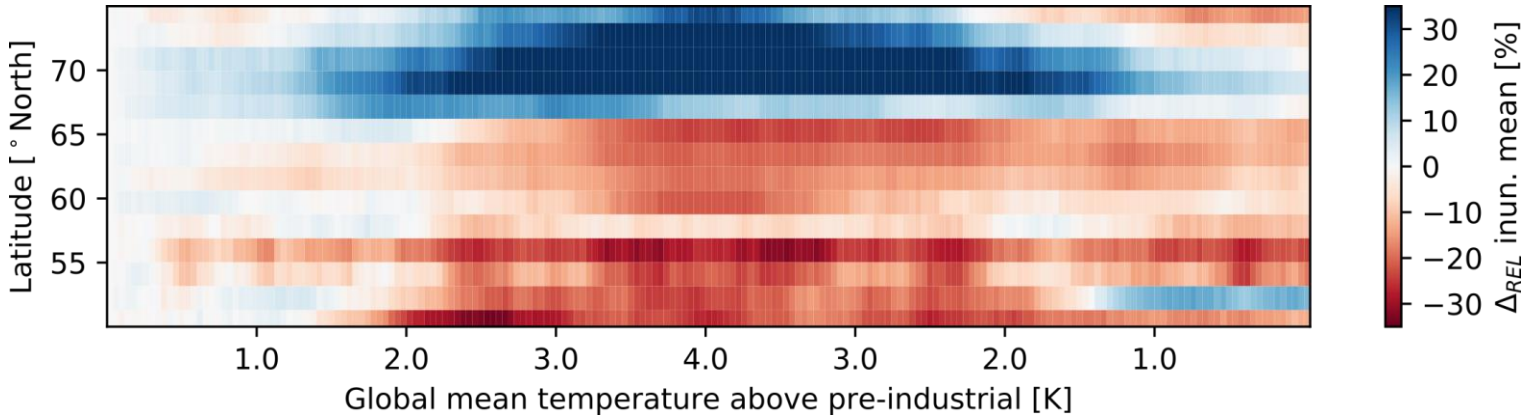
Factors determining soil CO_2 emission



Soil CH_4 emission



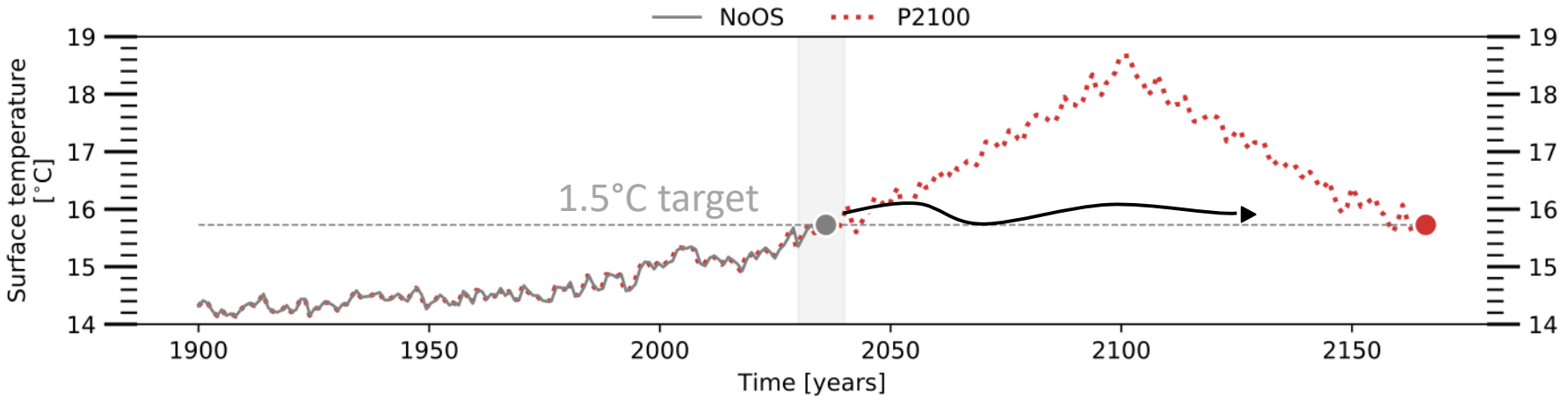
Wetland area



- Summary
  - CO_2 emissions have linear dependency on temp.
  - Result of hysteretic factors offsetting each other
  - CH_4 emissions exhibit pronounced hysteresis

- Publications
  - de Vrese, Stacke, Kleinen & Brovkin (2021), TC, 15, 1097–1130, https://doi.org/10.5194/569tc-15-1097-2021.

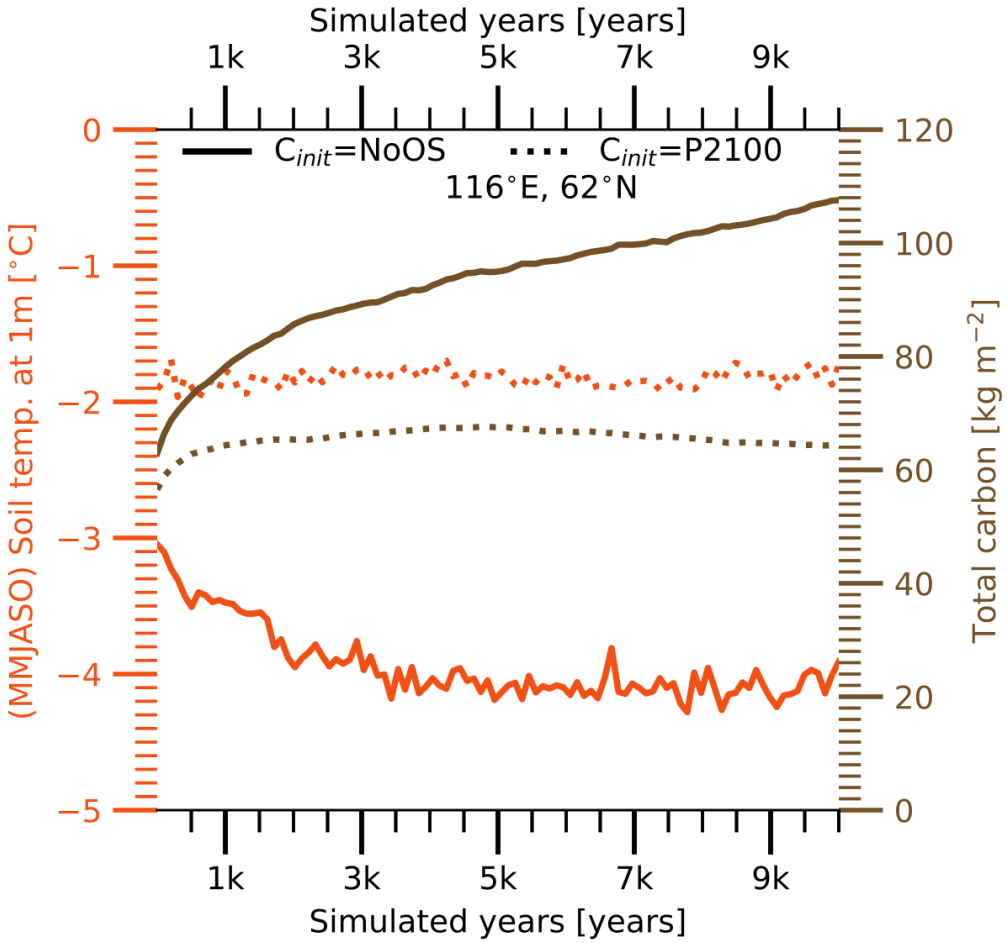
Climate trajectories to 1.5°-target



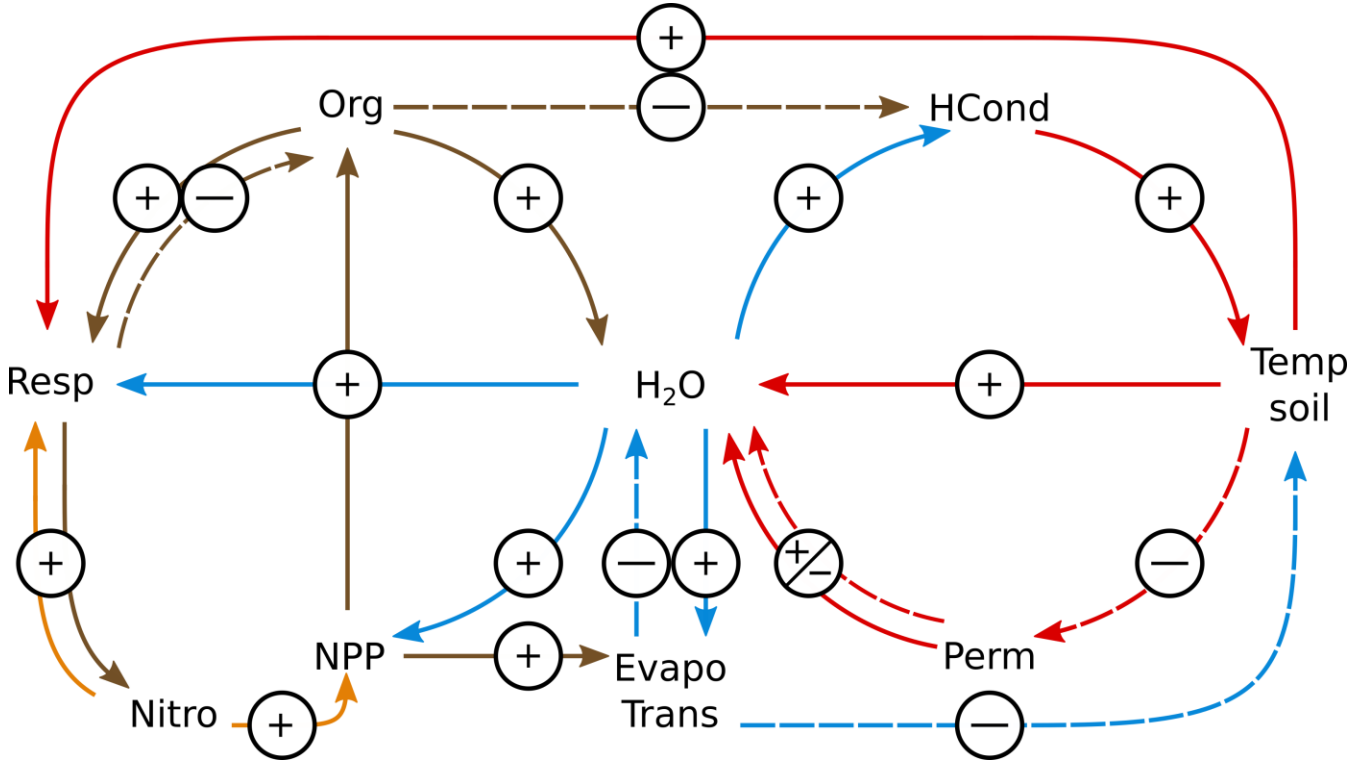
Forcing: Historical + SSP5-8.5

Cycling 2030-2039 (SSP5-8.5)

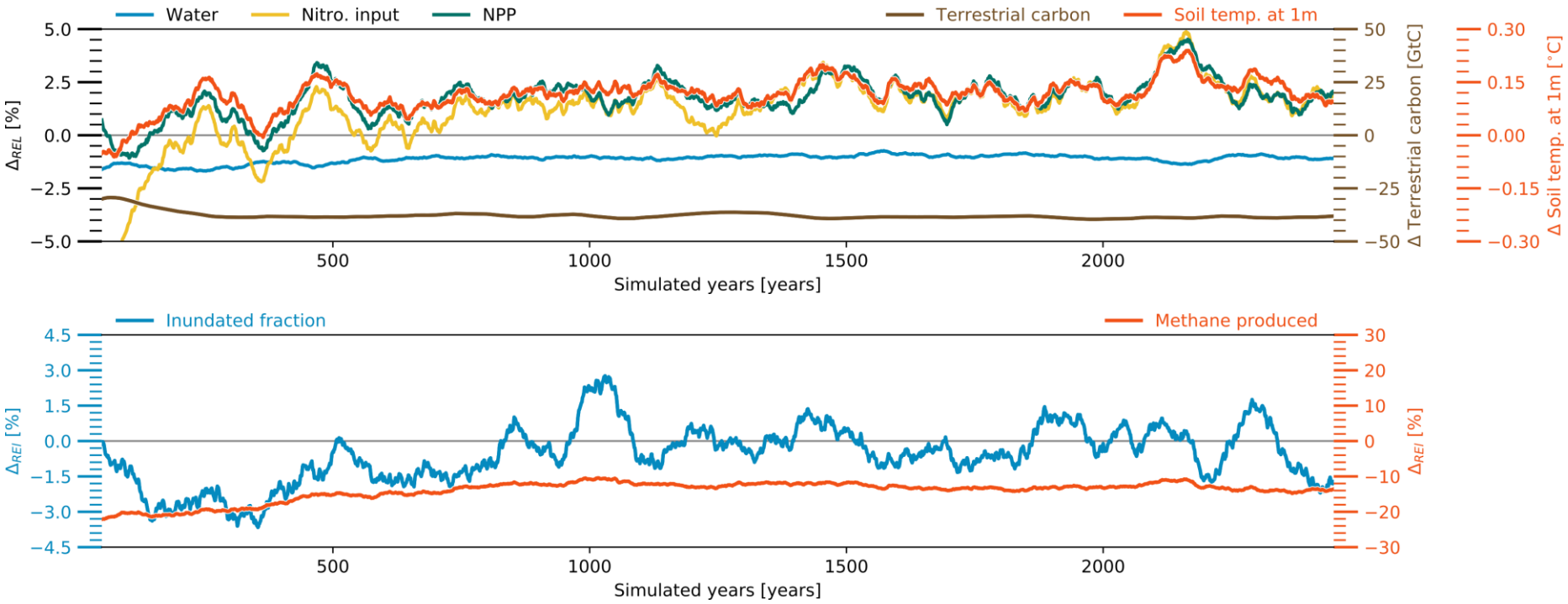
Multistability



Causes for multistability



Legacy effects at pan-arctic scale



- Summary
  - CO_2 emissions have linear dependency on temp.
  - Result of hysteretic factors offsetting each other
  - CH_4 emissions exhibit pronounced hysteresis
  - Feedbacks between water-, energy- and carbon cycles allow for multistability in pf. regions
  - States depend on the SOM content upon climate stabilization, which is significantly affected by an overshoot-induced soil carbon loss

- Publications
  - de Vrese, Stacke, Kleinen & Brovkin (2021), TC, 15, 1097–1130, https://doi.org/10.5194/569tc-15-1097-2021.
  - de Vrese & Brovkin (2021), nat. comm., under revision