Effect of plankton composition shifts in the North Atlantic on atmospheric pCO_2

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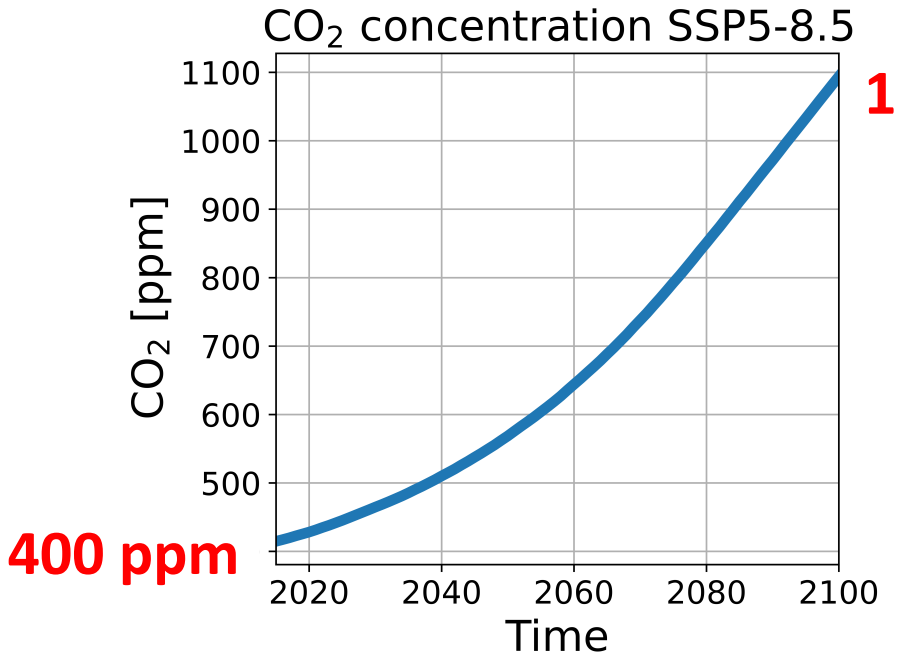
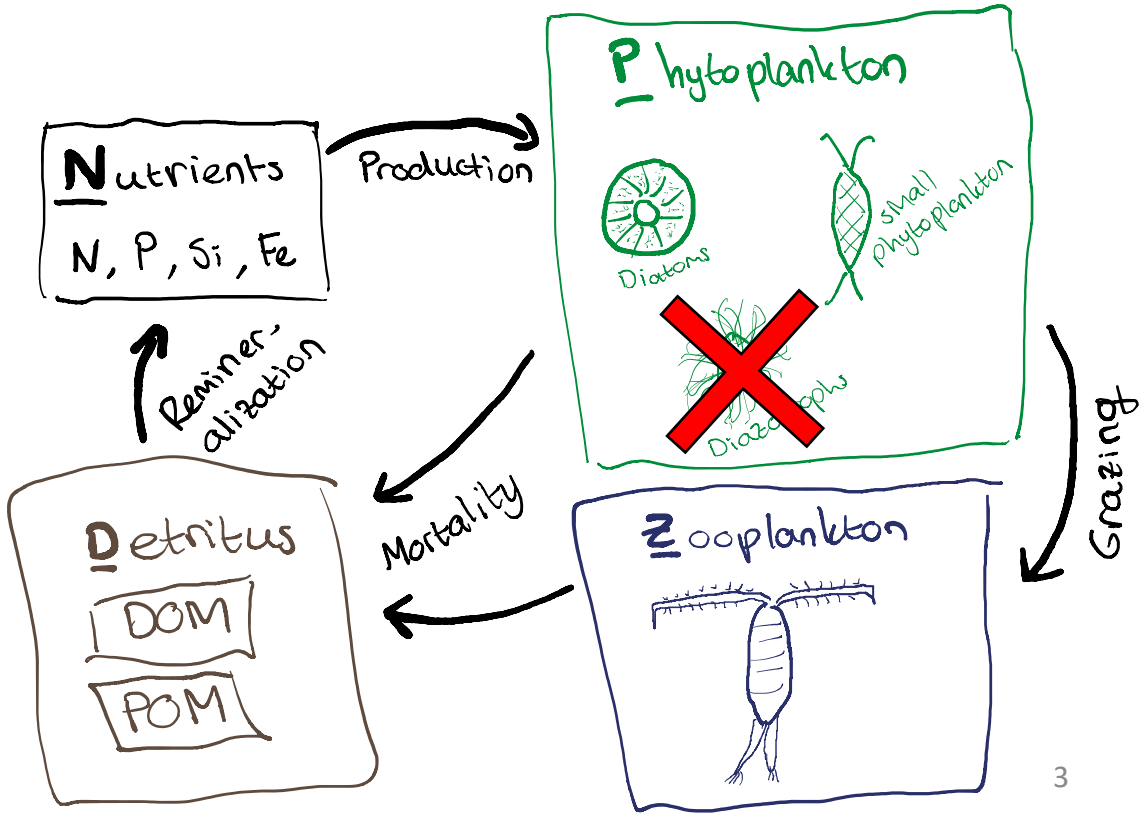
Introduction

1. How does biological production in the North Atlantic respond to higher atmospheric pCO_2 levels?
2. Does this lead to a positive or a negative feedback on atmospheric pCO_2?
3. What does this imply for the safe carbon budget?

Methods

- 1 Ensemble member Community Earth System Model v2[1]
- Ecosystem model: based on NPZD-model
- SSP5-8.5 forced by emissions



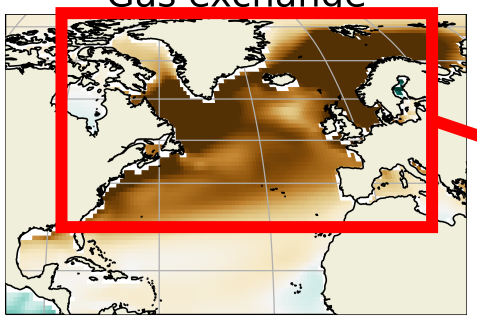


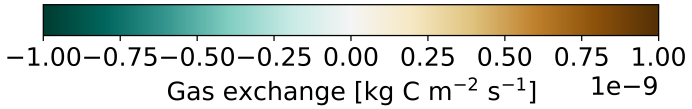
[1]Simulations performed by NCAR as part of CMIP6

Results

Begin simulation

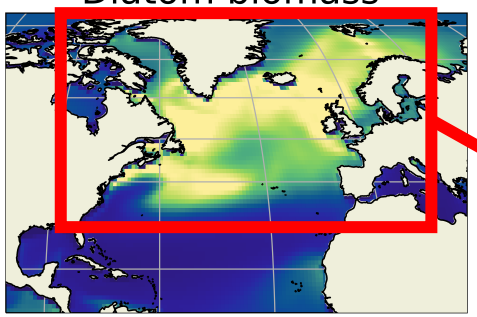
Gas exchange

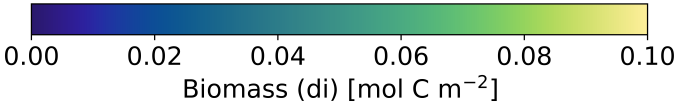




Carbon uptake

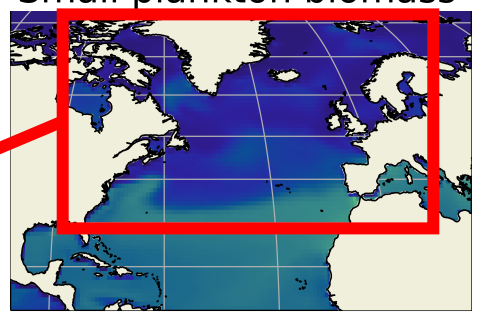
Diatom biomass

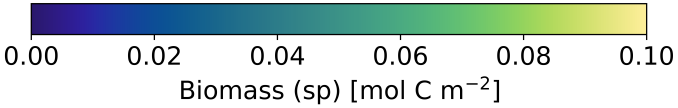




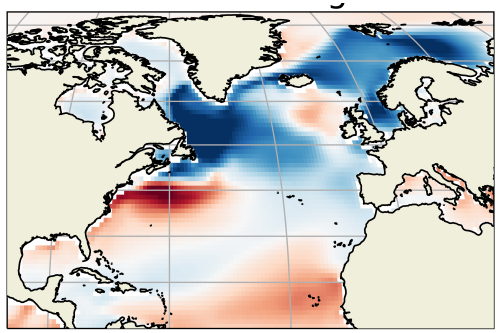
Diatoms dominant

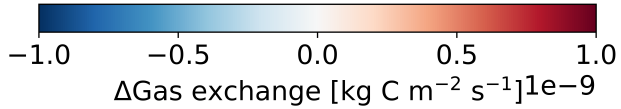
Small plankton biomass

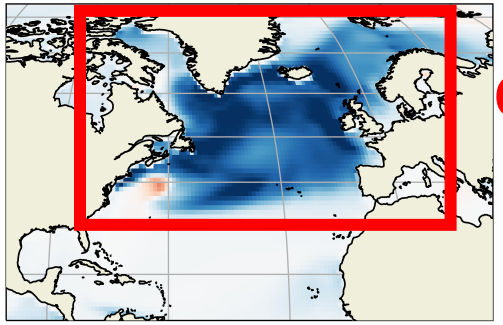


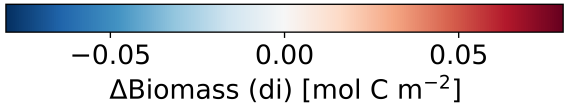


Difference: end - begin

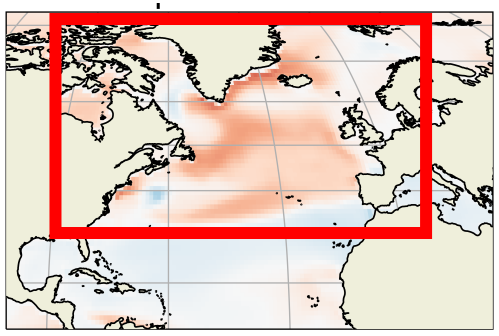


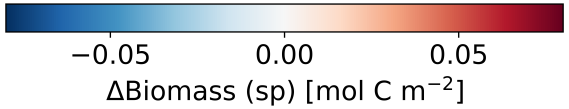




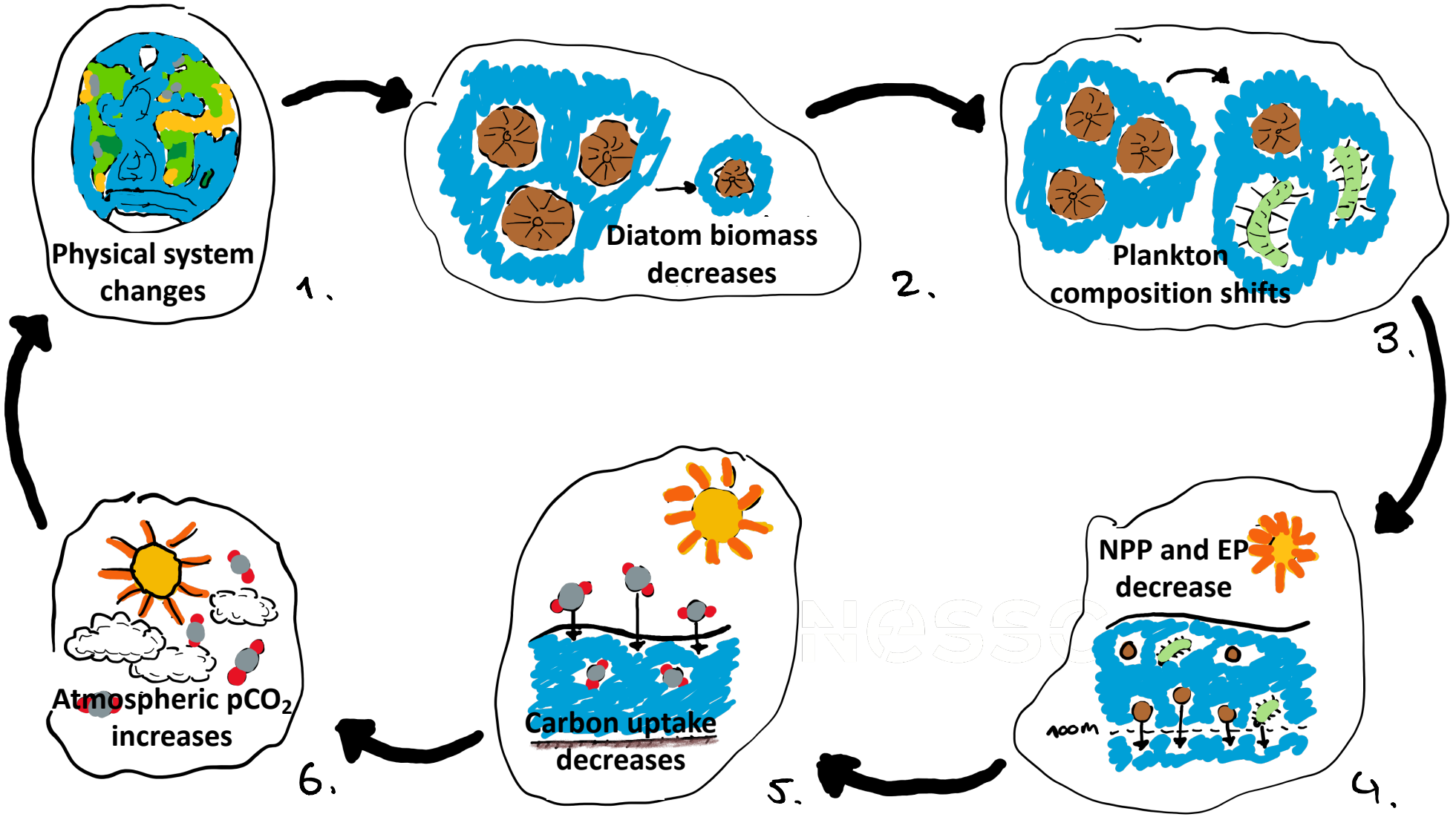


Composition shift



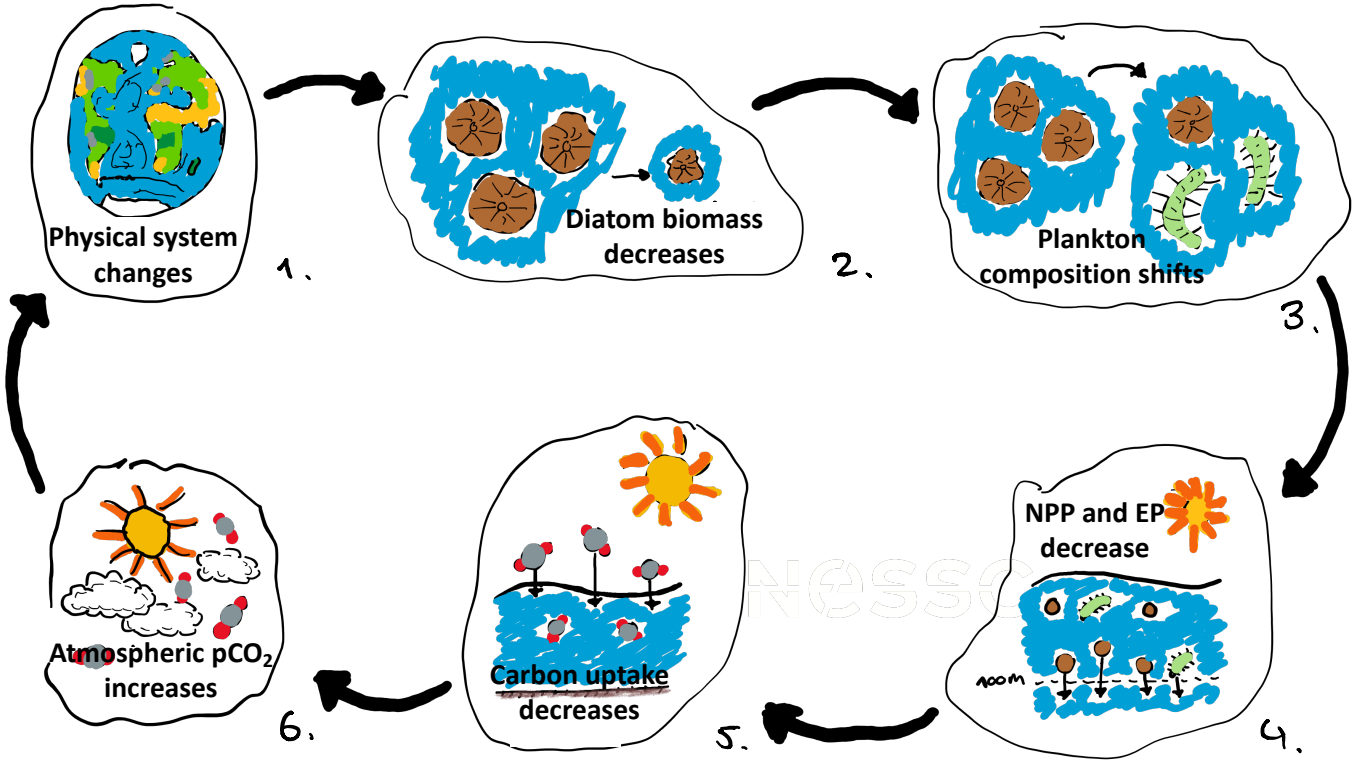


Results


Physical system changes
1.
Diatom biomass decreases
2.
Plankton composition shifts
3.
NPP and EP decrease
4.
Carbon uptake decreases
5.
Atmospheric pCO_2 increases
6.

Conclusion

1. Plankton compositions shifts from larger **diatoms** to **small phytoplankton** which decreases **NPP** and **EP**.
2. This introduces a **positive** feedback.
3. This affects the **1.5°C** and the **2°C** safe carbon budget.



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References

CESM2 data:

Danabasoglu, Gokhan **(2019)**. *NCAR CESM2 model output prepared for CMIP6 C4MIP esm-ssp585*. Version 20210607.Earth System Grid Federation. https://doi.org/10.22033/ESGF/CMIP6.7582

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