

Climate sensitivity and biogeochemical feedback

Min Xu and Forrest M. Hoffman

*Climate Change Science Institute, Oak Ridge
National Laboratory*

Science Questions

Important to predictions of future warming and contributed to the **biggest uncertainty** to the carbon budget estimations consistent with the Paris Agreement

1. What are the climate sensitivity and ecosystem feedbacks to the changing climates simulated by E3SMv1.1 CNP and CN simulations?
2. Are the simulated climate sensitivity and feedbacks consistent with those of other models in CMIP5 and CMIP6?
3. Will the phosphorus cycle affect the responses and feedbacks? And how?

Results

Fig. 1
 β_L at $2xCO_2$

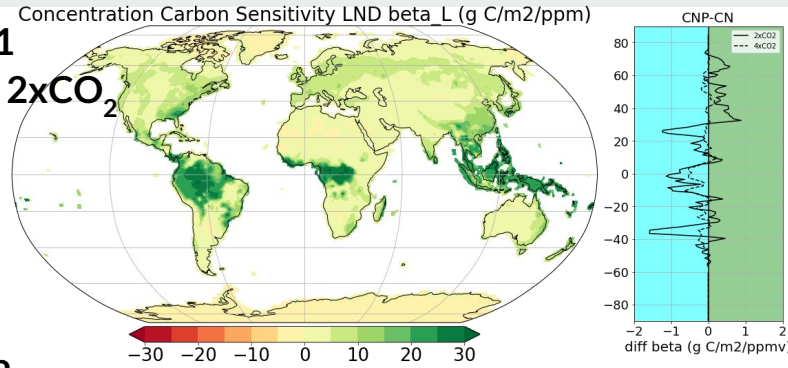


Fig. 3

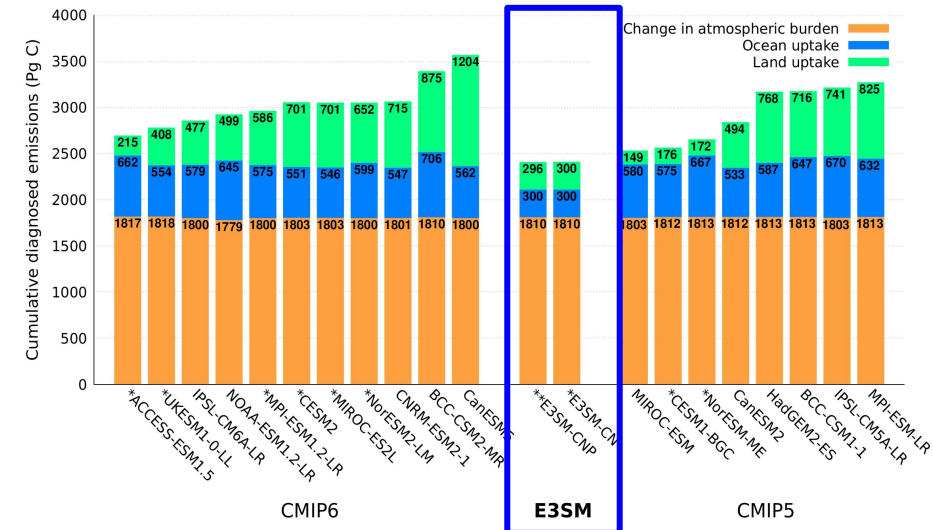


Fig. 2

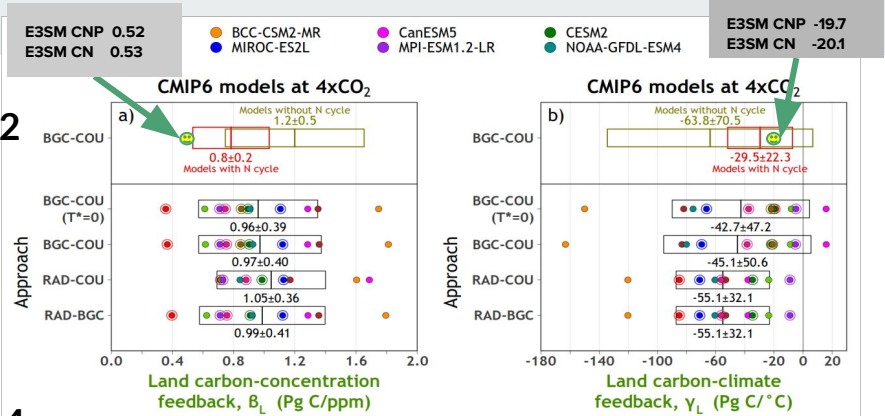
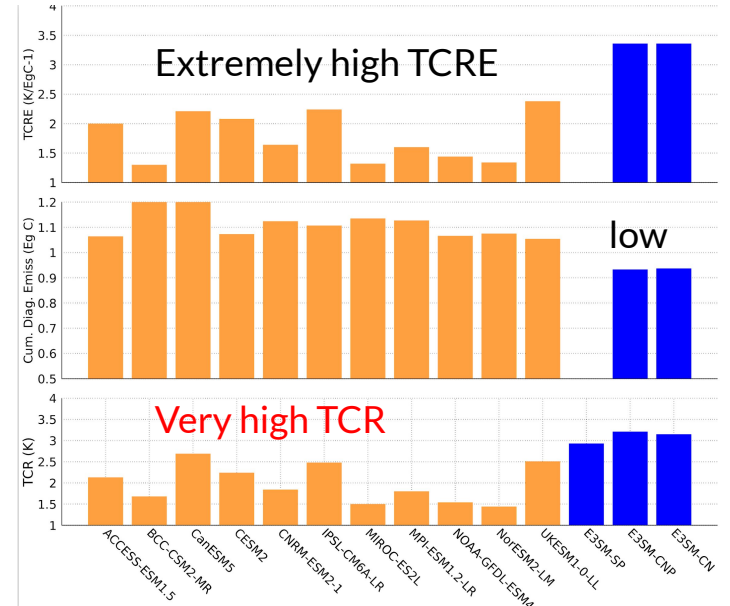


Fig. 4



E3SM CN and CNP results are computed from the E3SMv1.1 CTC 1pctCO2 simulations, Fig. 2 is from Arora et al. 2020, Fig. 3 and 4 are replotted using the data in Arora et al. 2020, the E3SM-SP TCR is obtained from Golaz et al. 2019



Future plans

- Investigate the processes causing the high TCR and low land uptake simulated by E3SM
- Include the E3SM 4xCO₂ simulations in the analysis
- Develop metrics and implement them into ILAMB/IOMB
- Develop emergent constraints
- Link to other E3SM simulations by collaborating with other members, including ECA and historical simulations



Relationship to white Paper

- Evaluate land surface responses and feedbacks to increasing CO₂ as mentioned in the sections of “Gaps in Current Research” and “Short Term Research Goals”
- Develop novel metrics for benchmarking tools as described in the section of “Short Term Research Goals”
- Study the impacts of the phosphorus cycle on the responses and feedbacks of tropical ecosystems as indicated in the paragraph of “Tropical biogeochemistry and hydrology” in the section of “Description of Challenges and Current Research in RGMA”