

Modeling biogeochemical feedbacks in a changing climate

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The fate of anthropogenic CO₂ emissions is modulated by the strength of the ocean and land carbon sinks. Any change in the processes regulating these carbon sinks may alter the biogeochemical feedbacks on climate and affect the rate of global change. To the first order, the relationship between global warming and cumulative CO₂ emissions is a near-linear. Yet, recent studies based on Earth system models (ESMs) highlight large uncertainty across models, due to our lacking understanding of the biogeochemical and physical processes. Computing ESMs with higher (km-scale) spatial resolutions leads to improved representations of the physical climate processes due to resolving subgrid physics. Yet, such ESMs still rely on oversimplified assumptions governing ocean microbial and ecosystem processes. Realistic representation of the complex marine biology as an interactive component in km-scale ESMs is a key scientific challenge. I will discuss the current progress, challenges and opportunities in modeling the changing ocean biogeochemical feedbacks in the Earth system with the new comprehensive ESM based on the ICON architecture and featuring higher spatial resolutions.