Session: B12 Oral presentation

Response of phytoplankton and ocean biogeochemistry to a warming world

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We examine the response to global change of diverse phytoplankton communities in an ocean circulation, biogeochemistry and ecosystem model. We resolves multiple ocean nutrients and 100 diverse phytoplankton types. This ocean component is embedded in an earth system model. Here we examine how the emergent modelled phytoplankton community structure responds to the changing physical and biogeochemical environment in both policy and no policy emissions scenarios. Community structure has a key role in the ocean carbon cycle and especially the export of carbon to depth. We discuss how the changes in temperature and ocean circulation each elicit the re-organization of the biogeography and biodiversity in the modeled plankton communities, as well as the feedback on marine biogeochemical cycles. Biological rates will increase due to warmer temperatures, promoting higher primary production. However lower nutrient supplies due to a slower circulation leads instead to a reduction. How these two effects play out in primary production and community structure leads to the complex patterns of shifts in export of carbon to the deep ocean, which in turn feeds back to the full earth system carbon cycle. We discuss the uncertainties in how we model both the temperature driven changes in biological rates (e.g. phytoplankton growth) and in our ability to model the changing circulation (and hence nutrient environment); the combination of the two could impact the sign of the ocean biological response in a warming ocean.