



The relative importance of phytoplankton light absorption and ecosystem complexity for the climate system

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While the complexity of Earth system models with respect to marine biota has increased over the years, the relative importance of biological processes in driving climate relevant mechanisms such as the biological pump and phytoplankton light absorption is still unclear. In particular, the effect of few versus many biological processes in ecosystem models on the global energy and heat budget has not been studied in detail. We have investigated the relative importance of ecosystem complexity and phytoplankton light absorption for climate studies. To shed light on the role of biologically mediated feedbacks, we performed model runs with the EcoGENIE Earth system model, with different degrees of complexity in the resolution of the marine ecosystem. Increasing ecosystem complexity has an impact on the carbon cycle, more specifically on the export production of particulate organic carbon and thus on the atmospheric CO₂. Phytoplankton light absorption modifies the sea surface temperature and the oceanic circulation affecting therefore the atmospheric temperature. But increasing ecosystem complexity and phytoplankton light absorption do not have the same impact on the climate system. We determine which processes are particularly relevant for the climate system and should thus be taken into account.