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Modelled response of marine ecosystems to Last Glacial Maximum forcing

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Marine plankton play a key role in climatic transitions through their ability to transfer atmospheric carbon dioxide (CO_2) to the deep ocean via the biological pump. It has been suggested that the lower atmospheric CO_2 concentrations during the Last Glacial Maximum (LGM) might have resulted from enhanced export production triggered by higher micronutrient (Fe, Si) availability from continental dust, particularly in the Southern Ocean. Such a scenario is consistent with higher sediment accumulation rates observed during the LGM.

In this study we use a new competition-driven ecosystem model that includes four major plankton types (diazotrophs, coccolithophores, diatoms and other general phytoplankton) to investigate their response to LGM climatic boundary conditions and to reconstructed micronutrient (Fe, Si) availability. We apply different dust fluxes, based on two plausible reconstructions (Mahowald et al., 2006 and Ohgaito et al., 2018). We compare LGM simulations with preindustrial simulations and disentangle the simulated ecosystem response due to climate forcing from the response due to micronutrient availability. We find that the ecosystem responses are complex and spatially heterogenic.