Stable carbon isotopes in the glacial ocean investigated with the REcoM marine ecosystem model

P. Köhler, M. Butzin, Y. Ye, C. Völker

Alfred-Wegener-Institut Helmholtz-Zentrum für Polar-und Meeresforschung (AWI), P.O. Box 12 01 61, 27515 Bremerhaven, Germany

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Abstract

Stable carbon isotopes have now been implemented in REcoM (Hauck et al., 2016), the marine ecosystem and biogeochemistry model applied at AWI. In an ocean-only setup implemented in the MITgcm 3D-OGCM we here show how changing boundary conditions influence the simulated δ^{13}C fields. Different to most other marine biogeochemistry models, RECOM does not rely on fixed stoichiometric ratios of phytoplankton organic matter. Instead, the composition of phytoplankton organic matter is calculated as a response to light, temperature and nutrient supply, which allows for assessing potential stoichiometric shifts between the past and present. We study different parametrisations of biogenic carbon-isotopic fractionation of marine phytoplankton during photosynthesis (Laws versus Rau) and their influence on model–data comparisons for the Last Glacial Maximum and the Holocene.

Furthermore, we perform simulations, in which the climatic boundary and initial conditions (SST, wind, precipitation, runoff, salinity) and / or the dust fluxes are prescribed for preindustrial or LGM conditions based on previous studies (Zhang et al., 2014; Völker & Köhler, 2013; Albani et al., 2016). This gives us four simulations, from which we will analyse how especially dust via iron fertilization of the marine biology versus mainly physical (ocean overturning) changes will influence simulated δ^{13}C fields. In doing so we will quantify how relevant the silicic acid leakage hypothesis and ocean overturning changes are for glacial δ^{13}C.

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