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Skill assessment of marine biogeochemical models

Andreas Oschlies (1), Iris Kriest (1), Olaf Duteil (1), Wolfgang Koeve (1), and Samar Khatiwala (2)

(1) IFM-GEOMAR, Marine Biogeochemical Modelling, Kiel, Germany (aoschlies@ifm-geomar.de), (2) Lamont Doherty Earth Observatory, Columbia University, Palisades, NY, USA

The evaluation of marine biogeochemical models against observations is mandatory for generating scientifically relevant information from the output of such models. Still, biogeochemical components of coupled carbon-climate models are difficult to evaluate because of the mapping of errors in the physical transport on the distribution of tracers and because of the multitude of empirical structural elements of different marine ecosystem models. We present a comparison of several marine biogeochemical models of varying degrees of complexity coupled to transport fields taken from different global ocean circulation models. A number of metrics, all based on the observed distributions of nutrients, oxygen, dissolved inorganic carbon and alkalinity, are used to evaluate the biogeochemical models and to investigate the sensitivity of the model results to changes in parameters or parameterizations. Our findings illustrate that increases in structural model complexity do not necessarily lead to improved model performance. We discuss the implications of typical model uncertainties for simulated carbon-climate feedbacks in global-warming and ocean-acidification scenario simulations. We also identify systematic deficiencies in the models investigated, particularly in modeled oxygen and alkalinity distributions, which may help to guide future model improvement.