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A skill assessment of the biogeochemical model REcoM2 coupled to the Finite Element Sea Ice–Ocean Model (FESOM 1.3)

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Abstract. In coupled biogeochmical–ocean models, the choice of numerical schemes in the ocean circulation component can have a large influence on the distribution of the biological tracers. Biogeochemical models are traditionally coupled to ocean general circulation models (OGCMs), which are based on dynamical cores employing quasi-regular meshes, and therefore utilize limited spatial resolution in a global setting. An alternative approach is to use an unstructured-mesh ocean model, which allows variable mesh resolution. Here, we present initial results of a coupling between the Finite Element Sea Ice–Ocean Model (FESOM) and the biogeochemical model REcoM2 (Regulated Ecosystem Model 2), with special focus on the Southern Ocean.

Surface fields of nutrients, chlorophyll *a* and net primary production (NPP) were compared to available data sets with a focus on spatial distribution and seasonal cycle. The model produces realistic spatial distributions, especially regarding NPP and chlorophyll *a*, whereas the iron concentration becomes too low in the Pacific Ocean. The modelled NPP is 32.5 Pg C yr^{-1} and the export production 6.1 Pg C yr^{-1}, which is lower than satellite-based estimates, mainly due to excessive iron limitation in the Pacific along with too little coastal production. The model performs well in the Southern Ocean, though the assessment here is hindered by the lower availability of observations. The modelled NPP is 3.1 Pg C yr^{-1} in the Southern Ocean and the export production 1.1 Pg C yr^{-1}.

All in all, the combination of a circulation model on an unstructured grid with a biogeochemical–ocean model shows similar performance to other models at non-eddy-permitting resolution. It is well suited for studies of the Southern Ocean, but on the global scale deficiencies in the Pacific Ocean would have to be taken into account.

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