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Identifying benefits and remaining challenges of modelling the marine iron cycle by data-based calibration of a global ocean biogeochemical model

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Despite consensus that iron is a key limitation factor in the biological carbon pump, state-of-the-art iron models presently do a poor job of simulating the dissolved iron distribution. We objectively calibrated an ocean model with iron modules of different complexity (e.g. no iron, an iron mask and a dynamic iron cycle) by constraining it with observations of NO_3, PO_4, and O_2. We find that the calibrated module with a dynamic iron cycle module performs the best in respect of reproducing observed macronutrient and oxygen distribution. We also find that by introducing iron as an additional constraint for the model with a dynamic iron cycle, the model suffers in producing macronutrient and oxygen distributions. The iron data constrained model reproduces the observed iron pattern relatively well in lower-iron regions, where scavenging is an important process. The model without the iron constraint reproduces the observed iron pattern relatively well in higher-iron regions, where our model is subject to uncertainty in external iron sources, e.g. along continental margins.