Two-way physics-biogeochemistry coupling constrained by ocean colour data assimilation

We implemented two-way physics-biogeochemistry coupling in the global NEMO-MEDUSA model, via the use of 3D model chlorophyll in the light attenuation calculations. This was tested with and without assimilation of chlorophyll observations from ocean colour to constrain the model, and the impact on model physics and biogeochemistry assessed. The two-way coupling impacted model physics differently on different time scales, as well as regionally and seasonally. There was a particularly significant impact on ocean heat content, with less heat taken up in the upper 300m in the two-way coupled model. This change in heat content was approximately doubled by assimilating ocean colour data. Both with and without ocean colour assimilation the two-way coupling led to a small increase in sea surface temperature and a larger decrease in subsurface temperature, with a larger impact on the subsurface when assimilation was introduced. By comparing model runs with constrained and unconstrained chlorophyll, the uncertainty in the biogeochemical feedback due to errors in free-running model chlorophyll could be assessed. This highlights the importance of data assimilation for improving model processes and therefore predictions.

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