Evaluation of Vertical Patterns in Chlorophyll-A Derived From a Data Assimilating Model of Satellite-Based Ocean Color

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Science Question

The estimation of oceanic carbon fluxes hinges on the correct representation of phytoplankton biomass both at surface and at depth. Our first step toward the estimation of Southern Ocean CO_2 fluxes is to evaluate how well does the NASA Ocean Biogeochemical Model (NOBM) represent vertical chlorophyll (Chl) profiles based on the assimilation of surface ocean color fields from space.

Analysis

NOBM produces 3D Chl fields based on the assimilation of surface ocean color data from MODIS. Model data is compared against fluorescence-based Chl estimates from autonomous profiling drifting floats (BGC-Argo), primarily deployed in the Southern Ocean.

Results

NOBM Chl is slightly higher than floats but replicates well the general seasonality and meridional gradients in surface and depth-resolved Chl from the BGC-Argo float array. Largest deviations (RMSE = 0.6 mg Chl m^{-3}) are found ~ 10m depth, and suggest that the model can correctly identify seasonal variations in float-based Chl, but might be unable to detect subtle changes at narrow local scales.

Significance

While neither float- nor model-based data produce perfect estimations of oceanic chlorophyll across all three dimensions, their general agreement suggests that the NOBM is able to mimic biological and physical dynamics beyond the surface ocean (where satellite data is assimilated). This provides confidence in the future simulation and projection of carbon export and air-sea CO_2 fluxes from the NOBM.

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Fig. 1 (Top) Trajectories of BGC-Argo floats used in this study. (a) Southern Hemisphere float trajectories. (b) Trajectories of floats nearby station ALOHA used for the comparison of float and model profiles against in situ data.

Fig. 1

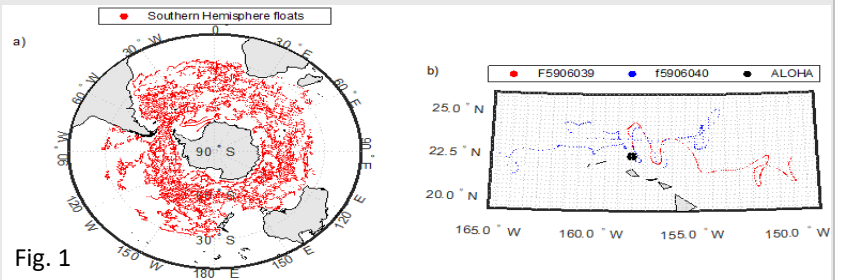

Fig. 2

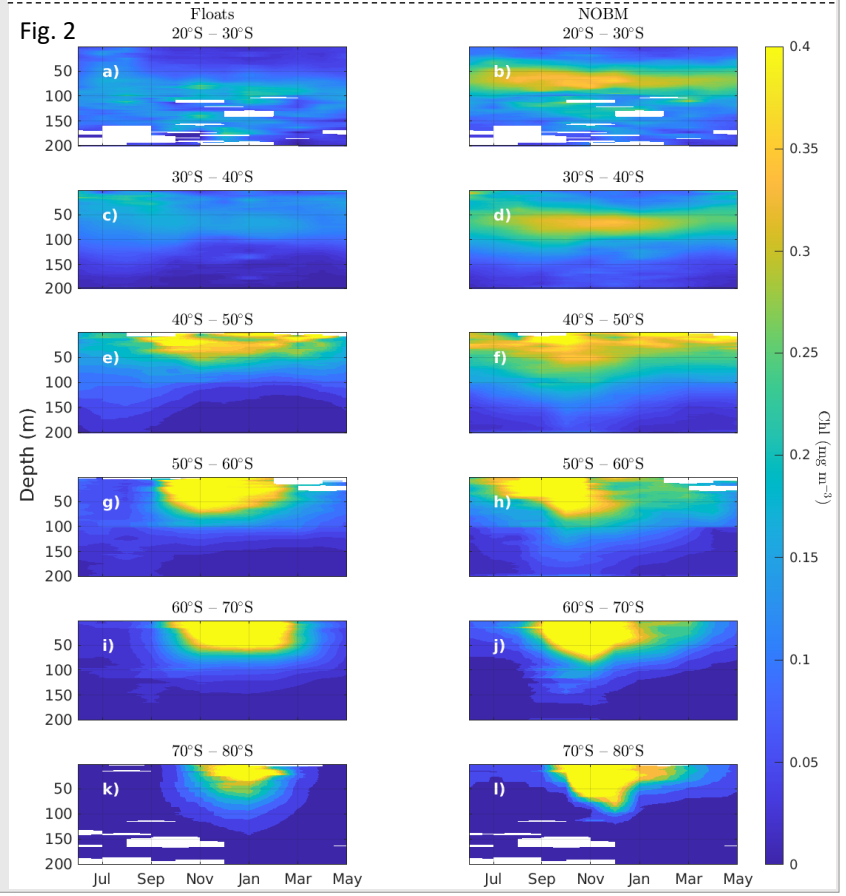

Fig. 2 (Bottom) Monthly- and depth-averaged chlorophyll (Chl) profiles from BGC-Argo floats (left panels) and the NOBM (right panels). Profiles are divided in 10° meridional bins

Notes

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