Ocean Biogeochemical EOS Assimilation Model

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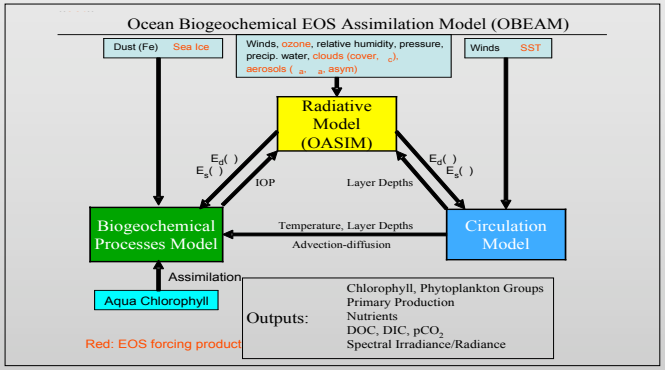
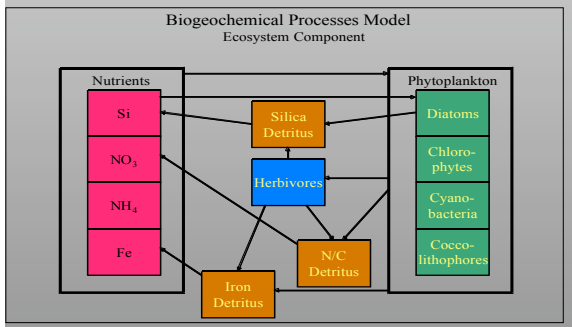
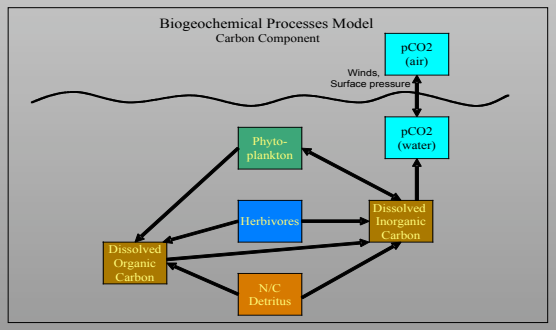
The Ocean Biogeochemical EOS Assimilation Model (OBEAM) is nearly completely constructed and is now routinely assimilating Aqua and SeaWiFS chlorophyll fields. OBEAM has a global bias of 1.4% and uncertainty of 8.9% compared to Aqua.



Conceptual diagram of OBEAM, illustrating the relationships among three model components. Forcing fields derived from EOS products are shown in red. Sea ice from AMSR remains to be implemented.





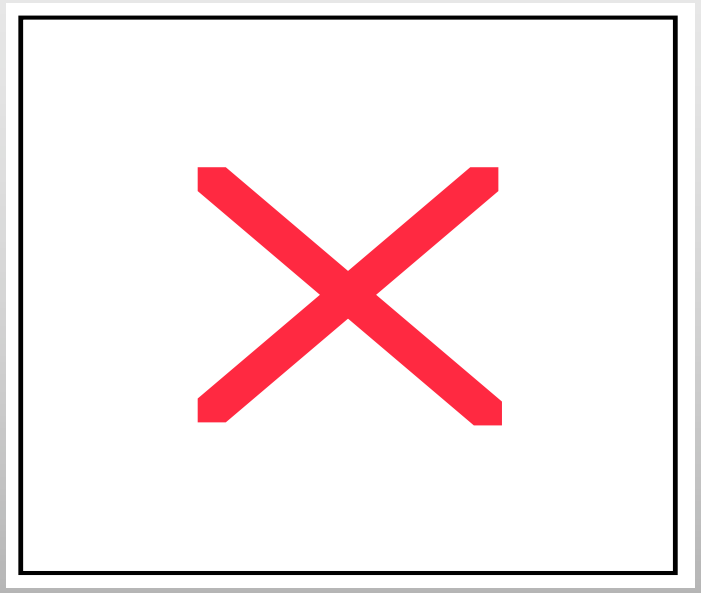
Assimilation Methodology

The assimilation methodology uses the conditional relaxation analysis method, commonly known as the blended analysis. This method assumes that the satellite chlorophyll data represent a truth field, and the model spatial distributions are realistic. Biases in the model are removed using the satellite data, while enforcing matching of Laplacian's with and without the inserted satellite data:

$$\nabla^2 C_T(\text{ana}) = \nabla^2 C_T(\text{model})$$

where C_T(model) is the total model chlorophyll (sum of all 4 phytoplankton components) and C_T(ana) is the analyzed chlorophyll, which contains the satellite chlorophyll where present. The method is heavily weighted toward the data, and thus data errors in Aqua are a critical issue in application. In our application, Aqua daily data was weighted at 25% with monthly means at 75%. Additionally, an error-weighting field was constructed, based on analysis of SeaWiFS errors (Gregg and Casey, 2004).

Forecast for Jan 1, 2005 Observed by Aqua



Top left: Forecast assimilation model for Jan 1, 2005. Top right: Daily Aqua actually observed. Bottom: difference. Units are mgChl m^{-3}.

Table 1. Statistics for the comparison of SeaBASS/NODC chlorophyll data for the period 1998-2003 with coincident, co-located SeaWiFS, free-run model and assimilation model chlorophyll. N indicates the number of points where in situ and satellite/model points were coincident and co-located.

	Bias	Uncertainty	N
SeaWiFS	-1.3%	32.7%	2086
Free-run Model	-1.4%	61.8%	4465
Assimilation Model	0.1%	33.4%	4465

References

Gregg, W.W. and N.W. Casey, 2004. Global and regional evaluation of the SeaWiFS chlorophyll data set. Remote Sensing of Environment 93: 463-479.

Gregg, W.W., P. Ginoux, P.S. Schopf, and N.W. Casey, 2003. Phytoplankton and Iron: Validation of a global three-dimensional ocean biogeochemical model. Deep-Sea Research II 50: 3143-3169.

Gregg, W.W., 2002. Tracking the SeaWiFS record with a coupled physical/biogeo-chemical/radiative model of the global oceans. Deep-Sea Research II 49: 81-105.

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