Assessing the Impact of BGC Argo float array deployment region on state estimation by using the Estimated Ocean State for Climate Research (ESTOC)

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We are trying to estimate both physical and biogeochemical ocean states with integrating various observations including BGC Argo float array through a 4-dimensional variational data synthesis system.

Focused on the dissolved oxygen observation collected by BGC float.

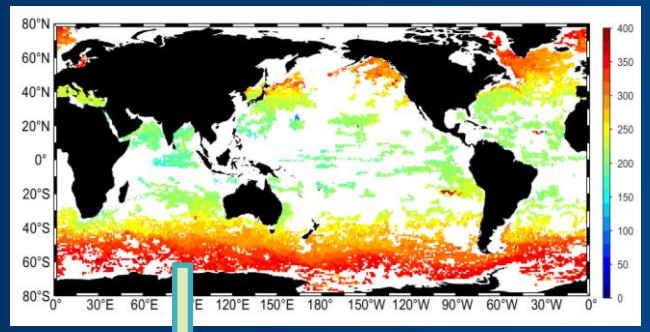
Examine the impact of each BGC float deployment area on ocean state estimation.

- ✓ The optimal model parameters are obtained for five basins (Atlantic, Pacific, Indian, Southern Ocean, and Arctic Ocean) with a Green's function approach.
- ✓ Evaluate the BGC float observation impacts on our ocean state estimation. Comparing the results based on obtained optimized parameters between with and without BGC float observations.

Synthesis of observational data and model

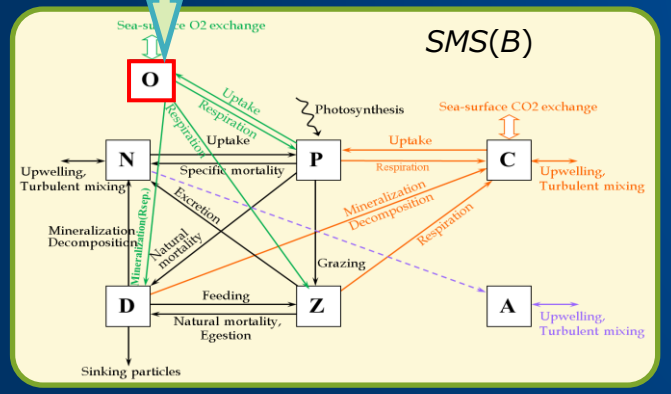
Observation

BGC ARGO from 2002 to 2020



Synthesis of observational data and model

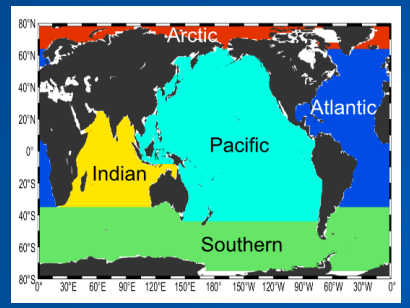
Model



Two model parameters related to dissolved oxygen in each basin were optimized. (O/N ratio and O_2 gas transfer rate)

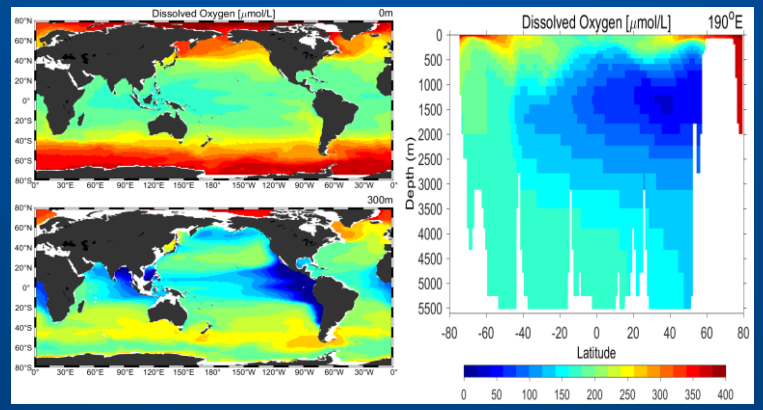
An optimal set of model parameters were searched through a Green's function approach (Menemenlis et al., 2005).

The costs are dissolved oxygen concentration obtained by BGC float observation.

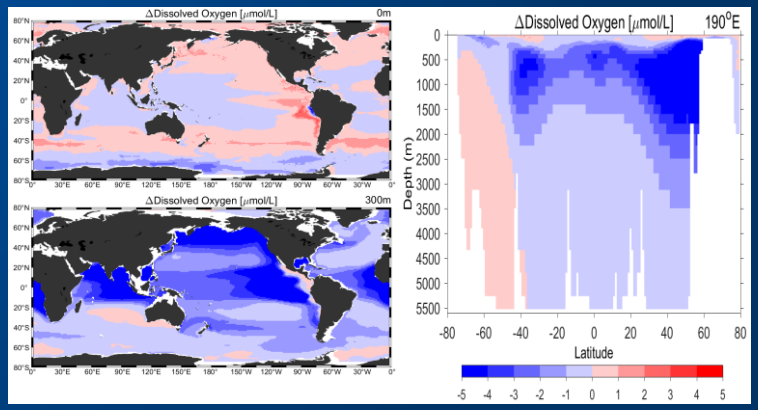


Optimized values for the control variables estimated by a Green's function approach

Parameter	First guess	Optimized values					
		Atlantic	Pacific	Southern	Indian	Arctic	Global
O/N ratio	8.63	9.39	9.47	8.47	9.35	8.94	
O_2 gas transfer rate (m/day)	2.00	2.09	1.83	1.75	1.81	1.51	
Cost reduction rate (%)	-	-2.9	-6.3	-0.2	-6.1	-19.0	-3.5



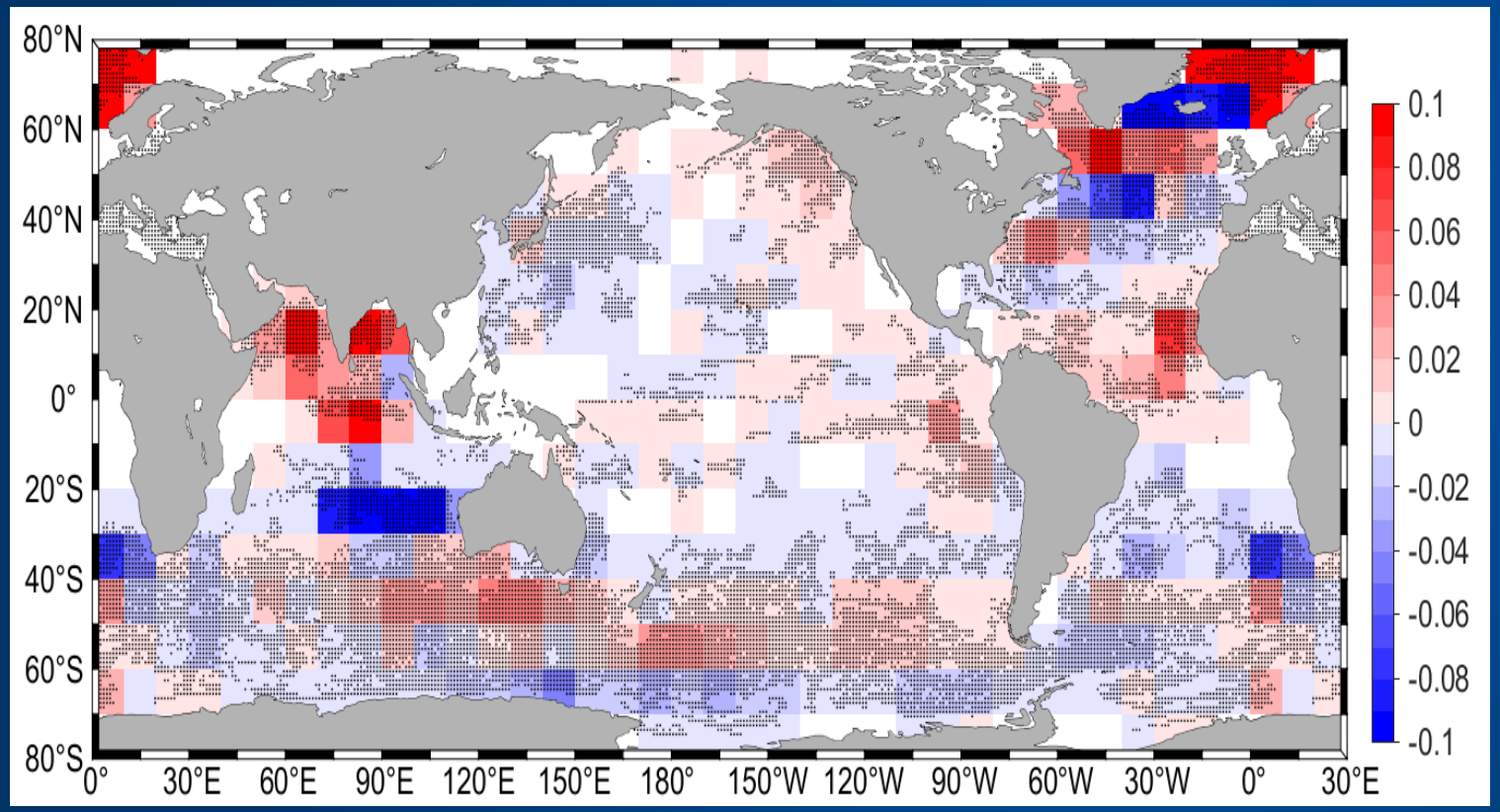
Dissolved oxygen distribution of the optimized model results.



Dissolved oxygen difference from the case without BGC float data.

Contribution of observational data to the model parameter optimization

Investigate the difference between
cost reduction rates from optimization using all observations
and
for each 10-degree rectangular region, the optimized cost reduction rate without considering its region's observation.



Map of differences in cost reduction rates (%pt).
The black dots show the locations of BGC float profile.

The colors.

Red : the basin cost increased.

Blue : the basin cost decreased.

White : there were no observed profiles in that region at all.