

## Estimated State of Ocean for Climate Research by Using a 4 Dimensional Variational approach Estimated State of Ocean for Climate Research by Using a 4 Dimensional Variational approach

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A 4-dimensional variational data assimilation system has been used to better define the 50-year global ocean state estimation for climate research. The synthesis of available observations and general circulation model with a pelagic ecosystem model based on nitrogen cycle yields a dynamically self-consistent dataset. Obtained ocean state estimation possibly has greater information than do models or data alone. In our 4D-VAR approach, optimized 4-dimensional analysis fields are sought by minimizing a cost function on the basis of adjoint method for physical parameters and Green's function approach for biogeochemical ones. The assimilated elements are temperature and salinity based on EN3 dataset provided by Met Office Hadley Centre, sea surface height anomaly from AVISO, nitrate from WOA05, and chlorophyll-a from WOA98 and SeaWiFS. We here present the properties of the analysis fields and some results of climate study by using this state estimation named ESTOC. This report implies that our synthesis scheme as a dynamical interpolation for sparse observations including bio-geochemical parameters is possibly promising and useful for " Integrated Earth System Analyses " .

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