Dataset: Deep convection simulation from the MITgcm (MIT General Circulation Model) (IVOMLS project)

Project(s): Interannual variability of oxygen and macro-nutrients in the Labrador Sea (IVOMLS)

Abstract: All experiments are preformed using the MIT General Circulation Model (MITgcm). The model is configured to allow non-hydrostatic dynamics to explicitly resolve deep convection. The model domain is a box with periodic boundary conditions in the x and y directions of 32 x 32 km with horizontal resolution of 250 m. The box has a uniform depth of 2 km with 41 z-levels whose thicknesses increases from 10 m at surface to 100 m near the bottom. The linear equation of state is used throughout this study. 16 sensitivity experiments are designed to explore the behavior of oxygen uptake during the deep convection events under different cooling conditions. Two validation runs are also applied by forcing the model using observational data from Argo. In this data set, horizontally averaged profiles and vertical transport of dissolved oxygen and temperature from all experiments are included. A few transect of dissolved oxygen and temperature are also included to demonstrate the evolution of the convection event. For a complete list of measurements, refer to the supplemental document 'Field_names.pdf', and a full dataset description is included in the supplemental file 'Dataset_description.pdf'. The most current version of this dataset is available at: http://www.bco-dmo.org/dataset/706167

Description: MITgcm model deep convection simulation output

This dataset includes deep convection simulation output from the MITgcm (MIT General Circulation Model). The data include profiles under different situations in an idealized domain. The experiment was based on winter Labrador Sea conditions.

Model output is available to download as MATLAB .mat files by clicking the "Get Data" link. Each file includes the output of one run covering 90 days.
* Contents of .mat files described in mat_file_variables.csv

Acquisition Description: All experiments were performed using the MIT General Circulation Model (MITgcm) [Marshall et al., 1997a, b]. The model was configured to allow non-hydrostatic dynamics to explicitly resolve deep convection, and the set-up was modified from Jones and Marshall [1993]. The model domain was a box with periodic boundary conditions in the x and y directions of 32 x 32 km with a horizontal resolution of 250 m. The box had a uniform depth of 2 km with 41 z-levels with increasing thickness from 10 m at surface to 100 m near the bottom. The linear equation of state was used throughout this study. 16 sensitivity experiments were designed to explore the behavior of oxygen uptake during the deep convection events under different cooling conditions. Two validation runs were also applied by forcing the model using observational data from Argo (http://www.argo.net/). Detailed information about all simulations can be found in Sun et al [2017]. In this data set, horizontally averaged profiles and vertical transport of dissolved oxygen and temperature from all experiments are included. A few transect of dissolved oxygen and temperature are also included to demonstrate the evolution of the convection event.

References:

Jones, H., and J. Marshall (1993), Convection with rotation in a neutral ocean: A study of open-ocean deep convection, Journal of Physical Oceanography, 23(6), 1009–1039.

Marshall, J., C. Hill, L. Perelman, and A. Adcroft (1997a), Hydrostatic, quasi-hydrostatic, and non-hydrostatic ocean modeling, Journal of Geophysical Research: Oceans, 102(C3), 5733–5752.

Marshall, J., A. Adcroft, C. Hill, L. Perelman, and C. Heisey (1997b), A finite-volume, incompressible navier stokes model for studies of the ocean on parallel computers, Journal of Geophysical Research: Oceans, 102(C3), 5753–5766.

Sun, D., T. Ito and B. Annalisa, Oxygen flux and vertical transport during deep convection events, submitted to Global Biogeochemical Cycles.

Processing Description: Arithmetic means calculated using Matlab software.

BCO-DMO Data Manager Processing notes:
27 Jun 2017: Metadata descriptions provided here are preliminary and have not yet been reviewed by the data contributor.
* model output files indexed with file sizes and download links added to the dataset.

Project Information

Interannual variability of oxygen and macro-nutrients in the Labrador Sea

NSF abstract: Recent observations and climate model projections indicate that the global oxygen inventory may be declining due to the lower solubility and the increasing stratification associated with a warming climate. Decomposition of organic matter in the deep sea consumes dissolved oxygen, which must be replenished by the circulation of oxygen-rich waters from the polar regions. Without vigorous oxygen supply from the high latitudes, the global oceans will lose oxygen. In this study, researchers at Georgia Tech will use a hierarchy of models to simulate oxygen and nutrient cycling in the Labrador Sea, one of the regions of deep water formation in the North Atlantic, over a fifty year period. The Labrador Sea is also a region of extreme seasonality and intense biological productivity, thus oxygen cycling there likely reflects multiple physical and biological processes. Results from this study will promote a better understanding of the interannual variability of oxygen and nutrients in the Labrador Sea, and ultimately contribute to knowledge on how a changing climate impacts these cycles. Broader Impacts: The broader impacts of this project include student training, international collaboration and outreach to K-12 students.