Selected output from the hindcast simulation (1948 to 2007) of the Community Earth System Model (CESM) Biogeochemical Elemental Cycle (BEC) for the Southern Ocean (SO Carb Chem Change project)

Website: https://www.bco-dmo.org/dataset/706151
Data Type: model results
Version:

Project
» The Variable and Changing Carbonate Chemistry of the Southern Ocean (SO Carb Chem Change)

Contributors	Affiliation	Role
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Dataset Description

This dataset contains selected output from the hindcast simulation (1948 to 2007) of the Community Earth System Model (CESM) Biogeochemical Elemental Cycle (BEC) for the Southern Ocean. These data were utilized in Lovenduski et al. (2013) to investigate multi-decadal trends in advection, mixing, and sea-air flux of natural carbon dioxide (CO2). 60 yearly output files (1948 to 2007) are available by pressing the "Get Data" button. The files are available to download individually (54 GB total) or as a .tar.gz compressed file containing all 60 files (32 GB).

References:

Lovenduski, N. S., M. C. Long, P. R. Gent, and K. Lindsay (2013), Multi-decadal trends in the advection and mixing of natural carbon in the Southern Ocean, Geophys. Res. Lett., 40, 139–142, doi:10.1029/2012GL054483.

Methods & Sampling

The hindcast output was generated with version 1.0 of the Community Earth System Model (CESM). The CESM is freely available at the CESM website (http://www.cesm.ucar.edu/).

Data Processing Description

Details of the model configuration, validation, simulations, and statistical analyses are available in the supplementary document cesm_aux_submitted.pdf for Lovenduski et al. 2013.

Reference:

Lovenduski, N. S., M. C. Long, P. R. Gent, and K. Lindsay (2013), Multi-decadal trends in the advection and

mixing of natural carbon in the Southern Ocean, Geophys. Res. Lett., 40, 139–142, doi:10.1029/2012GL054483.

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Data Files

File
CESM1_hind.csv (Comma Separated Values (.csv), 13.99 KB) MD5:1307ec3b9e2ca709ca96fdcc6349604c Primary data file for dataset ID 706151

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Parameters

Parameter	Description	Units
actual_year	Actual year in format yyyy	unitless
model_year	Model simulation year used for model development	unitless
filename	Filename of the yearly model output file	unitless
file_link	Link to download the yearly model output file	unitless

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Project Information

The Variable and Changing Carbonate Chemistry of the Southern Ocean (SO Carb Chem Change)

Coverage: Southern Ocean

NSF abstract:

The Southern Ocean is a source of great uncertainty and large potential change in predictions of the future carbon-climate system. In this project, a research team at the University of Colorado at Boulder will develop improved numerical models to better predict the rate of Southern Ocean carbon uptake over the next several decades to centuries. This will require a thorough understanding of the variable and changing carbonate chemistry of the Southern Ocean, including better constraints on the present-day mean state and seasonal cycle, quantification of past variability, and characterization of key processes driving change in the future. The primary numerical tool for this project will be the Community Earth System Model (CESM), a state-of-the-art Earth system model with fully interactive marine ecosystem and global carbon modules. Output from hindcast and 21st century CESM simulations, hydrographic data, and satellite data products will be used to understand model biases, interpret variability, and quantify carbon-climate feedback strength.

The specific objectives are to: (1) analyze biases in, and guide improvement of, the Southern Ocean alkalinity cycle in the CESM; (2) quantify multi-decadal changes in modeled Southern Ocean carbonate chemistry over the last 60 years, and validate these trends with satellite and hydrographic data sets; (3) identify drivers of interannual to multi-decadal variability in Southern Ocean carbonate chemistry; and (4)quantify carbon

feedbacks in the Southern Ocean due to changes in acidification, stratification, and wind-driven circulation.

By quantifying past variability in the inorganic carbonate chemistry of the Southern Ocean, and identifying the physical and ecological processes that modify carbonate chemistry here, this project will offer new insights into the changing rate of Southern Ocean carbon uptake and acidification. The vast user base of the CESM stands to benefit from the proposed improvements in the representation of biogeochemistry and ecology in the CESM.

Broader Impacts: This research will lead to a better understanding of the future evolution of the global carbon-climate system, which is of direct benefit to society. Results from this work will be widely disseminated in the scientific community through publication in peer-reviewed journals and presentation at scientific meetings. It will support an early-career scientist and the development of her research group. The PI is a mentor for the Summer Multicultural Access to Research Training program at her home institution, which aims to provide hands-on experience in research and an introduction to graduate education to undergraduate students who are members of racial/ethnic groups severely underrepresented in science, math, and engineering. The project will support the education and training of two graduate students. Significant research findings from this project will be incorporated into the curriculum of four courses at the University of Colorado.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1155240

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