Model input, output and code for individual-based copepod Calanus finmarchicus populations in Wilkinson Basin (WB), Gulf of Maine

Website: https://www.bco-dmo.org/dataset/823203
Data Type: model results
Version: 1
Version Date: 2020-09-03

Project
» Collaborative Research: Mechanisms supporting persistence of a key plankton species during climate change on the Northwest Atlantic continental shelf (Calanus Persistence GoM)

Contributors	Affiliation	Role
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Coverage

Spatial Extent: **Lat**:42.86167 **Lon**:-69.86333
Temporal Extent: 2012-01-01 - 2012-12-31

Dataset Description

Model input, output and code for individual-based copepod Calanus finmarchicus populations in Wilkinson Basin (WB), Gulf of Maine. Model output files contain results of backward tracking individal-based runs for copepod Calanus finmarchicus populations.

This model was published in Ji et al., 2017.

Methods & Sampling

Backward tracking individual-based runs for Wilkinson Basin (WB) copepod Calanus finmarchicus populations in the Gulf of Maine.

The detailed description of modeling concepts, equations and interpretation can be found in Ji, et al. (2017):

Methodology summary:
An individual-based model (IBM) was utilized to conduct copepod Lagrangian tracking and life stage development experiments. The model simulations were conducted in the so-called “offline” mode, i.e. the hydrodynamic model simulations were conducted prior to the IBM runs to provide flow fields for Lagrangian tracking and temperature for copepod life stage development. Both flow and temperature fields are stored to

allow multiple numerical experiments later, precluding the need to re-run the physical model.

* Copepod life history development is modeled based on temperature- and food-dependency.
* Temperature and flow field are interpolated from FVCOM-GOM3 model forcing.
* Food is estimated from MODIS satellite chlorophyll product.
* Two tracking schemes are used: depth-keeping and DVM.

The hydrodynamic model that generated the forcing data is the 3rd generation Gulf of Maine - Finite Volume Community Ocean Model (FVCOM) developed by collaborators at University of Massachusetts. More details can be found at http://fvcom.smast.umassd.edu/necofs/

There are 6 subfolders in the gom_cfin.tar.gz file available in the Supplemental Documents section of this page:

fiscm: Individual-based model (IBM) source code (in Fortran 95)
gom_hourly_example: One example of hourly hydrodynamic model output as forcing data for the FVCOM IBM model runs. The output can be recreated using model code provided. The full output is publicly available from a THREDDS server through the catalog http://ulysse2.whoi.edu:8080/thredds/catalog/data/gom_cfin/catalog.html in the 'gom3_hourly' subfolder.
data_files: Model configuration code and auxiliary data for model runs, including grid information, coastal and bathymetry, and WB polygon location.
depth_keeping: Depth-keeping model runs, including model setup. One example output netCDF file can be found at "depth_keeping/Year2012Gen2/WB_bit_20120930/example_output_file/fiscm_group_001.nc". The output can be recreated using model code provided. The full output is publicly available from a THREDDS server through the catalog http://ulysse2.whoi.edu:8080/thredds/catalog/data/gom_cfin/catalog.html in the 'depth_keeping' subfolder.
Matlab_data: Model data generated after processing the raw model output netcdf file from depth_keeping folder.
Matlab_scripts: Matlab codes for preparing model run files and postprocessing model output.

Data Processing Description

Matlab coding developed for post-processing model output.

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Data Files

File

Gulf of Maine Calanus finmarchicus model

filename: gom_cfin.tar.gz

(GZIP (.gz), 85.53 GB)
MD5:b062cb4d17a1f137c5059effe0771187

This folder (gom_cfin) contains backward tracking individual-based runs for Wilkinson Basin (WB) copepod Calanus finmarchicus populations in the Gulf of Maine.

The detailed description of modeling concepts, equations and interpretation can be found at:

Ji, R., Z. Feng, B. T. Jones, C. Thompson, C. Chen, N. R. Record, and J. A. Runge. 2017. Coastal amplification of supply and transport (CAST): a new hypothesis about the persistence of Calanus finmarchicus in the Gulf of Maine. ICES Journal of Marine Science, https://doi.org/10.1093/icesjms/fsw253.

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Related Publications

Ji, R., Feng, Z., Jones, B. T., Thompson, C., Chen, C., Record, N. R., & Runge, J. A. (2017). Coastal amplification of supply and transport (CAST): a new hypothesis about the persistence of Calanus finmarchicus in the Gulf of Maine. ICES Journal of Marine Science, 74(7), 1865–1874. doi:10.1093/icesjms/fsw253
Results

The Northeast Coastal Ocean Forecast System (NECOFS). (n.d.). Retrieved September 09, 2020, from http://fvcom.smast.umassd.edu/necofs/
Methods

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Related Datasets

IsSupplementedBy

Ji, R. (2020) Gulf of Maine Calanus finmarchicus model. THREDDS Data Server (TDS) catalog gom_cfin (updated 2020-09-03). Available from http://ulysse2.whoi.edu:8080/thredds/catalog/data/gom_cfin/catalog.html.

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Collaborative Research: Mechanisms supporting persistence of a key plankton species during climate change on the Northwest Atlantic continental shelf (Calanus Persistence GoM)

Coverage: Gulf of Maine/Northwest Atlantic Ocean

Description from NSF award abstract:
In the Gulf of Maine region, rapid warming of the ocean surface in recent years has raised concern in the research and resource management communities, fishing industry and the general public about effects on the coastal marine ecosystem. This interdisciplinary, collaborative project will improve understanding of the physical and biological processes controlling the abundance of a planktonic animal that is particularly important in the food web of the northeast coastal ocean. About the size of a grain of rice, the marine copepod *Calanus finmarchicus* is the primary prey for herring and other forage fish, as well as for the endangered northern right whale. This study will examine whether transport of *C. finmarchicus* into the Gulf of Maine from cold Canadian waters, in combination with growth and reproduction in the relatively cold Maine Coastal Current, is sufficient to supply the region with the numbers needed to attract and nourish the fish, seabirds and mammals that rely on its energy rich life stages, despite recent ocean warming. The research team will develop a computer model that links extensive understanding of the species' life history with ocean currents and temperature. Results from the model will be tested against field collections at two locations. This study will also contribute to the new Integrated Sentinel Monitoring Network, a joint effort planned by federal and state agencies with academic research participation to monitor future ecosystem change on the northeastern coastal shelf. It will train a graduate student and postdoctoral scientist in interdisciplinary research and also provide support for an early-career investigator.

The project will take a process modeling approach that takes into account regional and mesoscale interaction between life history and bathymetry and circulation to improve understanding of planktonic species distribution shifts. It will combine two decades of research on *Calanus finmarchicus* life history, including diapause, with a high resolution regional circulation model into an innovative application of a three dimensional, physical-biological model. The modeling approach represents an advancement of climate forecasts of species ranges by coupling a Lagrangian perspective with local processes to better resolve complex range boundaries. It will use Lagrangian parameters such as finite-scale or finite-time Lyapunov exponents, translating particle trajectories into scalar fields that represent the structure of the advective regime. The model will be informed by and tested with measurements of vital rates and demographic data collected on a research vessel at two time series stations. It will be used in backward-in-time and forward-in-time modes to test hypotheses about sources and destinations of *C. finmarchicus* in the Gulf of Maine, effects of match/mismatch in phenologies, and exploration effects of climate forced scenarios on advective pathways.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1459133

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