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ocean_data_tools: A MATLAB toolbox for interacting with bulk freely-available oceanographic data

Laur Ferris[1]

1 Virginia Institute of Marine Science

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Software

- Review
- Repository
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Editor: Kristen Thyng

Reviewers:

- @castelao
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Summary

`ocean_data_tools` simplifies the process of extracting, formatting, and visualizing freely-available oceanographic data. A wealth of oceanographic data (from research cruises, autonomous floats, global ocean models, etc.) is accessible online. However, many oceanographers and environmental scientists (particularly those from subdisciplines not accustomed to working with large datasets) can be dissuaded from utilizing this data because of the overhead associated with determining how to batch download data and format it into easily-manipulable data structures. `ocean_data_tools` solves this problem by allowing the user to transform common oceanographic data sources into uniform structs, call general functions on these structs, perform custom calculations, and make graphics.

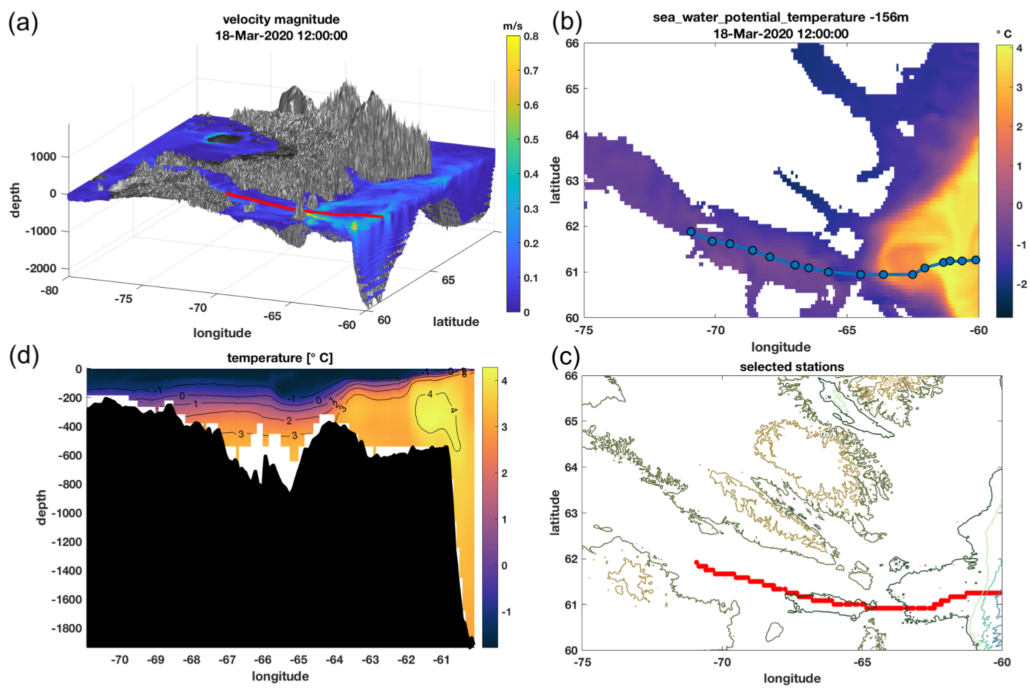

Figure 1: Building a virtual cruise from the Operational Mercator global ocean analysis and forecast system at 1/12 degree with 3D bathymetry (Smith & Sandwell, 1997). Showing (a) a 3D velocity plot created using `model_domain_plot`, (b) virtual cruise selection using `transect_select`, and `model_build_profiles`, (c) coordinates of the resulting uniform struct, and (d) a temperature section plotted using `general_section` with `bathymetry_section`. Three of the subplots use colormaps from cmocean (Thyng, Greene, Hetland, Zimmerle, & DiMarco, 2016).

The workflow of ocean_data_tools is to build uniform structs (e.g. argo, cruise, hycom, mercator, woa, wod) from raw datasets and call general functions on these structs to map, subset, or plot. Functions with the _build suffix load raw data into uniform structs. Structs are compatible with all general_ functions, as well as functions in the commonly-used Gibbs-SeaWater (GSW) Oceanographic Toolbox (McDougall & Barker, 2011). One application of the _build feature is to create virtual cruises from model output Figure 1. The user draws transects on a map (or passes coordinates as an argument) to build vertical profiles from model data. This may be used as a cruise planning tool or to facilitate comparison of observations (such as those from underwater glider surveys) with model output. Some ocean_data_tools functions employ nctoolbox (Schlining, Signell, & Crosby, 2009).

ocean_data_tools has already been used in scientific publications (Bemis, Tyler, Psomadakis, Ferris, & Kumar, 2020) and (Crear et al., 2020). This toolbox is built for extensibility; the plan is to continuously add support for additional datasets such as Remote Sensing Systems (http://www.remss.com/) products and European Centre for Medium-Range Weather Forecasts (ECMWF) products. The source code for ocean_data_tools has been archived to Zenodo with the linked DOI: (Ferris, 2020).

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