A long-term, interdisciplinary study of deep-sea-to-coast connectivity in the northeastern Gulf of Mexico

NEWS RELEASE
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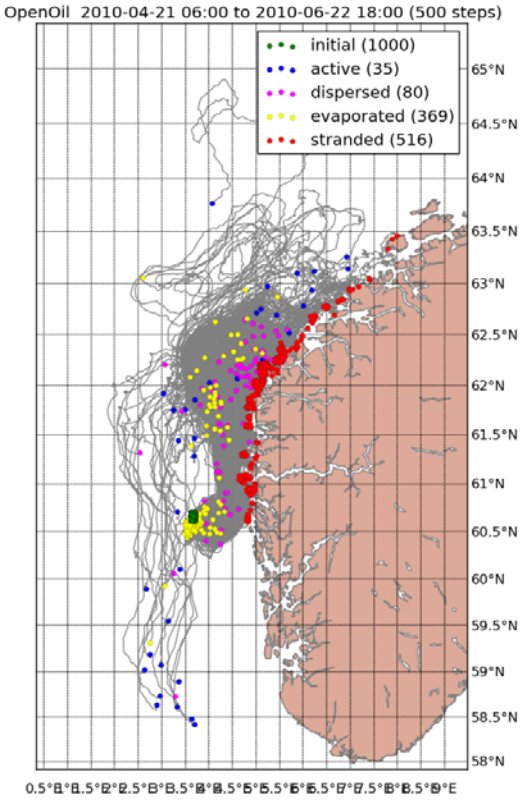
NEW SOFTWARE PROVIDES OPEN SOURCE FRAMEWORK FOR OCEAN TRAJECTORY MODELING



A new, open source software for modeling the trajectories and fate of particles (Lagrangian Elements) drifting in the ocean, or even in the atmosphere, has been developed at Norwegian Meteorological Institute in cooperation with Institute of Marine Research. The software, known as OpenDrift, is a generic framework written in Python. It is openly available at https://github.com/knutfrode/opendrift/.

The generic framework, programmed in Python, is modular with respect to three aspects: (1) obtaining input data, (2) the transport/morphological processes, and (3) exporting of results to file. Modularity is achieved through well defined interfaces between components, and use of a consistent vocabulary (CF conventions) for naming of variables. Modular input implies that it is not necessary to preprocess input data (e.g. currents, wind and waves from Eulerian models) to a particular file format. Instead "reader-modules" can be written/used to obtain data directly from any original source, including files or through web based protocols (e.g. OPeNDAP/Thredds).

Modularity of processes implies that a model developer may focus on the geophysical processes relevant for the application of interest, without needing to consider technical tasks such as reading, reprojecting, and co-locating input data, rotation and scaling of vectors and model output. In developing a new model (or "module"), one basically only needs to specify: (1) the properties the elements shall have and (2) how to use the environmental data (provided by readers) to move and/or modify positions and properties of the elements. A module for exporting output (trajectories) to netCDF files compliant with CF convention on trajectory data is available as a default option.

Key Features of OpenDrift

- Open source, GPL v2 license, providing full transparency - no black boxes
- Very simple installation, core OpenDrift requires only Python standard libraries
- Platform independent, runs on Linux, Mac/OS X, Windows
- Fast - typical simulation time is ~30 seconds for a 66 hour simulation with 1000 particles

- Modular: can simulate transport and fate of any kind of particles (oil, ships, persons, icebergs etc.). Simple to make new modules, based on existing modules or blank template
- Can use input forcing data (e.g. current, wind and waves) from any model, in any file format and any map projection:
    - avoids need to preprocess driver data
    - map reprojection and vector rotation performed on-the-fly, using PyProj library
    - may use input forcing from remote datasets (e.g. Thredds)
- Can use backup driver models (e.g. current, wind, waves) for robustness if first choice is not available
- Can run backwards in time by simply specifying a negative time step
- Output saved to CF-compliant netCDF files (but export modules may be written for other formats).
- Coming soon:
    - Input from ensemble models
    - Built-in user interface (probably Tkinter-based)

Download and Installation

OpenDrift is in the early development phase. Example applications related to oil drift and weathering have been demonstrated. A module for the leeway of search and rescue models is also under development. This version of OpenDrift should not be used for real studies and applications, however modelers are encouraged to use it and provide feedback. A stable first version is expected by the end of 2015.

OpenDrift can be downloaded with the command:
git clone https://github.com/knutfrode/opendrift.git

No installation is required for OpenDrift, but the following Python packages are required for some features:

- Basemap for plotting and default landmask
- python-netcdf4 for obtaining driver data from Thredds servers and netCDF4 files.

OpenDrift can be tested by running some of the executable example scripts located in the opendrift folder. These examples will automatically download required wind and ocean current input data.

The development of OpenDrift has partly been supported by the Deep-C Consortium, a long-term, interdisciplinary study investigating the environmental consequences of petroleum hydrocarbon release in the deep Gulf of Mexico on living marine resources and ecosystem health. The consortium focuses on the geomorphologic, hydrologic, and biogeochemical settings that influence the distribution and fate of the oil and dispersants released during the Deepwater Horizon accident, and is using the resulting data for model studies that support improved responses to possible future incidents. This research was made possible in part by a grant from the Gulf of Mexico Research Initiative (GoMRI) to the Deep-C Consortium.

For More Information or Questions

See the wiki for description and installation: https://github.com/knutfrode/opendrift/wiki. Or you can contact Dr. Knut-Frode Dagestad at knutfd@met.no with any questions.

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