

Model Shopping Tool: Strolling through the equations of Ocean Ecosystem Models

Background

The EUR-OCEANS network intends to seed long-lasting interactions within the research community to better observe the oceans' response to climate and anthropogenic forcing, and to incorporate that data into global ocean models* to help improve their predictive capabilities. This is a priority as the average net effect of human activities has been one of warming.

Through its activities on Model Interfacing, EUR-OCEANS aims to promote both a common terminology as well as the connectivity of existing modelling tools, in order to develop a set of marine ecosystem models linking the physical dynamics of the ocean with the organisms at the top of the food chain.

Why a common terminology?

Global models* are powerful tools for assessing our understanding of ocean processes and predicting their response in a changing environment. The modelling community, however, has to date developed a myriad of approaches, philosophies and custom-designed tools to address specific problems. With the increasing need to address a single question of global importance, the use of a universal terminology to facilitate interactions between research groups and improve dialogue with experimental scientists becomes even more urgent.

Why connect models?

Ecosystems are non-linear systems and climate and anthropogenic pressure effects are propagated in complex ways through the trophic levels. To quantify the impacts, ecosystems need to be modelled as a whole, from physics to whales, by constructing new generation models or connecting existing specialist-models for each part of the food chain.

What is MoST?

The Model Shopping Tool (MoST; www.eur-oceans.eu/models) is a common platform for sharing knowledge both within the modelling community, and with experimental scientists.

By providing an easy to search and browse databank on current modelling approaches, as well as model equations of key biological and ecosystem processes, MoST aims to:

- facilitate rapid comparison between the main models used.
- promote the establishment of a common terminology for modelling the ocean ecosystem from physics to whales.
- improve dialogue between modellers and experimental scientists by making the model equations of the main biological processes, and their parameters, available for scrutiny and comparison between the major models.
- provide a teaching and comparative simulation tool for young scientists.

Database content is provided, or approved, by the model developers and an interface allows the community itself to maintain and update the content as needed.



Figure 1 - The database portal allows search for full description and resources for ocean ecosystem models, search for model equations per biological process and a start-up database on species vital rates to support model parametrization.

What can MoST do?

The database offers fully descriptive data on current ocean ecosystem models, including details on simulated processes and number and descriptions of functional groups* or key variables computed. For selected ocean ecosystem models, the tool goes even further and shows another level of detail. Users can 'walk through' a model's individual components and appreciate how it is parameterised and where the strengths and weakness are.

* See Fact Sheet 6, Green Ocean Modelling, in the series available at www.eur-oceans.eu/KTU



Walking through an Ocean Ecosystem Model

At the heart of MoST database is a databank of the essential equations that underpin a virtual ecosystem. Users can search for the mathematical representation of biological or ecosystem processes incorporated in selected ocean ecosystem models, and compare them to their equivalents across other models.

All Models Summary & Trophic Coverage

Detailed model descriptions

Equation & parameter details

As well as serving as a teaching aid for graduates and young scientists, MoST can also serve as an interface between modelling experts and experimental scientists. The process equations and parameter values behind each model contain details of their performance and assumptions, and it is at this equation level that experimental scientists can bring critical expertise and data to improving the next generation of models.

Where next?

An integrated database of vital rates for species spanning the ocean ecosystem from bacteria to top predators (e.g. economically important species) will be developed by mid-2008, allowing model developers to examine the range of variability in specific processes, and parameterise different species growth rates, predation, mortality etc.

A further product is an online 1D global ocean simulator that will allow users to design and run customised simulations with selected biogeochemical models and rapidly view and download model outputs.

So, by the end of 2008, young biogeochemical model developers will be able to take a stroll from the vital rates parameters, to the various mathematical representations, and run customized global 1D simulations, all with their organism or variable of choice.

Action Points

- Programming expertise and streamline technical solutions are needed to insure the low-maintenance and user-sustainability of the tool beyond the life of the EUR-OCEANS network for example through future European Commission funding programmes.
- Research groups need to include their modelling efforts into MoST and, where possible, promote the MoST comparative tools amongst young scientists.
- Feedback from model developers would increase MoST power and usefulness.



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