

Theme Session L Coupled Physical and Biological Models: Validation, Parameterization and Application

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Background and Objectives

The theme session “Coupled Physical and Biological Models: Validation, Parameterization and Application” was initiated by ICES Working Groups on Modeling Physical and Biological Interactions and on Baltic Sea Ecosystem and co-sponsored by PICES.

This session aims to present recent advances related to development, validation, parameterization and application of both physical-biological models (PBMs) and Individual-based models (IBMs), and their coupling, with a particular emphasis on their validation on various temporal and spatial scales.

Summary of Presentations

The theme session had 18 oral presentations and 5 posters presented. Contributions covered a wide range of aspects in the context of PBMs, IBMs, and their coupling and applications to ecosystem studies and fisheries management. Presentations included results from several of geographic areas such as the Baltic Sea, Barents Sea, Mediterranean Sea, North Sea, Labrador Sea, Gulf of St. Lawrence, and off the US and Canada east coast. The theme session was grouped into 4 oral sessions and 1 poster session. Although three of the four oral sessions were on Friday, the attendance was good. The presentations were of high quality and stimulate interesting questions and discussions.

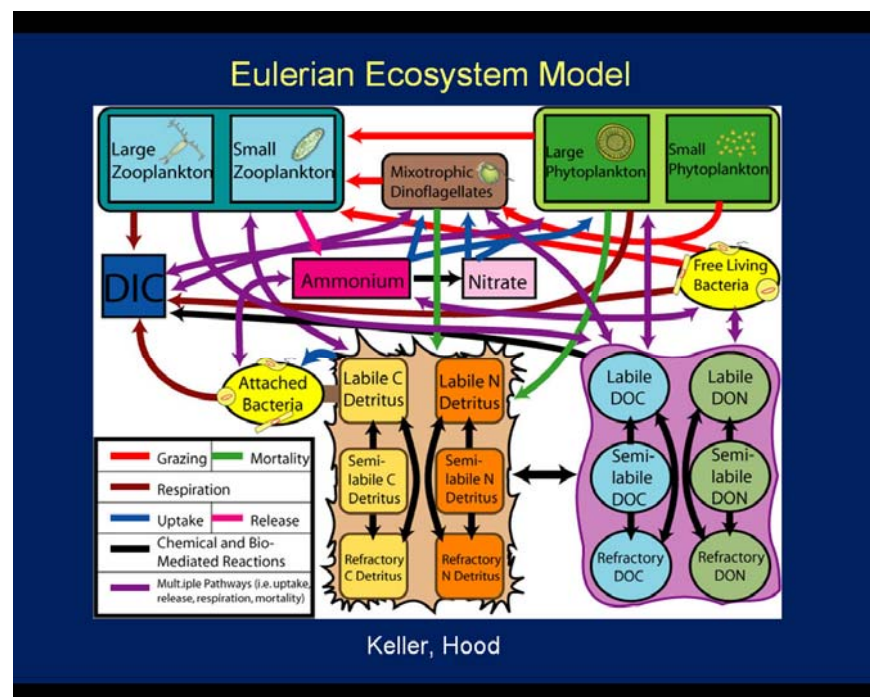


Figure: ICES CM 2008/L:20 Coupling Eulerian and Lagrangian models to understand sediment transport, ecosystem dynamics, zooplankton population fluctuations, and larval fish feeding success in upper Chesapeake Bay. E. W. North *et al.*

A focal aspect was surely directed to validation and application of coupled physical–biogeochemical models to understand ecosystem dynamics. These studies demonstrated the time- and space dependent influences of various processes, such as tidal dynamics, mixing, Ekman pumping, nutrient loading, and climatic variability. These coupled models are an important tool in monitoring, studying and predicting ecosystem status, variability and changes, in conjunction with in situ and remote sensing data. They provide ocean state variables, e.g. currents, temperature, salinity, biogeochemical and plankton variables, and are used to generate key indices that are of significance to fisheries management and ecosystem research.

Another forefront addressed the issue of coupling PBMs and IBMs, and applications to feeding success, survival and growth, and recruitment of early life stages. These papers examined the effect of time of spawning, ocean circulation, and food availability on population dynamics. The PBMs mainly resolve mesoscale hydrodynamic patterns and work with trophic levels, while IBMs account for micro-scale (centimeters to decimeters) processes and individual behaviour, which explains the transfer of carbon, energy and various substances between species and trophic levels. These studies demonstrate different effects of physical processes and individual behaviour at various time and space scales on biological processes.

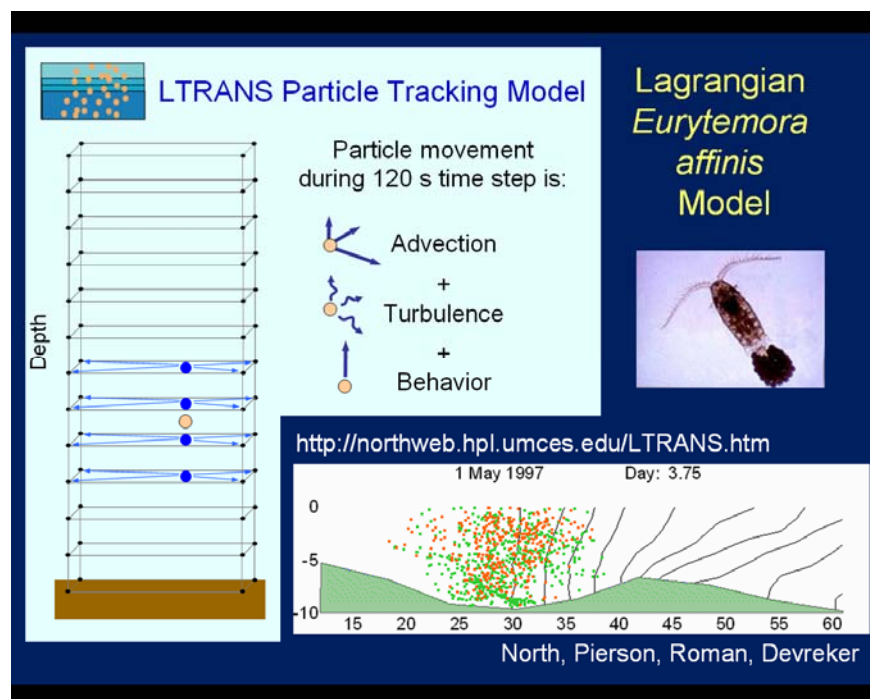


Figure: ICES CM 2008/L:20 Coupling Eulerian and Lagrangian models to understand sediment transport, ecosystem dynamics, zooplankton population fluctuations, and larval fish feeding success in upper Chesapeake Bay. E. W. North *et al.*

Various other aspects were also presented, for example, ecosystem models for sea-ice influenced seas, parameterization of biological processes in the benthic layer, the coupling of such a benthic layer model to a large-scale hydrodynamic model.

In addition, there were a couple of other related studies on a comparison of the parameterization of fisheries economics with data-fitted parameters in stock assessment models, and on the Barents ecosystem dynamics as coupled oscillators to long tides.

Concluding Remarks

The theme session provided a wide range of studies on coupled physical and biological models at various complexity levels. While simple models work well in many cases and remain important to the ICES community, high-resolution and sophisticated models that have improved dynamics and include realistic behaviour and accurate forcing are required to address ecosystem sciences and fisheries management for the ICES community. A few other issues were also raised during the session discussion including the effectiveness of assimilating oceanographic data into coupled physical and biological models and the capability of resolving fronts in these models. Finally, a comparative study of marine ecosystem models within the ICES regions seems warranted, in which various models are developed to simulate and forecast different ecosystems and these different models are used to compare predictions of the same location/species.