Session A3: Marine planktonic ecosystems

Towards a systematic statistical evaluation of diverse plankton/ecosystem models against observations from mesocosm experiments

Schartau M.

In ecological and biogeochemical modeLling the optimization of model parameter values as well as sensitivity analyses of simulation results with respect to parameter variations are often regarded as bothersome side aspects. It has been argued that these side works are makeshifts to compensate for limitations in our mechanistic understanding of plankton dynamics. Mechanistic descriptions of complex plankton interaction and/or of physiological acclimation are therefore prominent. In this regard improvements can be achieved by introducing physiological and ecological traits to plankton/ecosystem models. These trait-based models are beneficial, since they can downsize the number of empirical parameterizations. They remediate uncertainties in assigning parameter values e.g. to different plankton functional types. But, trait-based models with advanced descriptions of plankton interaction and growth can still hold limitations elsewhere, e.g. when reproducing changes in carbon (C), nitrogen (N), and phosphorus (P) standing stock observations.

In our study we wish to disclose benefits and limitations of some recent approaches to marine plankton modeling, while focusing on variations in C-, N- and P mass flux. We concentrate on three types of plankton models that differ in complicacy on microscale but are of similar complexity on system scale. For our analysis we consider a) a simple empirical quota-regulated growth model, b) a model in which growth is determined by optimally adapted traits, and c) a rather complicated growth model with adaptive traits. We investigate to which extent better representations of ecophysiological details can also improve mass flux estimates within a marine ecosystem. As a start we established a working environment in R for models that are incorporated in the Framework for Aquatic Biogeochemical Models (FABM, Bruggeman and Bolding, 2011, EU-FP7 MEECE report). The models are evaluated against data from a series of independent mesocosm studies. Some emphasis will be put on model cross-validation between different mesocosm experiments. In our presentation we provide information about first technical and scientific achievements during the early phase of our small project. Ultimately, we also hope to encourage other scientists (who are interested in statistical assessments of plankton models) to join and contribute to this ongoing research activity.

Keywords: Model assessment, Mesocosm data, Trait-based modelling

Oral presentation