



Using models in Integrated Ecosystem Assessment of coastal areas

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Numerical Models can greatly contribute to integrated ecological assessment of coastal and marine systems. Indeed, models can: i) assist in the identification of efficient sampling strategy; ii) provide space interpolation and time extrapolation of experimental data which are based on the knowledge on processes dynamics and causal relationships which is coded within the model, iii) provide estimates of hardly measurable indicators. Furthermore model can provide indication on potential effects of implementation of alternative management policies. Finally, by providing a synthetic representation of an ideal system, based on its essential dynamic, model return a picture of ideal behaviour of a system in the absence of external perturbation, alteration, noise, which might help in the identification of reference behaviour. As an important example, model based reanalyses of biogeochemical and ecological properties are an urgent need for the estimate of the environmental status and the assessment of efficacy of conservation and environmental policies, also with reference to the enforcement of the European MSFD.

However, the use of numerical models, and particularly of ecological models, in modeling and in environmental management still is far from be the rule, possibly because of a lack in realizing the benefits which a full integration of modeling and monitoring systems might provide, possibly because of a lack of trust in modeling results, or because many problems still exists in the development, validation and implementation of models. For instance, assessing the validity of model results is a complex process that requires the definition of appropriate indicators, metrics, methodologies and faces with the scarcity of real-time in-situ biogeochemical data. Furthermore, biogeochemical models typically consider dozens of variables which are heavily undersampled.

Here we show how the integration of mathematical model and monitoring data can support integrated ecosystem assessment of a waterbody by reviewing applications from a complex coastal ecosystem, the Lagoon of Venice, and explore potential applications to other coastal and open sea system, up to the scale of the Mediterranean Sea.