Geophysical Research Abstracts
Vol. 19, EGU2017-6945, 2017
EGU General Assembly 2017

An integrated modelling methodology to study the impacts of nutrients on coastal aquatic ecosystems in the context of climate change

Marco Pesce (1), Andrea Critto (1,2), Silvia Torresan (2), Monia Santini (2), Elisa Giubilato (1), Lisa Pizzol (1), Paola Mercogliano (2), Alberto Zirino (3), Ouyang Wei (4), Antonio Marcomini (1,2)

(1) Ca' Foscari University of Venice, Venice, Italy (critto@unive.it), (2) Centro Euro-Mediterraneo sui Cambiamenti Climatici, Italy (silvia.torresan@cmcc.it), (3) Scripps Institution of Oceanography, CA, USA (azirino@ucsd.edu), (4) Beijing Normal University, Beijing, China (wei@bnu.edu.cn)

It has been recognized that the increase of atmospheric greenhouse gases (GHG) due to anthropogenic activities is causing changes in Earth's climate. Global mean temperatures are expected to rise by 0.3 to 4.8 °C by the end of the 21st century, and the water cycle to alter because of changes in global atmospheric moisture. Coastal waterbodies such as estuaries, bays and lagoons together with the ecological and socio-economic services they provide, could be among those most affected by the ongoing changes on climate. Because of their position at the land-sea interface, they are subjected to the combined changes in the physico-chemical processes of atmosphere, upstream land and coastal waters.
Particularly, climate change is expected to alter phytoplankton communities by changing their climate and environmental drivers, such as temperature, precipitation, wind, solar radiation and nutrient loadings, and to exacerbate the symptoms of eutrophication events, such as hypoxia, harmful algal blooms (HAB) and loss of habitat.
A better understanding of the links between climate-related drivers and phytoplankton is therefore necessary for predicting climate change impacts on aquatic ecosystems. In this context, the integration of climate scenarios and environmental models can become a valuable tool for the investigation and prediction of phytoplankton ecosystem dynamics under climate change conditions. In the last decade, the effects of climate change on the environmental distribution of nutrients and the resulting effects on aquatic ecosystems encouraged the conduction of modeling studies at a catchment scale, even though mainly are related to lake ecosystem. The further development of integrated modeling approaches and their application to other types of waterbodies such as coastal waters can be a useful contribution to increase the availability of management tools for ecological conservation and adaptation policies.
Here we present the case study of the Zero river basin in Italy, one of the main contributors of freshwater and nutrients loadings to the salt-marsh Palude di Cona, a waterbody belonging to the lagoon of Venice. To predict the effects of climate change on nutrient loadings and their effects on the phytoplankton community of the receiving waterbody, we applied a methodology integrating an ensemble of GCM-RCM climate projections, the hydrological model SWAT and the ecological model AQUATOX. Climate scenarios for the study area revealed an increase of precipitations in the winter period and a decrease in the summer months, while temperature shows a significant increase over the whole year. The hydrological model SWAT predicted changes the Zero river's waterflow and nutrients' loadings. Both parameters show a tendency to increase in the winter period, and a reduction during the summer months. Simulations with AQUATOX predicted changes in the concentration of nutrients in the salt-marsh Palude di Cona, and variations in the biomass and species of the phytoplankton community. The simulation shows changes are highly species-dependent. Major changes are observed in the spring-summer period, where the abundance of warm-adapted species increase noticeably.