# ECO-HYDRODYNAMIC MODELLING OF EUTROPHICATION AND NUTRIENT CYCLES USING DELFT3D MODEL FOR THE CILICIAN BASIN

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## Abstract
Major rivers and domestic wastewater discharges from the cities of Mersin and Iskenderun exert a severe stress on the Cilician Basin ecosystem. Recent studies show that the coastal regions of the basin show eutrophic characteristics, where on the contrary, the offshore waters of the Eastern Mediterranean Sea show oligotrophic characteristics[1-2]. This study aims to model the hydrodynamics coupled with the ecosystem of the Northeastern Mediterranean Sea. The coupled model used for the study is DELFT3D of Delft Hydraulics Labs. Europhication is being observed in the hot spots of the region, and using these data specific limiting nutrients and their cycles are modelled including the life cycles of several phytoplankton and zooplankton species.
*Keywords: Models, Nutrients, River Input, Primary Production, Phytoplankton*

Physical, chemical, and biological properties of the basin is observed by six field surveys conducted by R/V Bilim of Middle East Technical University, Institute of Marine Sciences, within the framework of TARAL (TÜBITAK) project during September 2008 – August 2009. These cruises were conducted to observe the seasonal variations in the region, so there are winter, spring and summer data available for every field. We also collected chemical data from the related rivers. In order to analyse the eutrophication processes, a coupled physical-biological model was used. Observations were used to set the models initial and forcing fields. Two open water boundaries were included in the domain of the model being the south and west part of the basin, where the discharge of the major rivers, Seyhan and Ceyhan, and also a local river of Mersin Bay, Berdan are included. To show the effects of the domestic discharges, the discharge from the city wastewater plant of Mersin was included as inflow to the model. The studies show that the Northeastern Mediterranean Sea is phosphate limiting, but the effect of discharges show a shift in N/P ratio, especially in spring seasons.

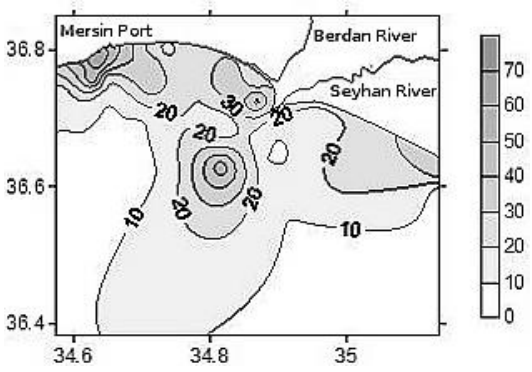


Fig. 1. Spring 2009 N/P Ratio of Mersin Bay, representing the impact of discharges

This result is clearly seen by the model as major impacts of the river discharges. At certain times of the year, the Mediterranean is under high level deposition of nutrients from the Sahara Desert, and for that reason, atmospheric calculations are included in the model. As physical forcing functions, varying heat fluxes and wind data are used in the model to force circulation and stratification and mixing of the water column in varying
seasons.

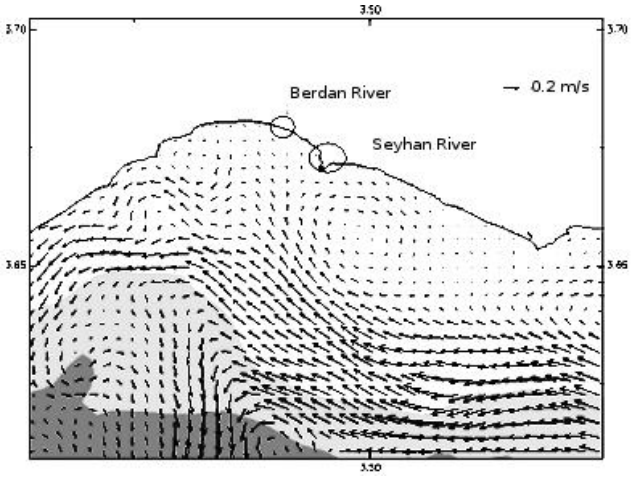


Fig. 2. Circulation model result of Mersin Bay showing the open water circulations and their effect on coastal regions

Regarding the eutrophication, four nutrients are taken as sources, $NH_4$, $NO_3$, $PO_4$ and Si. Three phytoplankton species are parameterized with respect to these nutrients being, flagellates, diatoms and dinoflagellates, and also general zooplankton species. Dissolved oxygen is modelled in conjunction with the eutrophication process, and biochemical oxygen demands results are observed respectively.

## References
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