Implementation of a modelling system for the investigation of the Saronikos Gulf marine ecosystem (Eastern Mediterranean)

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The coastal marine ecosystem of Saronikos Gulf, a busy Eastern Mediterranean embayment directly impacted by the greater metropolitan area of Greece’s capital, Athens, is examined through a series of state-of-the-art numerical models that address the hydrodynamics (Delft3D-FLOW), the wave regime (SWAN), the biogeochemistry, and pollution related to species of heavy metals and polyaromatic hydrocarbons (Delft3D-WAQ).

The study so far has focused on calibrating model components and on reproducing the seasonal thermohaline conditions, known circulation patterns and the variability of biogeochemical constituents (chlorophyll-a, nutrients, dissolved and particulate matter) and pollutant concentrations, focusing on the vicinity of inner Saronikos.

The annual cycle ‘Nov 2009 - Oct 2010’ is simulated, forced with atmospheric data from the ERA5 database. Three sets of open boundary conditions data are tested (Mediterranean Sea Physics Reanalysis dataset by Copernicus and two implementations of the ROMS model covering the Aegean and the Eastern Mediterranean respectively), constituting three classes of numerical experiments aiming to optimize model performance. Freshwater discharges from waste treatment facilities and rivers are considered, the latter drawn from the Swedish Meteorological and Hydrological Institute (platform ‘Hypeweb’).

Emphasis has been placed in compiling available information on point sources of pollution from the numerous human activities in the vicinity of the study area. These data are used as forcing in the modelling process.

A comprehensive dataset of field measurements collected monthly by the Hellenic Centre for Marine Research from a network of ten stations, as well as satellite derived SST data, are used for model validation.
This work is carried out within the context of the EMERGE Horizon 2020 project, that develops methodologies to evaluate, control and mitigate the environmental impacts of shipping emissions. For the scope of the project, next steps currently undertaken include the simulation of the Saronikos Gulf status for the year 2018 considering pollutant mass fluxes (a) from shipping emissions as calculated by the Ship Traffic Emission Assessment Model (STEAM) and (b) from atmospheric depositions as calculated from atmospheric modelling, both components from data provided by consortium partners.