Geophysical Research Abstracts
Vol. 12, EGU2010-10448, 2010
EGU General Assembly 2010

Study of the Tagus estuarine plume using coupled hydro and biogeochemical models

Nuno Vaz (1), Paulo C. Leitão (2), Manuela Juliano (3), Marcos Mateus (4), João Miguel Dias (1), and Ramiro Neves (4)

(1) CESAM, University of Aveiro, Campus de Santiago, 3810-193 Aveiro, Portugal (nuno.vaz@ua.pt), (2) Hidromod, Av. Manuel da Maia, 36, 3º Esq., 1000-201 Lisboa, Portugal (paulo.chambel@hidromod.com), (3) LAMTec, Laboratory of Marine Environment and Technology, University of Azores, Azores, Portugal (manela@uac.pt), (4) MARETEC, Instituto Superior Técnico, Av. Rovisco Pais, 1049-001 Lisboa Portugal

Plumes of buoyant water produced by inflow from rivers and estuaries are common on the continental shelf. Buoyancy associated with estuarine waters is a key mediating factor in the transport and transformation of dissolved and particulate materials in coastal margins. The offshore displacement of the plume is influenced greatly by the local alongshore wind, which will tend to advect the plume either offshore or onshore, consistently with the Ekman transport. Other factor affecting the propagation of an estuarine plume is the freshwater inflow on the landward boundary.

In this paper, a coupled three-dimensional ocean circulation and biogeochemical model with realistic high and low frequency forcing is used to get insight on how the Tagus River plume responds to wind and freshwater discharge during winter and spring. A nesting approach based on the MOHID numerical system was implemented for the Tagus estuary near shelf. Realistic hindcast simulations were performed, covering a period from January to June 2007. Model results were evaluated using in-situ and satellite imagery data.

The numerical model was implemented using a three level nesting model. The model domain includes the whole Portuguese coast, the Tagus estuary near shelf and the Tagus River estuary, using a realistic coastline and bottom topography. River discharge and wind forcing are considered as landward and surface boundary conditions, respectively. Initial ocean stratification is from the MERCATOR solution. Ambient shelf conditions include tidal motion. As a prior validation, models outputs of salinity and water temperature were compared to available data (January 30th and May 30th, 2007) and were found minor differences between model outputs and data. On January 30th, outside the estuary, the model results reveal a stratified water column, presenting salinity stratification of the order of 3-4. The model also reproduces the hydrography for the May 30th observations. In May, near the Tagus mouth, measurements show low salinity stratification (when compared to the January observations). During this month, stratification is mainly due to water temperature.

In general, the correlation between water temperature from the model and satellite data, reveals values higher than 0.5 (significant values) for the whole simulation period, presenting high correlations (about 0.8) in January and February, when the plume propagation is mainly controlled by the estuarine discharge. The correlation between the model results of suspended sediments and the satellite data (suspended matter) presents significant values (higher than 0.5) for almost the whole simulation period.

On the shelf, near the Tagus mouth, the export of estuarine waters forms a plume which is highly influenced by the geography of the coastline, inducing a plume trajectory very close to shore. Northern winds events cause a displacement of the coastally trapped plume, driving a new offshore plume. The relaxation of the northern wind regime pushes back the coastal jet toward the coast, propagating estuarine water to the north along the coastline.

The model was also able to reproduce the effect of the estuary plume over the coastal surface chlorophyll patterns observed remotely and the in situ chlorophyll and nutrient profiles, especially in the periods of low wind intensity. In periods of persistent Northerly winds the effect of the Sintra Mountains Ridge over the wind field tend to be underestimated. This leads to a southerly transport by the model slightly more intense than the one observed remotely.