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Analyses of Tiber river plume dynamics and the interaction with phytoplankton primary production

Viviana Piermattei[1,2], Alice Madonia[2], Giovanni Coppini[2], Giorgio Fersini[3], and Marco Marcelli[1]
[1]University of Tuscia, Laboratory of Experimental Oceanology and Marine Ecology, DEB, Civitavecchia, Italy (v.piermattei@unitus.it)
[2]Ocean Predictions and Applications Division, Centro Euro-Mediterraneo sui Cambiamenti Climatici, 73100 Lecce, Italy
[3]Port Authority System of the Central Northern Tyrrhenian Sea, 00053 Civitavecchia, Italy;

Marine areas facing the river mouths are characterised by high primary and secondary production. Fluvial inputs affect primary production both directly with high nutrients inputs and indirectly through the interaction both with offshore water masses and the distribution of benthic communities.

The study area includes the mouth of the Tiber river which, with a length of 405 km and a catchment area of 17375 km², represents the main river in central Italy.
The area affected by the Tiber plume has a wide extension being conditioned by strong dynamics forcing. It extends towards the open sea up to the limit of the continental shelf and along the coast in the entire physiographic unit between Capo d'Anzio and Capo Linaro, although fine particulate can reach up to the promontory of Monte Argentario.

The main characteristics of the inputs behaviour are mainly modulated by the dynamic processes: wave currents, general circulation and tidal currents as well as geomorphological factors as bathymetry and shoreline.

Accordingly, the abundance of phytoplankton biomass is modulated by the presence of fluvial inputs and consequently by the dynamics of the meteo-oceanographic and climatic characteristics of the area.

The main objective of this work is to analyse the influence of the Tiber river on the central Tyrrhenian Sea, also considering the influence that the basin-scale circulation has on the coastal water masses.

Satellite data do not allow a detailed analysis of this complex phenomenon, limiting the observation field at the surface layer, so the area was characterised by a series of oceanographic campaigns to analyse the interaction between coastal, transitional and offshore waters.

The dynamic processes that contribute to the primary production modulation in space and time

were also analysed using high resolution numerical models developed for the study area and nested into the macro and mesoscale models for the Tyrrhenian and Mediterranean basins. The models were validated using data of the existing observing system which includes other measurement platforms at different spatial and temporal scales, in addition to the oceanographic campaigns.

In order to study this high variability area the sustainability of an extended observing system and its functioning for the operational tools (development and validation of mathematical models) is fundamental.

The international scientific community (Oceanobs 2019, GOOS) strongly promotes the necessity of integrated coastal observing systems based on cost-effective and advanced technologies both to carry out new measurements and to reduce the costs of existing oceanographic instrumentation.

For this reason the future development of this work is the integration of autonomous observation platforms (Glider and ASV) and cost-effective technologies for the extention of the existing the observing spatial and temporal capacity.