The Civitavecchia Coastal Environment Monitoring System (C-CEMS): an integrated approach to the study of coastal oceanographic processes

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The study of the physical and biological processes of the coastal environment, characterized by high spatial and time variability, requires the adoption of multidisciplinary strategies of investigation that takes into account, not only the biotic and abiotic components of coastal marine ecosystems, but also the terrestrial, atmospheric and hydrological features linked to them. The understanding of coastal environment is fundamental to face efficiently and effectively the pollution phenomena, as expected by Marine Strategy (2008/56 EC) Directive, which is focused on the achievement of GES by 2020 in all Member States. Following these lines, the Laboratory of Experimental Oceanology and Marine Ecology (University of Tuscia) has developed a multi-platform observing network (the Civitavecchia Coastal Environment Monitoring System, C-CEMS) that operates since 2005 in the coastal marine area of Civitavecchia (northern Tyrrhenian Sea, Italy), where multiple uses (industrial, commercial and tourist activities) and high ecological values (Posidonia oceanica meadows, hard-bottom benthic communities, priority species, etc.) closely coexist. Furthermore, in the last years the Civitavecchia harbour, which is one of the main ports of Europe, has been subjected to a series of expansion works that could impact significantly on the coastal environment. The C-CEMS, implemented in the current configuration, is composed by five main modules (fixed stations, in-situ measurements and samplings, satellite observations, numerical models, GIS) which provide integrated informations to be used in different fields of the environmental research. The fixed stations system controls one weather, two water quality and two wave-buoy stations along the coast. In addition to the long term observations acquired by the fixed stations (L-TER), in situ surveys are periodically carried out for the monitoring of the physical, chemical and biological characteristics of the water column and marine sediments as well as of the benthic biota. The in situ data, integrated with satellite observations (temperature, chlorophyll a and TSM), are used to feed and validate the numerical models, which allow to analyse and forecast the dynamics of conservative and non-conservative particles under different conditions. Finally, the C-CEMS informations combined with diverse kind of datasets (fishery, land use, hydrology, orography, archeologic, naturalistic, etc) can be represented in thematic maps called Sea Uses Maps, supporting the management decisions of the stakeholders. As examples of C-CEMS applications two case studies are reported in this work: the analysis of faecal bacteria dispersion for bathing water quality assessment, and the evaluation of the effects of the dredged activities on Posidonia meadows and soft-bottom benthic communities.