Geophysical Research Abstracts, Vol. 7, 03763, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03763

Real-time tracking and monitoring of sea-surface water quality: an experimental approach in a gulf of Tyrrhenian Sicily.

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The coastal marine environments are influenced by a complexity of factors, such as dynamics and oceanography of the coastal waters and by the effects on the ecological compartments by anthropic forcing, especially those that modify the water quality. The Gulf of Milazzo is a natural Bay of about 25 Km^2 of the northern coast of Sicily, open to the southern Tyrrhenian Sea. The city and its harbour are located in the lee of Cape Milazzo and in the neighbours a refinery and a thermal power plant are located; the east side of the area hosts several seasonally-controlled stream outflows. Hydrodynamics in the gulf is driven by a general cyclonic circulation in the uppermost layer of off-shore waters, while in the inner part by a smaller anticyclonic structure influenced by geomorphology and winds. The most frequent winds are from SE and from NW, this latter can be often very intense in winter and spring. Aim of this work is to describe a seasonal spatial trend obtained from real-time automatic acquisition inserted in an oceanographic data monitoring activities, supplying an example of integration of different measure systems on the same area.

Through an experimental approach, data from instruments designed for shipboard determination of sea surface (pumped-water) oceanographic data from underway vessel and data obtained by hydrographic cruises to monitor a nearshore station are combined. Three seasonal hydrographic tracking survey (March-November '03) of surface waters along the coast-line (15 km) were conducted on board the R/B "Luigi Sanzo". The water surface (0.5m depth) at the fixed station was monitored with fortnightly frequency covering the same period. Temperature, salinity, nutrients and fluorescence from chlorophyll a (Chl$a$) were measured in a on line seawater flux by a CTD (SBE 19 *plus*) implemented with fluorometer Turner (Scufa II) and a Systea analyser (μMac

fast MP3; for nitrate, ammonium and orthophosphate determinations). The same water parameters were monitored at the fixed station with standard oceanographic methods for data acquisition (CTD) and sampling of NO_3+NO_2, NH_4, PO_4 and Chl$a$. The implemented measuring system is constituted by two connected equipments both automatically collecting parameters at high frequency (in time and in space). The output provides a real-time measurements stream and consequent data transmission to a PC by a multiplexed serial port.

Heterogeneous space and time distribution of the examined parameters was found. A well-evident increase of the waters temperature ($\Delta t > 2$ $^{\circ}$C) in the central zone (in front of the thermal power plant) was measured in every season and its extension was driven by the wind and the surface current. The salinity decreases close to the Niceto River with a minimum of 32.5 in spring. Nutrients distribution was variable: ammonium concentration was always high (max. 3.0 μM) in the western zone (close to the industrial plants and the city); while the nitrate values were high above to Niceto river with a range from 2.5 to 3.0 μM (max 12.0 μM in March). Phosphate concentration were generally low and under the threshold of 0.6 μM. Chlorophyll $a$values, expression of the phytoplanktonic biomass, never exceed 0.4 μg l^{-1} showing the oligotrophic condition of the gulf. Maximum Chl$a$ concentration, measured in March in the eastern zone, was correlated with high nitrate and lower salinity values clearly influenced by continental input.

This work is based on data collected during 2003 in the frame of “Cluster10” Projects, SAM programme dealing with the development of new technologies and approaches to coastal monitoring.