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Remote sensing of dynamic patterns in the Adriatic Sea

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The intention of the present work is not to review the overall remote sensing contribution to our understanding of the physical oceanography of the Adriatic Sea in the last decade. While remote sensing technology enables detection of the sea surface temperature, colour, roughness and distance from the sensor, we limit our attention here to colour/derived pigment (Coastal Zone Colour Scanner - CZCS) and temperature (CZCS infrared channel and Advanced Very High Resolution Radiometer - AVHRR). Majority of remote-sensing related publications on the Adriatic justifies such a choice. Furthermore, we make distinction among works dealing with *in situ* calibration of pigment and temperature derivation algorithms, those dealing with direct interpretation of pigment and/or temperature fields, and finally investigations that make use of pigment or temperature data to corroborate *in situ* measurement and/or mathematical modelling results or to derive current field information. We pay particular attention to the last group and focus on remote sensing contribution to currents and circulation studies of the Adriatic.

To this end we have first briefly reviewed a decade of classical oceanographic work (data analysis and mathematical modelling) following ORLIC *et al.*, (1992). The review demonstrates researchers' bias towards general-circulation and wind-induced current related themes, over the subjects of tidal currents, inertia-period oscillations and eddies. A similar review of remote sensing papers shows predominant use of pigment and temperature fields to corroborate empirical and/or modelling findings regarding surface dynamics (often general-circulation related features), and a somewhat surprising lack of interest in pigment or temperature fields *per se*. However, it must be remembered that direct use of pigment and temperature requires reliable derivation of those fields from noisy remotely detected scenes. Consequently, the need for, and interest, in pigment fields seems to be reflected in a number of papers that have been devoted to retrieving algorithms calibration.

Within the framework of auxiliary use of pigment and temperature data we consider in more detail studies that relate remotely observed patterns to the influence of the Po river discharge. BARALE *et al.* (1984) were among the first to use the CZCS visible radiation and apparent temperature to trace motions in the surface layer. Most recently STURM et al. (1992) explored Po-affected pigment patterns on the Adriatic shelf. The two works span a series of papers that consider the extent to which remotely observed patterns correspond to a particular, more conventionally studied, aspect of the Adriatic Sea circulation.

In conclusion we project the most immediate future for the remote sensing research of the Adriatic Sea.

REFERENCES

BARALE V., MALANOTTE-RIZZOLI P., HENDERSHOTT M.C., 1984.- Remotely sensing the surface dynamics of the Adriatic Sea. *Deep Sea Research*, 31, 1433-1459.

ORLIC M., GACIC M., LA VIOLETTE P. E., 1992. - The currents and circulation of the Adriatic Sea. *Oceanologica Acta*, 15, 109-124.

STURM B., KUZMIC M., ORLIC M., 1992. - An evaluation and interpretation of CZCS-derived patterns on the Adriatic shelf. *Oceanologica Acta*, 15, 13-23.

Gelatinous aggregates in the northern Adriatic : Water column processes

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In the waters of the shallow Northern Adriatic, algal blooms and discoloured waters are not exceptional since it has an enhanced terrigeneous input of organic and inorganic nutrients, and essential metals. During the summers of 1988 and 1989, sticky whitish yellow slime accumulations, up to 15 centimeters thick and several kilometers long, concentrated along the western and to a lesser extent eastern coasts of the Northern Adriatic. The phenomenon was repeated during August 1991.

The first public report of similar gelatinous (mucus or slime) accumulations in the Northern Adriatic dates back to 1729 and detailed descriptions exist for the outbreaks in 1872, 1891, and several others in the 20th century. Marine scientists have long been puzzled by this phenomenon and it is still poorly understood. Microscopic examination of the collected material showed that generally the mucus contained different planktonic and sometimes benthic organisms. Various species of pelagic diatoms, from time to time dinoflagellates and benthic diatoms, were most frequently recorded, as well as numerous cyanobacteria.

In view of the dominant organisms found within the mucus, some authors suggest that mucus is produced by phytoplankton, though others cast doubt on its pelagic origin, implying that it is derived from benthos. Data and field observations of mucus structure, behaviour and the organisms involved have accumulated, and several authors tried to explain the mechanism of the phenomenon by analysing the biochemical composition of mucus, surveying aggregates for organisms, and determining environmental factors before and during the outbreaks, but none convincingly.

In 1990, a research programme aiming at elucidating the origin, development, and consequences of gelatinous aggregates in the Northern Adriatic was launched by the Observatory of the Northern Adriatic, Trieste, with participation of five laboratories from Austria, Croatia, Italy (regions Friuli-Venezia Giulia and Veneto) and Slovenia. A field programme in the Northern Adriatic including the Gulf of Trieste and the Kvarner region followed the development of water column stratification, inorganic and organic nutrient dynamics, seasonal changes in suspended matter, microbial plankton, phytoplankton, microzooplankton and net zooplankton, sedimentation rates, microphytobenthos, meiobenthos and macrobenthos. The *in situ* distribution, development and transformations of macroaggregates were surveyed by SCUBA divers and different types of aggregates analyzed biochemically and under the microscope.

Of the two years studied, the summer of 1990 was characterized by modest development of macroaggregates in the form of stringers up to a few centimeters long, little flakes and loose masses in the form of small clouds or veils, but without larger accumulations on the surface. The distribution of macroaggregates within the water column was related to the stratification. During 1991, besides the forms observed in 1990, larger and more compact rounded structures were observed in the water column in July, and initially transparent strands on the surface amassed into sticky slime accumulations along the northern Adriatic coasts during August.

In this communication a preliminary analysis of some data deriving from the northern Adriatic Observatory Programme is given, and the importance of different pelagic processes for macroaggregate development and slime accumulations is discussed.