Bio-Optical Variability in the Western Mediterranean

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Ocean color satellite data were used to investigate the monthly and spatial variability of phytoplankton pigment concentration and diffuse attenuation coefficient (k(490)) in the western Mediterranean Sea. Coastal Zone Color Scanner (CZCS) composite products (Feldman, 1989) for 1979-1980 were used to define the bio-optical variabilities in specific regions: the Ligurian Sea, Gulf of Lion, Balearic Sea, Central Algerian Basin, Algerian Current, and Alboran Sea.

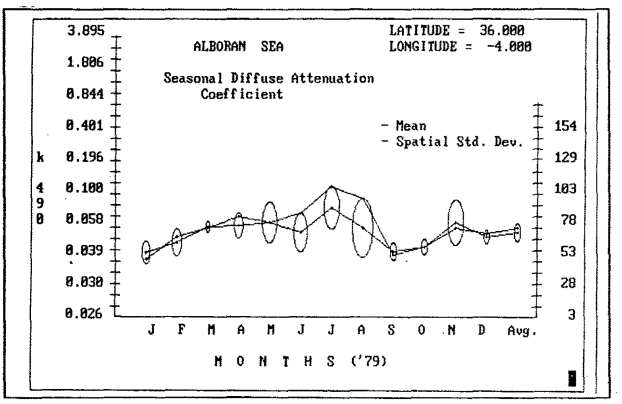
The development of mesoscale ocean features and bio-optical evolution of water masses in these regions were characterized by monthly CZCS imagery. The imagery were averaged into 20 km pixel resolution and processed by standard atmospheric removal methods (Gordon and Clark, 1980). Ratio algorithms (Gordon and Clark, 1980; Austin and Petzold, 1980) applied to these results produced monthly mean and standard deviation bio-optical properties. Although ocean color represents only the integrated upper ocean (approximately the first attenuation length), the surface distributions depict the bio-optical climate of the sea (since stronger biological responses occur near the surface).

The composite monthly results show that the evolution of biological and optical properties in the western Mediterranean interacts strongly with the regional surface circulation. The results also indicate a biological response to meteorological forcing of the Mistral. The biological repercussions of coastal processes and its effects on the large scale biological budget of the sea is also evidenced.

The mean phytoplankton distribution for the entire Western Mediterranean indicates that the lowest concentrations occur in September. High concentrations vary seasonally from region to region. The Alboran Sea has the highest concentrations as well as the strongest seasonal variability (the strongest bloom occurring in July (1 mg/m3) with a secondary bloom in November) (figure). The Gulf of Lion also shows a bi-modal pigment seasonal distribution, with maximums (0.4 mg/m3) occurring in April and December. The central Algerian Basin maintains a weak seasonally stationary phytoplankton distribution (<0.1 mg/m3). As a result of the regional ocean dynamics, the Algerian current exhibits significant spatial variability with elevated concentrations occurring in June.

The monthly standard deviation of the bio-optical properties is similarly associated with the surface circulation. High standard deviations occur in energetic areas such as ocean fronts and upwelling regions do to the response of phytoplankton to the rapidly changing physical processes. Thus, the locations of high monthly bio-optical changes are coincident with positions of fronts and eddies within the several ocean basins and within coastal areas.

This study illustrates the biological seasonal evolution of surface waters in the Western Mediterranean. This biological climate may be used to assess the amplitude and frequencies of seasonal biological productivity (Lohrenz et al, 1989). The study confirms a direct coupling of the overall general circulation and the surface biological phytoplankton distribution. CZCS imagery indicates that elevated phytoplankton concentrations associated with coastal processes extends well offshore and may have an impact on the regional water mass biological character.



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