SPECTRAL SIGNATURES OF PIGMENTS IN THE KAŠTELA BAY

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Abstract
Several cruises were performed in the middle Adriatic coastal area (Kaštela Bay) in late spring and early fall 2009 with an hyperspectral sensor and an in-situ optical profiler, accompanied with other oceanographic measurements and measurements of in-situ pigments. Spectral surface signatures revealed a difference between the two optical methods.
Keywords: Adriatic Sea, Ocean Colours, Pigments

Two kinds of optical measurements were performed at 8 stations in the Croatian Adriatic coast (Figure 1) during three cruises in May and October 2009. Multispectral in-situ irradiances and radiances were measured with a Biospherical optical profiler PRR800 at 14 wavebands (340; 380; 412; 443; 465; 490; 510; 532; 555; 589; 625; 665; 683 and 710nm).

A hyperspectral sensor (ASD FieldSpec® 3 VNIR spectrometer) measured every 3 μm within the range 350-1050nm and was used from the ship, at about two meters above the water surface. A SeaBird CTD profiler measured temperature, salinity and transmission. The measurements were accompanied with the analysis of pigments.

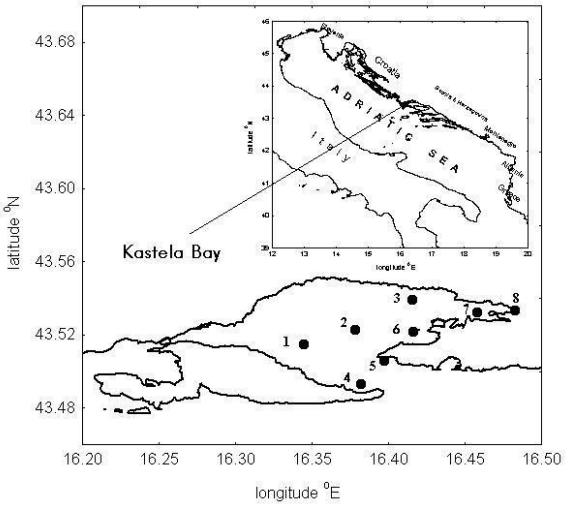

Fig. 1. Location of Kaštela Bay and stations in the eastern Adriatic

During two measurements qualitative and quantitative analyses of 17 different pigments were determined using a reverse-phase HPLC (High Performance Liquid Chromatography) method [1] from water samples filtered through Whatman GF/F filters and frozen until analyzed at -80° C.

The vertical structure of the water column during the cruises was stratified on 26-27 May, with thermocline developed to 7m. In mid October, the thermal structure was homogenous with 20^{o}C temperature reaching the deepest part of the bay (35m). The environment was rather turbid during both measuring periods with transparencies between 11-12m in May and 6-10m in October.

After calculating optically weighted pigments for the surface layer, the spectral absorption curves were reproduced for the main pigments groups. Absorption spectra were digitized and with the use of spectral absorption data available in the literature [2], were normalized to pigment content to yield estimates of specific absorption curves, which were compared to calculated attenuation coefficients and reflectances.

Different in-situ pigment groups have had lesser influence to overall spectral reflectance curves because of the presence of dominant Chlorophyll type pigments.

Spectral reflectance curves have shown typically one peak in the visible spectrum between 490nm and 555nm, but at some stations, they were sometimes different for the two methods. However, examining the first differences, typically in both methods a distinct peak appeared between 555nm and 589nm (Figure 2). Higher order differences revealed some identical peaks, pointing to the similarity between the two methods.

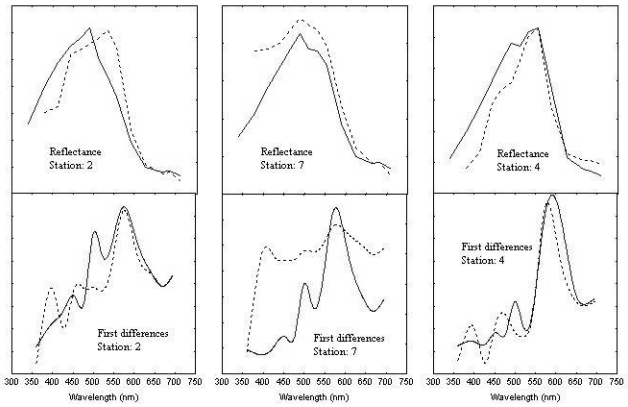

Fig. 2. Reflectances and first differences at some stations in the Kaštela Bay form optical profiler (full line) and from hyperspectral scanner (dashed line).

Additional analyses have explained to some extent the initial differences between reflectance spectra.

Vertical structures of optically active substances have had higher impact to profiler measurements, while the differences to the measurements from the air could have been caused by the higher sensitivity of the latter to particular conditions at the sea surface. In spite of the difficulties in distinguishing the water column impact and the bottom reflectance in the shallow region, the analysis has shown the potential for mapping of different coastal water types with both methods.

References
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