Deriving diel changes of the backscattering coefficient from in situ apparent optical properties: a case study in the Mediterranean Sea (Boussole site).

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The focus on the diurnal scale is a preparatory phase in the development of the future generation of ocean colour sensors embarked on geostationary platforms. To take full advantage of the hourly observations that these missions will provide, it is imperative to better understand the diurnal variability of the marine reflectance.

It is still unclear whether or not the diel variability of IOPs (Inherent Optical Properties), in particular of \( b_{bp} \) (particulate backscattering coefficient) that is observed in situ transfers as a sizeable diel variability of AOPs (Apparent Optical Properties) (both from in situ and remote sensing measurements). The objective is to analyze the IOPs variability and to study the transfer of this variability to the AOPs.

1. The BOUSSOLE project

In the NW Mediterranean Sea, at an oceanic site (case 1 waters), the BOUSSOLE mooring allows continuous recording of optical properties since September 2003 (Antoine et al., 2006, 2008).

![Map of the Northwestern Mediterranean sea showing the location of the site BOUSSOLE in the Ligurian sea (white star).](Image)

Scheme of the BOUSSOLE buoy.

2. Diel variability of \( b_{bp} \)

You can read more about diel variability of \( b_{bp} \) in Kheireddine and Antoine, 2014.

The relative amplitude of \( b_{bp} \), \( \Delta b_{bp} \), vary between 10-15% ± 20-30% according to the season.

Average \( \Delta b_{bp} \) (± standard deviation dashed area) during situations of mixing, bloom, decline and oligotrophy. The light grey area at right of each panel indicates the night-time.

The timing of the daily peak in \( b_{bp} \) during periods of mixing, decline and oligotrophy was considerably earlier than that of \( b_{bp} \) during the bloom period.

3. Optical closure

Are the modeled \( R \) and \( K_d \) are consistent with in situ measurements of AOPs?

![Example of daily changes of \( R \) (A), \( K_d \) (B), PAR (gray line) and modeled \( R \) and \( K_d \) (red line).](Image)

Results demonstrate the consistency of the AOPs and IOPs measurements performed at BOUSSOLE site.

4. Inversion performance

IOPs, particularly \( b_{bp} \) are derived from AOPs (\( R \) and \( K_d \)) (Morel and Gentili, 2004; Morel and Gentili, 1991).

Is it possible to retrieve the diurnal changes of \( b_{bp} \) from inversion of in situ measurements of AOPs?

![Example of daily changes of \( b_{bp} \) in situ (solid line) and retrieved (dashed line) \( A \) and in \( \Delta b_{bp} \) in situ (solid line) and retrieved (dashed line) \( B \) in green (555-560 nm).](Image)

We can reproduce the relative daily increase generally observed for \( b_{bp} \).

Use \( \Delta b_{bp} \) to infer biogeochemical quantities with AOPs-derived values, is more conceivable in the green.

The performance of current AOP inversions is clearly insufficient for those methods being used to derive diel signals of relatively low amplitude.