

IOPS MEASUREMENTS DURING BOUSSOLE MONTHLY CRUISES (NW MEDITERRANEAN SEA)

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Since 2003, the BOUSSOLE mooring deployed in NW Mediterranean Sea (Fig. 1) is acquiring a long-term time series of *in situ* bio-optical properties. A program of monthly cruises, started in July 2001, provides complementary measurements. It includes IOPs profiles performed with new instrumentation since December 2011. Here we show some insights on the protocol used for absorption measurements, an intercomparison between two classes of transmissometers and time series from cruise and buoy measurements.

DATA ACQUISITION

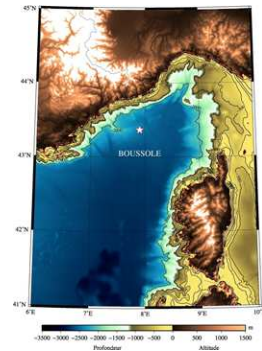


Fig.1 : Map of the NW Mediterranean Sea showing the location of the BOUSSOLE site (left). CTD Rosette + IOPs package deployment at the BOUSSOLE site (right).

IOPs profiles (0-400m) :

- o IOP package:
 - Hobilabs a-Sphere** absorption coefficient ($a_{\lambda-w}$) between 355 and 765 nm.
 - Hobilabs Hydroscat-VI** : total angular scattering coefficient at 140° ($\beta(140)$) at 420, 442, 488, 550, 620, 700 nm.
 - Hobilabs Gamma-IV** : beam attenuation coefficient ($c_{\lambda-w}$) at 442, 488, 550 and 660 nm.
- o CTD Rosette : **WetLabs C-Star** : beam attenuation coefficient $c_{\lambda-w}$ at 650 nm.

Discrete sampling (0-400m):

- o Particulate absorption coefficient (a_p)
- o CDOM absorption coefficient (a_{CDOM})

ABSORPTION COEFFICIENTS

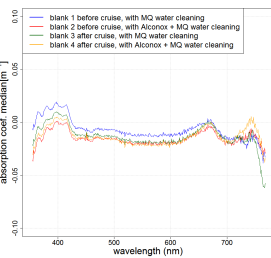


Fig.2 : example of pure water absorption spectra (blanks) measured with different methods of cleaning, before and after deployment.

PROTOCOL

- o Blanks performed after cleaning with Alconox detergent are more reproducible and only one cleaning is required.
- o Cleaning is performed before each deployment of the absorption meter.
- o T/S correction is applied (Röttgers *et al.* 2014).

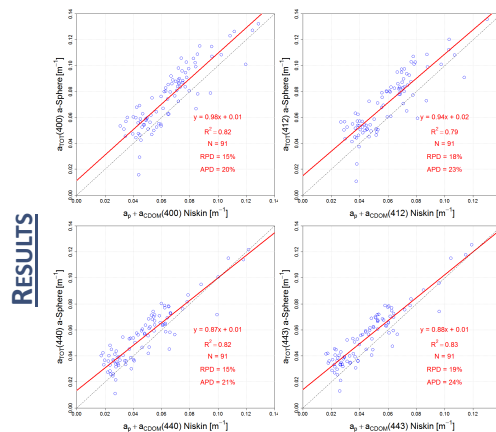


Fig.3 : Regressions between total absorption ($a_{\lambda-w}$) measured with the *a-Sphere* and a_{p+CDOM} obtained by discrete sampling at 4 wavelengths (400, 412, 440 and 443 nm).

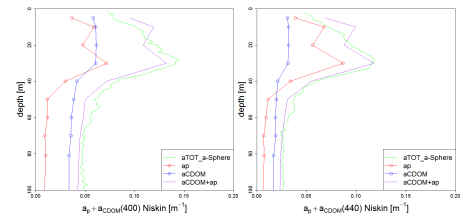


Fig.4 : Example of absorption profiles (0-100 m) measured at BOUSSOLE in May 2016, with the *a-Sphere* ($a_{\lambda-w}$) and a_{p+CDOM} at 400 and 440 nm obtained by discrete sampling.

- o Significant correlation between data from the *a-Sphere* and data from discrete sampling in the blue domain.

BACKSCATTERING COEFFICIENT

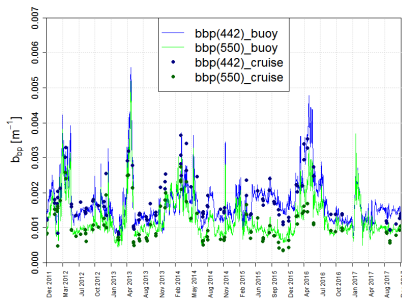


Fig.5 : b_{bp} time series at 2 wavelengths (442 and 550 nm) measured from cruise profiles (*Hydroscat-6*) and from buoy (*Hydroscat-4*) between Dec. 2011 and Dec. 2017, at 9 m.

- o Dark measurements are performed systematically and T/S correction applied for b_{bp} data processing (Zhang & Hu, Zhang *et al.* 2009).
- o b_{bp} time series at 442 and 550 nm obtained from cruises are consistent with b_{bp} time series obtained from buoy acquisitions.

ATTENUATION COEFFICIENT

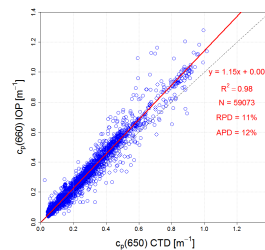


Fig.6 : Regressions between $c_p(660)$ measured with *Gamma-4* and $c_p(650)$ measured with *C-Star*.

$c_{\lambda-w}$ profiles are corrected with an adjustment of mean 375-400 m depth values (clear Levantine Intermediate Waters, LIW).

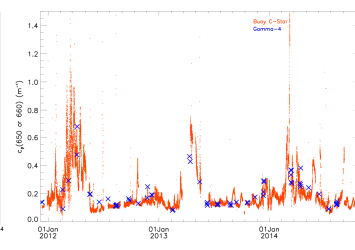


Fig.7 : $c_p(660)$ or 650 time series measured from cruise profiles (*Gamma-4*) and from buoy (*C-Star*) between Dec. 2011 and Nov 2014, at 9 m.

- o Significant correlation between data from *Gamma-4* and *C-Star*.
- o c_p time series obtained from cruises are consistent with c_p time series obtained from buoy acquisitions.

CONCLUSIONS & PERSPECTIVES

- o First steps of validation of IOPs measurements obtained during BOUSSOLE monthly cruises have been performed : absorption (blue wavelengths), $c_p(660)$, $b_{bp}(442)$ and $b_{bp}(550)$.
- o Additional studies are needed to characterize absorption data obtained for green to red wavelengths.
- o Intercomparison between *a-Sphere* and *AC-S/AC-9* will be performed (simultaneous casts already acquired).

REFERENCES

Antoine D. *et al.*, 2006. *NASA/TM N°2006-214147*, NASA/GSFC, Greenbelt, MD, 61pp.
 Röttgers R. *et al.*, 2014. *Optics Express*, 22, 25093-25108.
 Zhang X and L. Hu., 2009. *Optics Express*, 17, 1671-1678.
 Zhang X. *et al.*, 2009. *Optics Express*, 17, 5698-5710.

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