PEACETIME In-Line ACS Processing

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Measurements

Hyperspectral attenuation and abosrption spectrum were measured continuously on board the R/V Pourquoi Pas ? during the PEACETIME expedition in the Mediterranean Sea from May 12, 2017 to June 10, 2017. The ACS (serial number 111, last serviced May 20, 2015) was set with a switching system running 0.2 um filtered sea water through the instrument 10 minutes/hour and total sea-water the rest of the time, allowing to retrieve the particulate attenuation (c_p) and absorption (a_p) independtly from the instrument calibration (Slade et al. 2010). The ACS was cleanned weekly and filters were changed at that time.

Processing

Bad spectrums are removed manually and arise, generally due to bubbles going through the ACS. The software automatically removed suspect minute of data which fail the following test:

$$\frac{bin_{95} - bin_5}{2\sqrt{n}} > max(0.02 \times bin_{median}, 0.0025)$$

$$\frac{bin_{std}}{\sqrt{n}} > max(0.02 \times bin_{median}, 0.0025)$$

With bin_{95} and bin_5, 95th and 5th percentile of a bin, bin_{std} the standard deviation of a bin, n is the number of records averaged into a bin, bin_{median} is the median of a bin.

For each minute, the remaining data between the 15th and 75th percentiles are binned-averaged and their standard deviation is reported. The ACS data was synchronized with the In-Line data (e.g. GPS, TSG) of the Pourquoi Pas ?, a delay of 127 seconds was found. The particulate bins are processed by subtracting the filtered measurements (interpolated linearly as no significant variation in FDOM was observed) from the unfiltered measurements.

The mismatch in spectral band positions between absorption and attenuation are corrected using interpolation. We use the 3rd method of Zaneveld et al., 1994 to correct for scattering with 730 nm as the null wavelengths simultaneously performing a residual temperature correction (Slade et al., 2010). Attenuation is also corrected for residual temperature effect. Then, we perform a spectral unsmoothing based on the method in Chase, A., et al., 2013. We have left spectra with negative absorption in the red regions, as these values are not significantly different from zero.

Products

Chlorophyll a (chl) is computed using the particulate absorption line height at 650 nm.

$$chl = 157 \times (a_p(676) - (39/65 \times a_p(650) + 26/65 \times a_p(715)))^{1.22}$$

The particulate organic carbon (POC) is computed using the particulate attenuation at 660.

$$POC = 380 \times c_p(660)$$

Gamma is computed using the method of Boss et al. 2001.

Note: The code InLineAnalysis and configuration used to process the data is available on GitHub.

References

Boss, E., W.S. Pegau, W.D. Gardner, J.R.V. Zaneveld, A.H. Barnard., M.S. Twardowski, G.C. Chang, and T.D. Dickey, 2001.

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Slade, W.H, E. Boss, G. Dall'Olmo, M.R. Langner, J. Loftin, M.J. Behrenfeld, and C. Roesler, 2010. Underway and moored methods for improving accuracy in measurement of spectral particulate absorption and attenuation. Journal of Atmospheric and Oceanic Technology, 27:10, 1733-1746.

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