NAAMES 2 ACS data processing
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Cruise: NAAMES 2
Region: North Atlantic
Dates: May 12 – June 4, 2016
Project website: https://naames.larc.nasa.gov

DOCUMENTATION UPDATE ON March 21, 2019:
Specify the relationship used to derive the chlorophyll a, POC, and gamma products computed from the particulate spectrums:

- Chlorophyll a (chl) is computed using the particulate absorption line height at 676 nm and the global relationship from Tara Ocean (Boss et al. 2013):
  - line_height = a_p(676) - (39/65 × a_p(650) + 26/65 × a_p(715))
  - chl_regional = 95 × line_height ^1.06 (relationship applied here, specific to NAAMES)
  - chl = 157 × line_height^1.22 (relationship not applied here, from Tara Ocean)
- The particulate organic carbon (POC) is computed using the particulate attenuation at 660 nm Using the global relationship from Gardner et al. (2006):
  - POC = 380 × c_p(660)
- Gamma is computed using the method of Boss et al. 2001.

UPDATED DATASET ON Jan 4, 2019: The data were re-QC'd using a new version of processing code that allows for manual QC hour-by-hour of all data, for the most accurate version of the data possible. Notably, 1.5 days of data have been removed (May 30-31) during which time a storm introduced many bubbles into the flow through system.

We use a calibration independent technique (Slade et al., 2010) to obtain particulate absorption and attenuation by differencing measurements with a 0.2um filter from measurements made with no filter. Dissolved absorption and attenuation are obtained by subtracting daily MilliQ run from .2um filtered measurements. Filters are exchanged weekly and flow-tubes are cleaned about every other day to once a week. Switching between filtered and unfiltered measurements is done every 60min (50min total, 10min dissolved).

The data is processed by first differencing the filtered from total data. Values which fall between 2.5% and 97.5% percentiles are used for binning. Both attenuation and absorption data are minute-binned using the median (dissolved values needed to obtain the particulate values are linearly interpolated to the time of particulate measurements).

Wavelengths over 750nm are then removed and a 750 wavelength is linearly interpolated. The mismatch in spectral band positions between absorption and attenuation are corrected. We use the 3rd method of Zaneveld et al., 1994 to correct for scattering with 730nm as the null wavelengths simultaneously performing a residual temperature correction (Slade et al., 2010). Attenuation is also corrected. Then, we perform a spectral unsmoothing based on the method in Chase, A., et al., 2013. Finally, we filter out data based on two criteria:

1. If the bin fails:
   (abs(TSW_bin_median - TSW_bin_mean))./(TSW_bin_median-FSW_interp_median) > max(0.3 , 0.001./(TSW_bin_median-FSW_interp_median));
2. If the bin fails:
   TSW_bin_std > stdThreshold where the stdThreshold is .015 for a, and .030 for c.

We have left spectra with negative absorption in the blue regions, as these values are not significantly different from zero. In extreme cases we replace bad values with -9999. Files of the same name with ap, or cp appended to the end of the name go together. Date, time, latitude, longitude, temperature, and salinity are repeated in these paired files, when available.

The device file use to process this data is included with this data set. It is acs091.dev, dated 2/6/15. The software used to process this data may be downloaded from: https://github.com/OceanOptics/ACCode.git It was processed with the code revision dated August 8, 2016.

Please refer to the following document for additional information, including calibration procedures: Chase, A., et al., 2013. Decomposition of in situ particulate absorption spectra. Methods in Oceanography 7, 110-124.

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.

Zaneveld, J. R. V., J. C. Kitchen, and C. Moore, “The scattering error correction of reflecting-tube absorption meters,” in Ocean Optics XII, S. G. Ackleson ed., Proc. SPIE 2258, 44-55 (1994).