EXPORTS 1 LISST data processing

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Cruise name: EXPORTS 1
Cruise id: RR1813
Ship: R/V Roger Revelle
Location: Station Papa, North East Pacific
Dates at sea: 2018/08/11 to 2018/09/12 01:00
    Epoch 1:2018/08/14 4:30 to 2018/08/23 9:00
    Epoch 2:2018/08/23 9:00 to 2018/08/31 9:00
    Epoch 3:2018/08/31 9:00 to 2018/09/08 9:00
    At Station P: 2018/08/14 0:00 to 2018/08/23 9:00
Operators: Nils Haëntjens and Emmanuel Boss
Group Leaders: Emmanuel Boss and Lee Karp-Boss
Sequoia LISST serial numbers 1183

We use a calibration independent technique (Slade et al., 2010) to obtain particulate attenuation (cp) and particulate volume scattering function (VSF) at 670 nm 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 0.2um filtered measurements. Filters are exchanged weekly and flow-tubes are cleaned every day. Switching between filtered and unfiltered measurements is done every 60min (50min total, 10min dissolved).

Bad VSF are removed manually and arise, generally from bubbles going through the instrument. For each minute, the remaining data between 15^{th} and 75^{th} percentiles are binned-averaged and their standard deviation is kept for reporting. The particulate bins are processed by subtracting the filtered measurements from the unfiltered measurements. Filtered values needed to obtain the particulate values are interpolated to the time of particulate measurements linearly.

The LISST measurements are processed using standard procedures described in Boss et al. 2018, Agrawal and Pottsmith 2000, and Sequoia Processing Manual (2008). Resulting products submitted to SeaBASS includes the particulate forward volume scattering function (VSF), beam attenuation (cp) and the particulate size distribution (PSD).

The *dcal* provided by the manufacturer was generating an artefact in the VSF at 9.941º (ring 30). To correct the issue the original *dcal*(30) of 5.0166411 was replaced by 2.6. While the new *dcal*(30) looked realistic for the majority of the spectrums, when the instrument was internally changing gain settings to one different for which the *dcal* was tunned, the VSF was unrealistic and thereafter replaced by the interpolated VSF at 9.941º based on the other angles. Unrealistic value are defined as ratio between the measured and interpolated value greater than 15%.

The code used for processing is available at:
https://github.com/OceanOptics/InLineAnalysis/blob/c0fc9402d182ca390978a199685a8904b1d828ae/lib/processLISST.m.

The calibration parameters used are:

ZSC = [2.203500e+001, 2.568500e+001, 2.503000e+001, 2.986000e+001, 2.842500e+001, 3.283000e+001, 3.077000e+001, 3.659500e+001, 2.978000e+001, 3.552000e+001, 3.198000e+001, 4.216000e+001, 3.916500e+001, 4.662500e+001, 3.974000e+001, 4.454000e+001, 4.403500e+001, 4.604500e+001, 4.430000e+001, 4.510500e+001, 4.719500e+001, 3.850000e+001, 5.373000e+001, 2.664000e+001, 3.180500e+001, 1.655500e+001, 2.205500e+001, 1.554000e+001, 1.422000e+001, 1.123000e+001, 8.780000e+000, 8.555000e+000, 1.515000e+003, 1.167900e+003, 6.410000e+001, 1.055150e+003, 7.700000e+001, 2.116600e+003, 1.807000e+003, 5.476500e+003]

DCAL = [1.0000000e+000, 1.0038000e+000, 9.9360000e-001, 1.0027000e+000, 9.9720000e-001, 9.9570000e-001, 9.9030000e-001, 9.9430000e-001, 9.9290000e-001, 9.9000000e-001, 9.9290000e-001, 9.9300000e-001, 9.9150000e-001, 9.9300000e-001, 9.9230000e-001, 9.9090000e-001, 1.1032000e+000, 1.1123000e+000, 1.2430000e+000, 1.1562000e+000, 1.3273000e+000, 1.1999000e+000, 1.0740000e+000, 1.7489000e+000, 1.5382000e+000, 2.5109000e+000, 2.5468000e+000, 3.5504000e+000, 3.9338000e+000, **2.6**, 7.5143548e+000, 1.2528083e+001]

VCC = 48493

Spherical Inversion

DS = [1.2500, 1.4750, 1.7405, 2.0538, 2.4235, 2.8597, 3.3744, 3.9818, 4.6986, 5.5443, 6.5423, 7.7199, 9.1095, 10.7492, 12.6841, 14.9672, 17.6613, 20.8403, 24.5916, 29.0180, 34.2413, 40.4047, 47.6776, 56.2595, 66.3863, 78.3358, 92.4362, 109.0747, 128.7082, 151.8757, 179.2133, 211.4717, 249.5366]

References

Agrawal, Y. C. and H. C. Pottsmith, 2000. Instruments for particle size and settling velocity observations in sediment transport. Mar. Geol. 168, 89–114.

Boss, E., N. Haëntjens, T. K. Westberry, L. Karp-Boss, and W. H. Slade, 2018. Validation of the particle size distribution obtained with the laser in-situ scattering and transmission (LISST) meter in flow-through mode. Optics Express. DOI: 10.1364/OE.26.011125.

Sequoia Scientific, Inc., 2008. Processing LISST-100 and LISST-100X data in MATLAB. https://www.sequoiasci.com/article/processing-lisst-100-and-lisst-100x-data-in-matlab/.

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.