AOP Questionnaire: Summary of Responses

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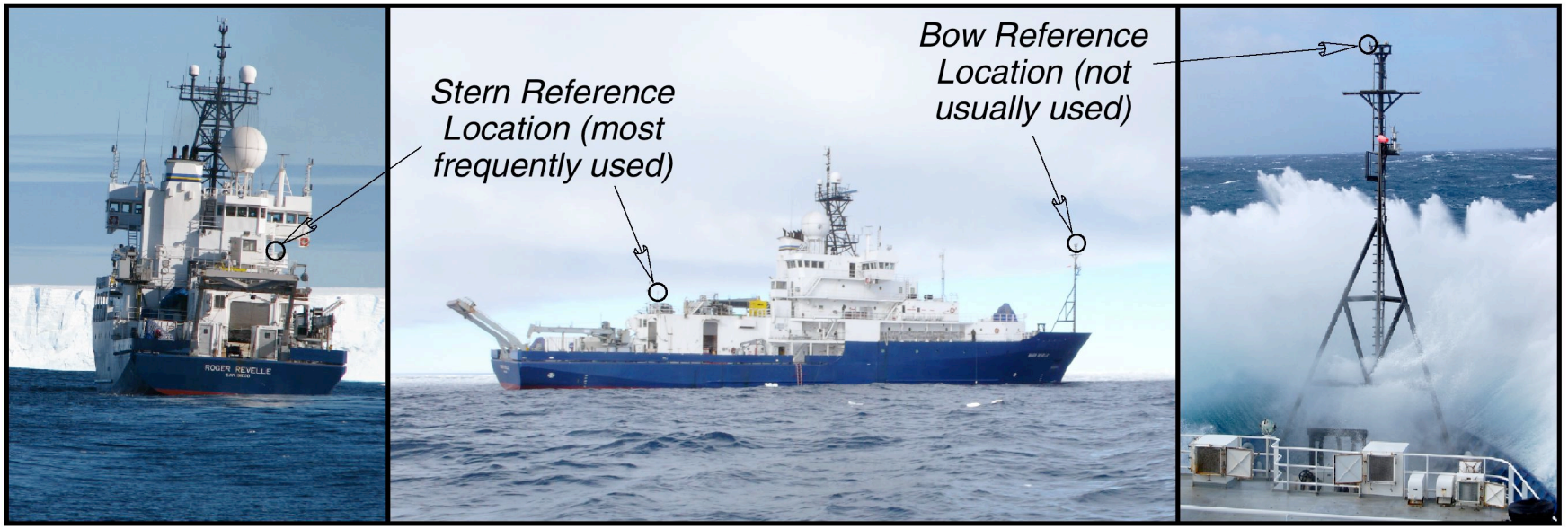
AOP Data Processing Baseline Requirements

A baseline of the required features for a Web-based AOP data processor can be established by constructing what the typical PI is doing:

- The most common type of instrument system is a free-fall (rocket-shaped) profiler.
- The typical fixed-wavelength instruments are the Biospherical PRR and Satlantic SPMR profilers; the Satlantic HyperPro is the typical hyperspectral profiler.
- Most PIs measure E_d and L_u spanning the UV to red wavelengths (rarely the infrared) using more than 10 channels; E_u is rarely measured.
- Almost all instrument systems measure pressure, the vertical tilt of the in-water instrumentation, and water temperature.
- Most PIs simultaneously measure the incident solar irradiance during in-water profiles, *but many do not use the data during data processing*.
- Very few PIs measure the diffuse solar irradiance.
- The solar irradiance sensor usually has tilt sensors, and almost every PI asserts *the instrument is mounted as far away as possible from any reflecting or shading structures, as well as any other sources of contamination (e.g., exhaust systems)*.

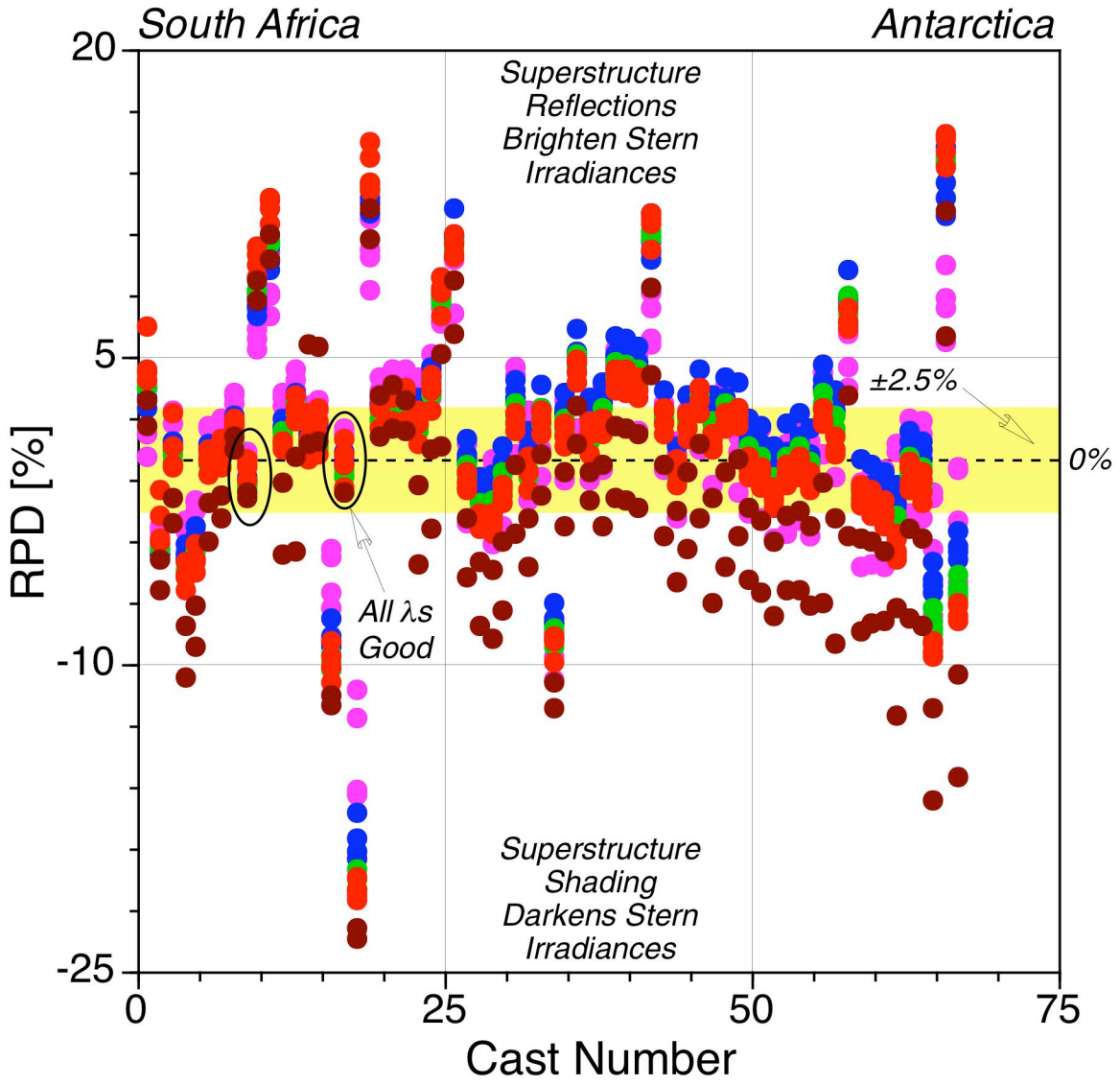
Investigations of Uncertainties in High-Latitude AOP Data



A curious aspect of the high-latitude SeaBASS AOP data is a significant portion of it is ultimately classified as being inadequate for calibration and validation activities. In some cases, entire cruises and all the contributions from a single principal investigator have been excluded. The CVO participated in CLIVAR I6S to not only fill in the resulting undersampling of high latitudes, but also to understand what problems might be degrading AOP data and, hopefully, provide solutions. Although the *R/V Roger Revelle* provides many advantages for oceanic sampling, it is not very attractive for optical measurements: *the highest point on top of the main mast is not really available to scientists, and the bow mast cannot be accessed at sea*. Consequently, *a solar reference is usually mounted in a less than ideal location*.

Intercomparison of the Bow and Stern Solar References on CLIVAR I6S

The importance of properly positioning the solar reference is shown by comparing the bow and stern references on CLIVAR I6S. In this analysis, the bow sensor is assumed to provide the best data (i.e., the closest to truth), because it is mounted at the highest elevation and the farthest away from the ship's superstructure: RPD = $100(E_{stern}-E_{bow})/E_{bow}$. If properly sited, two solar references should agree to within the calibration uncertainty (about 2.5%). The stern sensor exceeds this threshold about 49% of the time and has only a few examples wherein all the data agree with the bow sensor to within 2.5%.



AOP Data Processing Baseline Requirements (*cont.*)

- The typical PI has a hybrid data processing capability based on code from the instrument manufacturer or a legacy processor, plus additional in-house modules (written in a variety of languages).
- Documentation for the processor is mostly based on what the manufacturer has published or makes available; most legacy processors have very dated documentation.
- Most PIs are collecting both Case-1 and Case-2 data, but those that are not, collect primarily Case-1 data, so *Case-1 data is probably collected the most*.
- The typical PI needs to process on the order of 100 casts per year, but the spread is from 10–12,000 casts per year.
- Almost every PI applies an immersion factor correction, but *all PIs do not apply a depth offset correction*.
- *Very few PIs apply a self-shading correction, and many do not normalize the in-water data based on the solar illumination*.
- Although most PIs apply a tilt threshold to the in-water data, *many PIs do not use a threshold and some use a rather large value (10° or more)*.
- *Only a few PIs attempt to mitigate the effects of ship motion on the solar reference measurements* (either during data collection or data processing).

AOP Data Processing Baseline Requirements (*cont.*)

- Almost all PIs time stamp the field data when it is acquired—*but some do not*—and some do not use a reference time base (e.g., GMT).
- Almost every PI collects dark data, but many do not collect it correctly or use it in their data processing scheme.
- Although the typical PI does not bin the data, many PIs bin the data vertically and the binning is usually done before extrapolation intervals are chosen; quite a few PIs bin the data after processing (usually to 1 m).
- Most PIs select the extrapolation intervals based on a visual inspection of the data, but quite a few used fixed intervals with rigid criteria (e.g., 2–10 m), and most PIs use one interval for all wavelengths.
- The typical sampling resolution in the extrapolation interval is approximately 10 samples per meter, but the range is 0.5 to over a 100 samples per meter.
- *Most PIs do not properly sample wave-focusing effects and do not have mitigation strategies to reduce their influence on the data.*
- The most common data products are $L_u(0^-)$, $E_d(0^-)$, L_W, K_{Lu}, K_d, and R_{rs}. Although quite a few PIs produce L_{WN} values, many are not using the correct citation for the F_0 terms (Thuillier et al. 2003) and most do not provide exact values.

AOP Data Processing Baseline Requirements (*cont.*)

- *Very few PIs have an estimate of the uncertainties in their data products*, although many would like to be able to do these computations.
- Most PIs do not produce ancillary data products (e.g., mixed-layer depth), but a few compute the depths of various light levels.
- *Very few PIs compare the* $E_d(0^-)$ *value transmitted through the sea surface to the corresponding solar irradiance within the extrapolation interval*.
- A few PIs need one or more models to complete their processing (e.g., self-shading correction).
- Most PIs compare their *K* values to their pure water equivalents as a quality control measure, but many do not.
- Most PIs have had to reprocess all their data at one time or another.
- The primary intended use of the data products most PIs produce is algorithm validation and water quality monitoring.
- Only a few PIs would not use a Web-based processor if it was available.
- Almost every PI wants automatic data submission to SeaBASS.
- Almost every PI is willing to reprocess their data; the typical archived amount is hundreds of casts, but many PIs have thousands of casts.