

Overview of Breakout workshop on
“ Protocols for Water leaving
radiance and other parameters”

Co-chairs: Giuseppe Zibordi
Zhongping Lee
Kevin Ruddick
Ken Voss

Current Protocols

NASA/TM-2003-

**Ocean Optics Protocols For Satellite Ocean Color Sensor
Validation, Revision 4, Volume III:**

Radiometric Measurements and Data Analysis Protocols

Chapter 2

**In-Water Radiometric Profile Measurements and Data
Analysis Protocols.**

James L. Mueller

Center for Hydro-Optics and Remote Sensing, San Diego State University, California

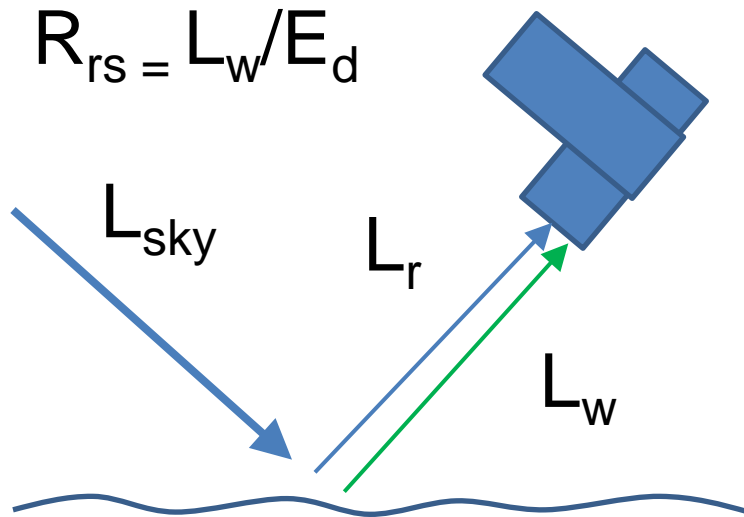
Structure of breakout

- Focused on methods to measure remote sensing reflectance:

$$R_{RS}(\lambda, \theta, \phi \in \Omega_{FOV}; \theta_o) = \frac{L_w(\lambda, \theta, \phi \in \Omega_{FOV}; \theta_o)}{E_s(\lambda; \theta_o)}$$

Broke discussion into two parts: above water methods and in-water methods.

Above water methods



Discussed measurement angles, instrument characteristics, documentation required other aspects of the measurement

$$L_w = L_{sfc} - \rho L_{sky}$$

ρ is critical in this method

Results

- The agreed upon statement about measurement angles is the protocol should specify angles, with reasoning behind choice, so users will know what they are losing when operating in a different fashion.
- Documentation needs to be complete including pictures of sky, sea surface during measurement, instrument integration time.
- (detail) The one consensus seemed to be to use ρ from Mobley '99 rather than the more recent work by Mobley, but there are limitations due to lack of a spectral sky in this work. On the other hand, there is a lot of work going on right now that could/will improve this factor.

Additional points

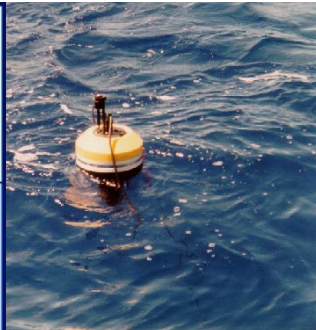
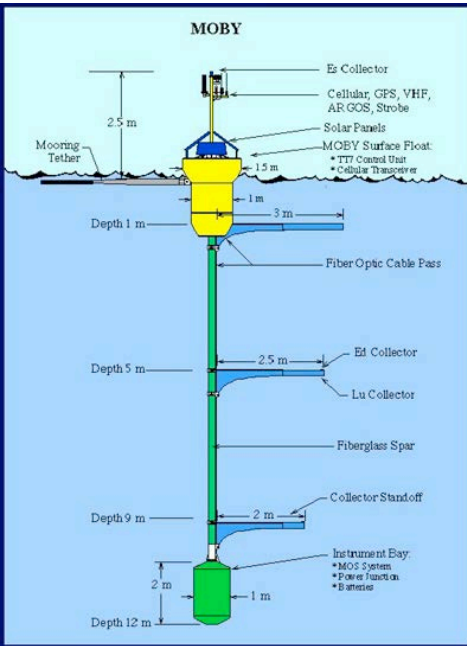
- Reflectance plaque, when used, should be carefully calibrated and documented.
- There should be an experiment (data might already exist) to compare irradiance measurements taken with a calibrated irradiance collector and that taken with a reflectance plaque.....
- Impact of making measurements during non-ideal conditions has to be considered.
- Spectral calibrations need to be carefully done on all instruments, and measurement time carefully noted and recorded.

In-water protocols

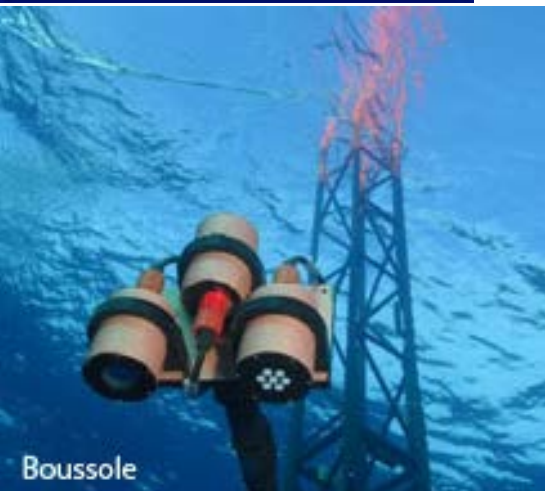
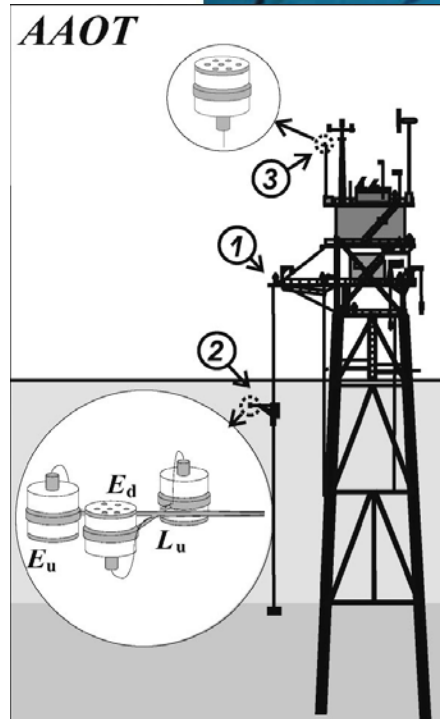
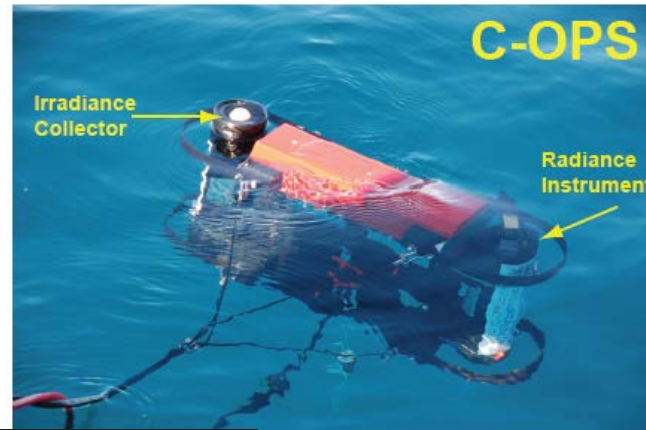
- Overview kindly provided by Emmanuel Boss. Many instruments developed since protocol first appeared.
- These methods use in-water measurements to get L_w , then above water irradiance meter to get E_s .

Current systems

Fixed depth:



Profiling systems:



Best practices

- Avoid ship shadow in some manner....
- Correct for self-shading
- Currently says.... 6-8 samples/meter (more on next slide)
- Dark measurements should be obtained with each measurement (possibly temperature dependent).
- Temperature should be measured on detector mounting surfaces (instrument should be allowed to equilibrate).
- Correct for clouds – surface irradiance (E_s).
- Deal with focusing/defocusing near surface

Recommendations from session

- Protocols need to be updated to describe multi-cast method, slow drop method, and Shadow Blocked method (SBA).
- Protocol should discuss number of samples/depth, but also time over which samples are taken.
- Protocols should include strategies for alternative platforms (floats, gliders, etc.)
- Some consensus that Es collector should not be gimballed, but results filtered to eliminate tilts > 5 degrees (this may also be too large).

Additional points

- Care should be taken to eliminate shadowing as much as possible
- Calculations can and should be done for instrument self shadowing.
- The depth range, and methods used for calculating K_{Lu} (required to adjust L_u at some depth to the surface) should be refined.

Common recommendations

- Users should carefully consider and document measurement uncertainties, protocols should include information to help with this.
- SeaBASS should add a flag which can be used to indicate whether or not data is validation quality.
- The important issue of BRDF corrections (to get “exact” parameters, was purposely not discussed, but is extremely important.

Thank you to all the workshop attendees, and I hope it was worth your three hours.....