Report from the "In situ radiometric measurements and validation" working group 5
SIMBIOS Science Team meeting 2002
16 January, 2002

Session chairs: Norm Nelson, ICESS UCSB, Jim Mueller, CHORS SDSU

Goals:
1) Develop topics for ocean optics protocols update (WG 8)
2) Discuss currently evolving issues in radiometer calibration and characterization

Jim Mueller gave an update on the status on the protocols volume. Major changes are planned to chapter 6 (radiometer characterization) – Carol Johnson of NIST will lead this effort. Chapter 10 (measurement and data analysis procedures) will be revised, as will Chapter 12 (above-water radiance measurement protocols). New chapters (heretofore not included in the volume) will include a chapter on MOBY procedures by the MOBY team, a chapter on drifter and buoy data protocols, a chapter on ocean color measurements from aircraft, a chapter on IOP profiling instruments (a,c,beta), and a chapter on the procedures for computing LwN, emphasizing the newer "exact" computation of LwNs (of Morel and Gentili) over the traditional Gordon and Clark formulation. Jim will report more on the details.

Stan Hooker, Giuseppe Zibordi, and Scott McLean reported on their recent activities having to do with uncertainty budget analysis and radiometer characterization. Stan and Giuseppe described in detail their error budget computations for the Venice Tower campaigns.

A very interesting result that captured the attention of the working group was gained from the Data Analysis Round Robin. A principal source of uncertainty in data analysis for remote sensing reflectance was the choice of the extrapolation interval (the depth range over which in-water data are extrapolated to the surface for computation of water leaving radiance). The working group discussed the possibility of developing some heuristics for choosing the extrapolation interval (based on inwater and environmental conditions) that might harmonize this decision process for SIMBIOS researchers. This will require a bunch more data analysis, for example of the DARR data set, and is suggested as a goal for the future (i.e. 4^{th} revision of the protocols).

Giuseppe went on to describe some difficulties in validating zero-minus vs. zero-plus irradiance data which led him to want to further pursue characterization of the Satlantic in-water radiometers. Stan and Giuseppe, Scott, and Jim Mueller then mounted a large effort to determine the immersion coefficient and cosine response factors for a number of Satlantic OCI-200 7-channel irradiance detector heads, using the labs at CHORS and Satlantic.

Briefly, the cosine response of the detectors was found to be acceptable. Deviations from the ideal cosine response were found to be < 2% for angles up to 60 deg from normal, and < 6% for larger angles.

The immersion coefficients, however, were found to differ considerably from the original immersion coefficients determined in the early 90s. Some values in the blue were found to be up to 10% lower. Results from the two laboratories were found to be comparable, and for the most part different instruments were found to have similar immersion factors. On the other hand there were a number of outliers. Deviations from the mean between instruments averaged about 1.5% for blue wvlns and 3% for red wvlns, suggesting that for provisional data at least the mean coefficients can be used for other radiometers (your results may vary. California mileage will be lower). These results are going to be published shortly.

Incidentally similar results were found for Satlantic OCI-1000 14 channel irradiance heads, in separate studies done at Satlantic and at CHORS. We will put these results up on the BBOP web site for interested parties (URL is http://www.icess.ucsb.edu/bbop/bbop.html).

Finally, Gerhard Meister reported on the SIMRIC study, in which he travelled to different calibration labs (Satlantic, Biospherical, SIO, UCSB, and GSFC Code 910) with the Seawifs Transfer Radiometer II (SXR-

II) to determine the uncertainty of radiance calibration measurements using either plaque-reflected lamp radiance or integrating sphere light sources.

Despite differences in methodology used by the laboratories, most laboratories were found to have calibration uncertainties within 2-3% (usually more uncertainty in the blue). The working group discussed a number of issues having to do with differences in procedure that may help to reduce some lab-lab differences. It should be recommended that labs use the effective-distance correction when working with FEL lamps, and if this correction can not be directly determined, the value should be estimated from examination of the filament. It should also be recommended that labs *not* use the 50cm distance from lamp to plaque for calibrations, as this is too close and the filament image appears on the plaque. The NIST 2000 irradiance scale described by Howard Yoon yesterday should be the scale to which calibration labs refer, but this is going to be a difficult problem until (for example) Optronic labs (who provide most routinely used cal labs) switch to the new scale. This is going to be an issue for a while.

There was considerable discussion of plaque BRDF, and the value of the correction factor that converts the Labsphere 8deg/hemispherical standard value to the required 0/45deg BRDF. The previously identified factor of 1.028 is thought to be too high (and spectrally invariant, when a 1% variability across the vis spectrum is expected), and this value will be investigated. Results from previous SIRREX studies may be recommended. Calibrators purchasing new plaques from Labsphere should request the 45deg calibration when they buy the plaque

Use of the Tuillier (sp) extraterrestrial solar irradiance spectrum in LwN calculations was identified as an upcoming important issue, as ocean color missions (esp. MERIS) will be switching to this scale. It was noted that several means of computing the earth-sun distance anomaly are in previous editions of the protocols, and it should be discussed which one should be used.