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Chapter 8

Absolute Calibration of the SQM and SQM-II

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Abstract

To better understand the capability of portable sources, a series of experiments were conducted to transfer an absolute calibration to the original SQM and four SQM-IIs, and to map the homogeneity of an SQM-II exit aperture. Approximately 25% of the central portion of the exit aperture was within 2% of the maximum signal, and about 40% was to within 5%. The decay in SQM flux over a 500 day time period, which included one shipping event, was estimated to be approximately 0.9% every 100 days. The decay for an SQM-II (S/N 004) over the same time period, but encompassing four shipping events, was approximately 2.2% every 100 days. The average and standard deviations in the coefficient of variation was used as a stability parameter for the SQM and SQM-II. Both sources showed a spectral dependence with the greatest stability in the red part of the spectrum, and the least stability in the blue. The standard deviation in the coefficient of variation was independent of wavelength for the SQM, but the SQM-II had a noticeable spectral dependence—the reddest wavelength (775 nm) had a standard deviation approximately half that of the blue wavelengths. Using the overall averages as generalized metrics for stability, the SQM was more stable than the SQM-II: the overall average was a factor of three smaller, and the overall standard deviation was an order of magnitude smaller.

8.1 INTRODUCTION

Most SeaWiFS validation campaigns have been on Atlantic Meridional Transect (AMT) cruises (Aiken et al. 2000), which occur twice a year and involve a transit of the Atlantic Ocean between Grimsby (UK) and Stanley (Falkland Islands) with a port call in Montevideo (Uruguay). In all of the AMT cruises the SQM was a part of, it was shipped long distances between the US, the UK, and the Falkland Islands or Uruguay (also once to South Africa) with no negative effects on performance both during the cruise time period and between cruises.

The SQM lamps were changed after its commissioning to produce a flux level more in keeping with the radiometers being deployed on AMT cruises, but the same lamp set was used during AMT-5 through AMT-7 (another lamp change was made after AMT-7 to fine tune the flux levels). During the design stage of the SQM, there was some controversy about running the lamps below their rated current (approximately 95% of rating), but there has been no observable degradation in the performance of the lamps as a result of this—indeed, they have survived long shipment routes using a variety of transportation vehicles (trucks, planes, etc.) on repeated occasions, as well as, the high vibration environment of a ship.

Figure 30 is a summary of SQM performance during the AMT-5 through AMT-7 time period (spanning 460 days). It shows the internal blue monitor signal, measured with the glass fiducial, as a function of time, but presented as the percent difference with respect to the mean value for the entire time period. A confirmation of the signal is given by the R035 radiometer for the 443 nm channel (which is very similar to the blue internal monitor), and it very nearly mirrors the internal monitor signal. The two detectors yield similar decay rates of approximately 0.007% per day, or approximately 0.25% for a 35-day cruise. This is an underestimate, however, because the degradation is due mostly to lamp usage, and this is most significant during use, and not during shipping and storage. This is best seen by looking at the individual cruises, and comparing them to the laboratory work after AMT-7.