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Volume 23, Tower-Perturbation Measurements in Above-Water Radiometry

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Chapter 5

Preliminary Results

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Abstract

The analytical results are organized by separating the above-water radiometric data into near- and far-field categories. The former correspond to data for which $x < 13\,\mathrm{m}$, and the latter to data for which $x \geq 13\,\mathrm{m}$, where x is the perpendicular distance of the surface spot viewed by the sea-viewing sensor away from the tower. The far-field observations confirm uncontaminated above-water data can be collected in the vicinity of a large structure as long as the surface spot is as far away from the platform as it is high (in this case about 13 m). The near-field data show significant perturbations, as much as 100% above far-field levels, which are substantially above any fluctuations that could be attributed to natural environmental variability (in the absence of floating material). A separate investigation of both the widespread and the sporadic effects of floating material showed perturbations as much as 25% above normal (uncontaminated) levels.

5.1 INTRODUCTION

Although in-water measurements have successfully been used for deriving water-leaving radiances and are recurringly used for validating ocean color sensors, above-water measurements form an alternative, which remain to be similarly exploited. From a measurement perspective, the above-water approach is more restrictive, because there is presently no reliable mechanism for floating an above-water system away from a measurement platform (which is easily and effectively accomplished for an in-water system), so all above-water measurements are made in close proximity to a large structure.

Despite any limitations, the above-water approach for vicarious calibration remains attractive for a number of reasons:

1. The data can presumably be collected more rapidly, and from a vessel underway;
2. The frequently turbid and strongly absorbing waters in shallow Case-2 environments impose severe limitations on in-water measurements, because of the instrument self-shading effect and the difficulty of resolving optically thin layers, particularly those close to the surface; and
3. When collecting an autonomous time series of data, the biofouling of in-air sensors is negligible in comparison to in-water sensors.

It is important to remember that above-water systems cannot be deployed in arbitrary locations, because a stable and accessible mounting location is needed to ensure the required precision for pointing the sensors with respect to the sun, the sea surface, and the sky. Note that the accessibility requirement becomes less important for a robotic system, because only limited visits associated with maintaining the equipment are required; there is no need for an operator to satisfy the pointing requirements, because this is provided automatically.

Recent studies have carefully intercompared both methodological approaches (Hooker et al. 2002a and Hooker and Morel 2003) and provided recommendations for improving above-water techniques. Many of the latter have either been incorporated into the Q01 and Q02 methods used here (e.g., using an aggressive glint filter, calculating and using a more precise surface reflectance that is wind-speed dependent, and correcting for bidirectional effects) or are part of the objectives associated with this study (e.g., quantifying and avoiding the effects of platform perturbations).