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Chapter 9

SIRREX-7 Synthesis, Discussion, and Conclusions

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Abstract

A combined uncertainty budget for radiometric calibrations can be constructed from the SIRREX-7 data set. Although it is comprehensive, it does not address every source of uncertainty at the same level of detail and some must be considered as approximate. Nonetheless, the care taken in each experiment ensures the uncertainty estimates are representative of what can be expected if careful metrology and practices are used. Perhaps just as importantly, the consequences of discrepancies are also well estimated. To provide a range of possible outcomes in the calibration process, minimum, typical, and maximum uncertainties are computed from the various entries, which range from 1.1–3.4% and 1.5–6.7% for irradiance and radiance calibrations, respectively. The Satlantic facility falls somewhere between the minimum and typical values. If an additional (average) 1.0% is included to account for an unknown bias detected with the lamp and plaque uncertainty experiments (described in Sects. 3.2 and 4.2, and discussed in Sects. 9.2 and 9.5), the uncertainty for Satlantic irradiance calibrations is 1.8%, and the uncertainty for radiance calibrations is 2.3%.

9.1 INTRODUCTION

This chapter synthesizes the results from the various SIRREX-7 experiments and discusses the conclusions that can be drawn from them. The lessons learned are separated according to irradiance or radiance calibrations, and those applicable to both. Not all types of Satlantic sensor were included in SIRREX-7, in fact, the most common instrument was the model 200 series of radiance and irradiance sensors (Table 7). Most Satlantic instruments share design commonalities, however, so the results have some applicability to most instrument classes. An obvious exception is the difference between single- and multiple-aperture sensors: the latter have more complicated alignment effects, because they have multiple viewing axes.

A summary of the various experiments executed during SIRREX-7 is presented in Table 13. Although it was not possible to replicate all the experiments the same number of times, the primary experiments were executed as many times as economically feasible to ensure statistical reliability. Most of the experiments involved the use of all three principle components of radiometry, source, target, and detector, so most have results applicable to other objectives. The material presented here is organized primarily according to the order the experiments were presented in Chapters 3–8 (some information originally presented in different chapters was combined into one section).

9.2 LAMP UNCERTAINTIES

The results from the investigations into lamp uncertainties (Sect. 3.2.3) showed a deterministic bias when the irradiance of the lamps calculated from the SXR measurements of the NIST plaque were compared to the values supplied with the lamp (Fig. 5). Each component of the experiment has an uncertainty on the order of 1%, and given another (maximum) 1% from mechanical setup uncertainties, the range of uncertainty seen with the so-called *trusted* lamps is within the quadrature sum of these components, that is, the approximately 2% uncertainty in the blue part of the spectrum is very close to $\sqrt{4}$.

The spectral dependence in SXR uncertainties is approximately 0.5% (Johnson et al. 1998a), with maximal un-