Climate Data Records of Sea-Surface Temperature, International Space Science Institute, 2011-2014

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fiducial reference temperature measurements

ISFRN Workshop, NOCS, February 27 – 28, 2019

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International Space Science Institute

ISSI International Teams

- Teams are composed of about 8-15 scientists of different laboratories, nationalities and expertise. They hold a series of two to three one-week meetings over a period of 12 to 18 months.
- Annual competition, with majority being related to satellite astronomy and astrophysics.
- Minnett & Corlett proposal **"Generation of Climate Data Records of Sea-Surface Temperature from current and future satellite radiometers"** was selected.

Background and Objectives

- Take advantage of temperature being an SI Base Variable to establish the procedures to generate satellite-derived SST CDR with SI-traceability.
- Stress role of ship-based radiometers for CDR generation.
- Build on the three "Miami" IR radiometer workshops.
- Focus on three ship-board radiometers:
  - M-AERI
  - ISAR
  - SISTeR
- Develop "Best Practices" guidelines for calibration, at-sea deployment, data handling and distribution.
- Establish a foundation of papers for future reference and topic development.

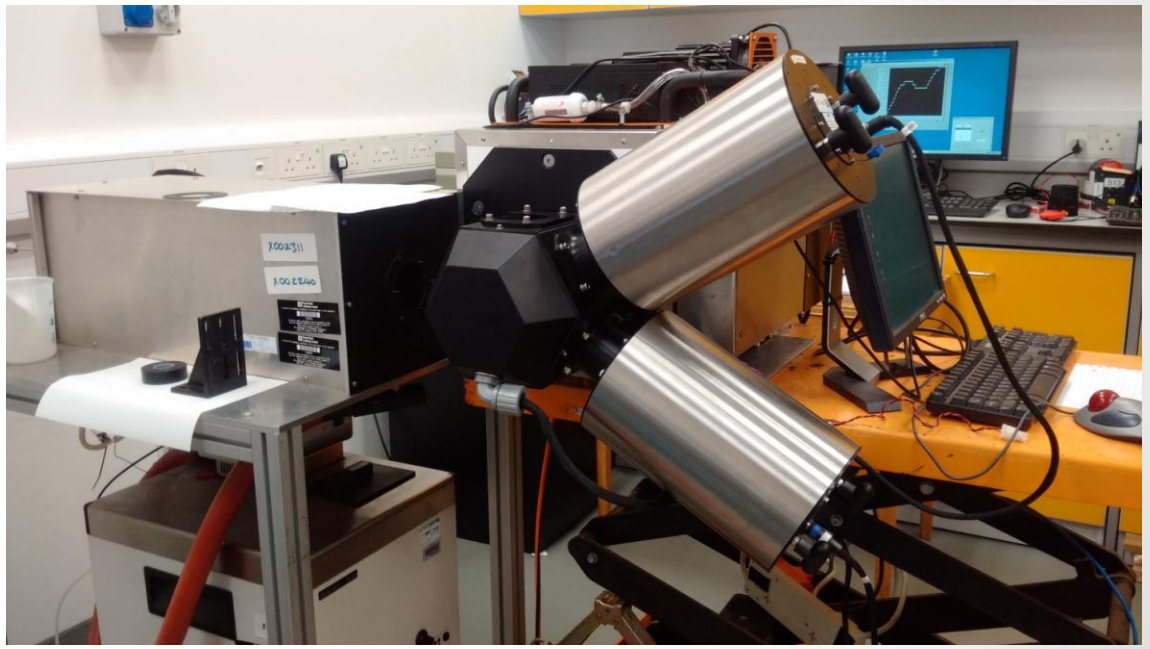
Detailed Objectives

- Review of the results of the three Miami infrared workshops and lay the groundwork for the next series of workshops to be held in the USA or Europe.
- Review the current "state of the art" of satellite SST retrieval uncertainties, and identify the contributions to the satellite-derived uncertainty budget from the validating radiometers, and from the method of validation.
- Revisit the specifications for future SST validation radiometers.
- Establish and publish a Best Practices Handbook for validation of satellite-derived SSTs.
- Ensure the steps to establishing SST CDRs are rigorous and well-understood by those involved in this activity.
- Make longer term, coordinated plans to validate new satellite radiometers – VIIRS on NPP and JPSS, and SLSTR on Sentinel-3.
- Coordinate the validation of the satellite-derived SSTs within the framework of the CEOS QA4EO.
- Examine the initial validation results of the VIIRS on NPP.
- Finalize publications.

Participants

Outcomes

- Fourth "Miami" IR radiometry workshop was held in June 2016 at NPL.
- More ambitious than earlier workshops held at RSMAS.
- Ensured SI-traceability for ship-board radiometer measurements.



Data Formatting

- Similar to L2P for satellite-derived SST, for surface radiometers.
- Facilitates data exchange, and long-term custody.
- Preferred format for felyx.

GHRSST
Group for High Resolution Sea Surface Temperature

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The Recommended ISRN L2R Data Specification

Version 1.1 Revision 0

Document Management			
Reference:	The Recommended ISRN L2R Data Specification v1.1 rev0.doc		
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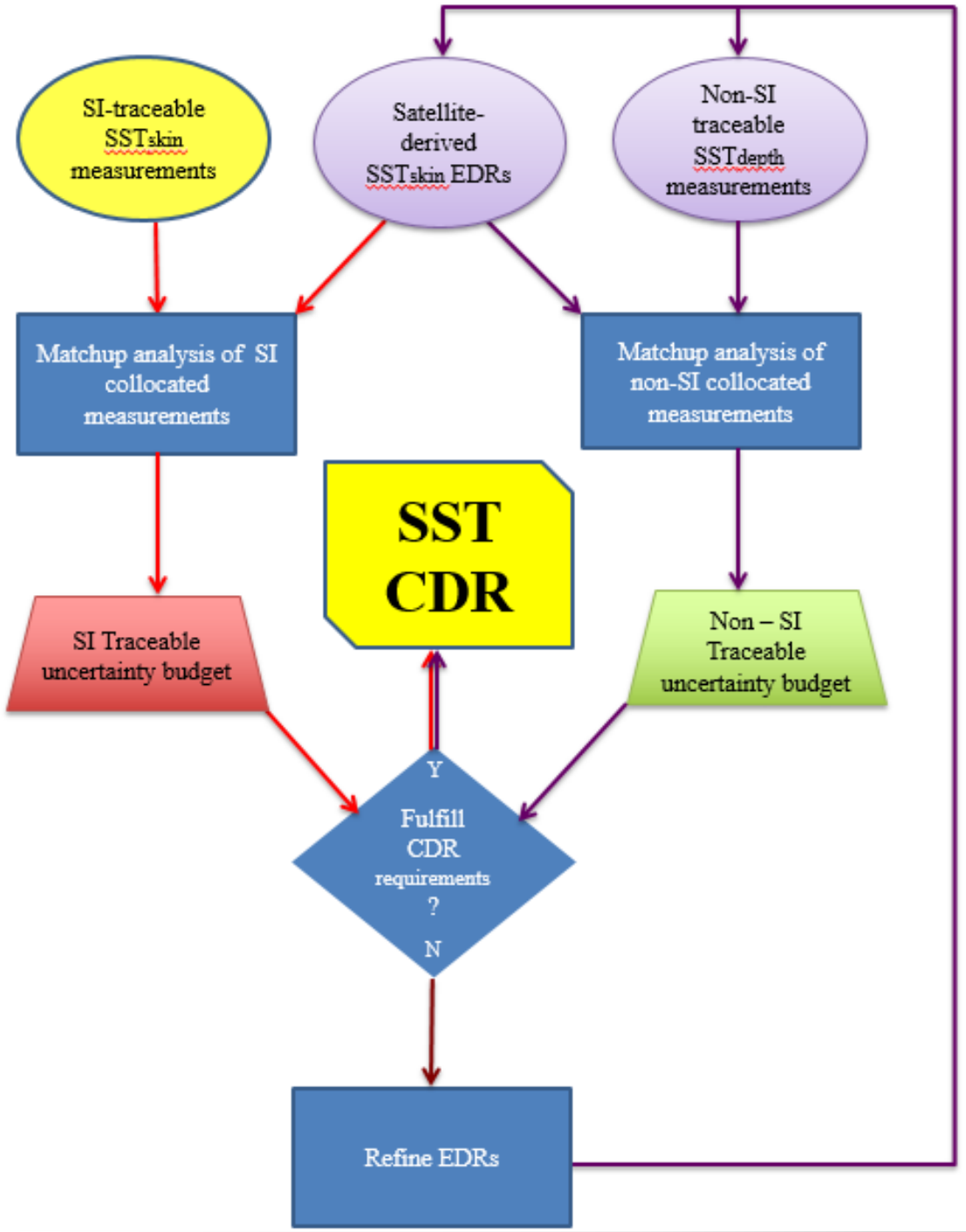
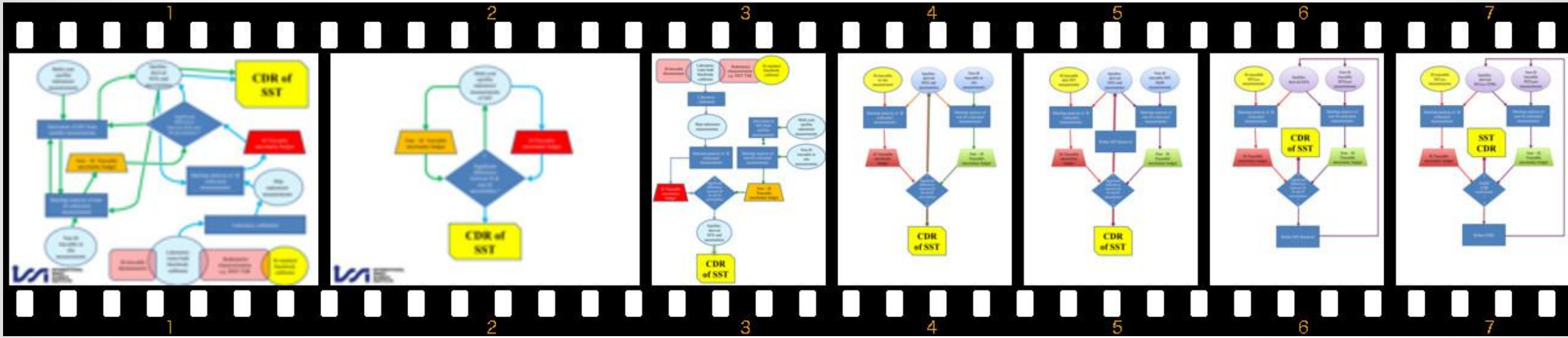
Book Captain:	Tim Nightingale		
Author:	International Shipborne Radiometer Network		
Master File Location:	Approved on-line version: TBD Development versions in: TBD		

Generating an SST CDR

- Ship radiometers measure skin SST and are SI-traceable.
- But are few in number.
- Buoys measure sub-surface SST, and are not SI-traceable.
- But are numerous, even if not uniformly distributed.

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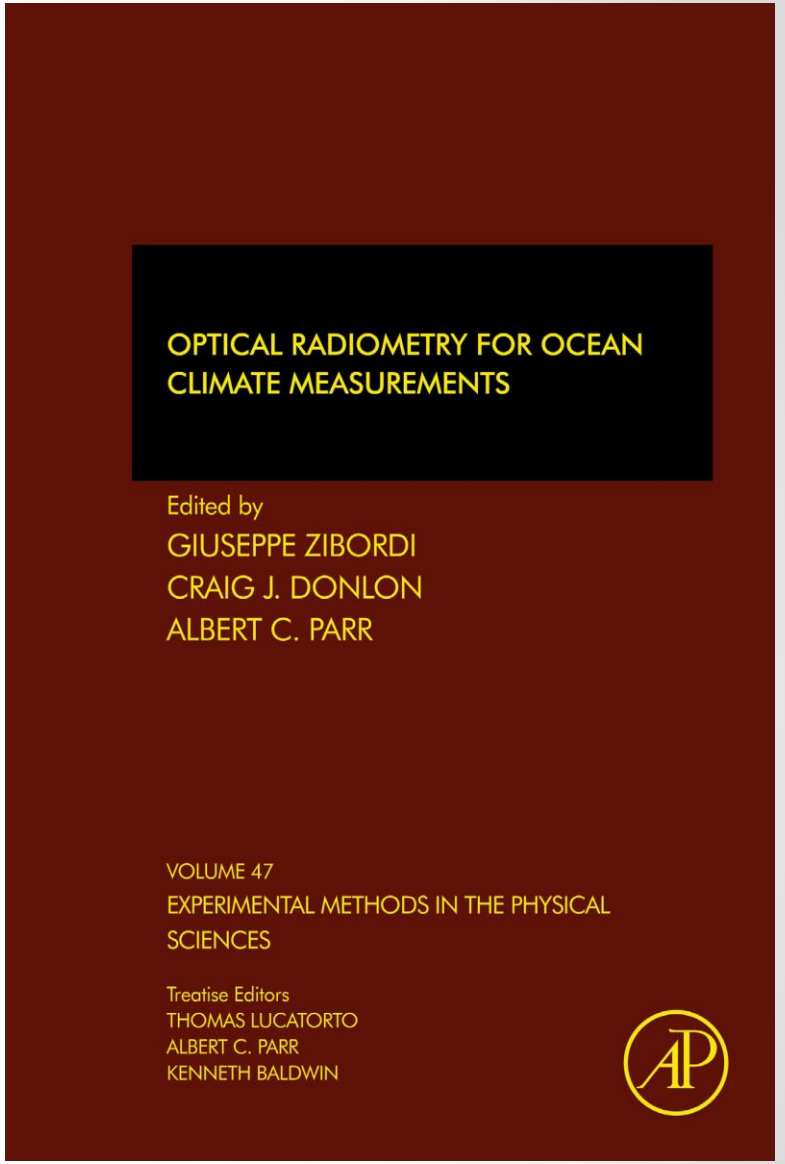
Publications.

Minnett, P.J., & Corlett, G.K. (2012). A pathway to generating Climate Data Records of sea-surface temperature from satellite measurements. *Deep Sea Research Part II: Topical Studies in Oceanography 77–80*, 44-51. 10.1016/j.dsr2.2012.04.003

This was already written ahead of the International Team meetings, but was a stimulus for further discussion.

Many discussions and recommendations were incorporated in chapters of:

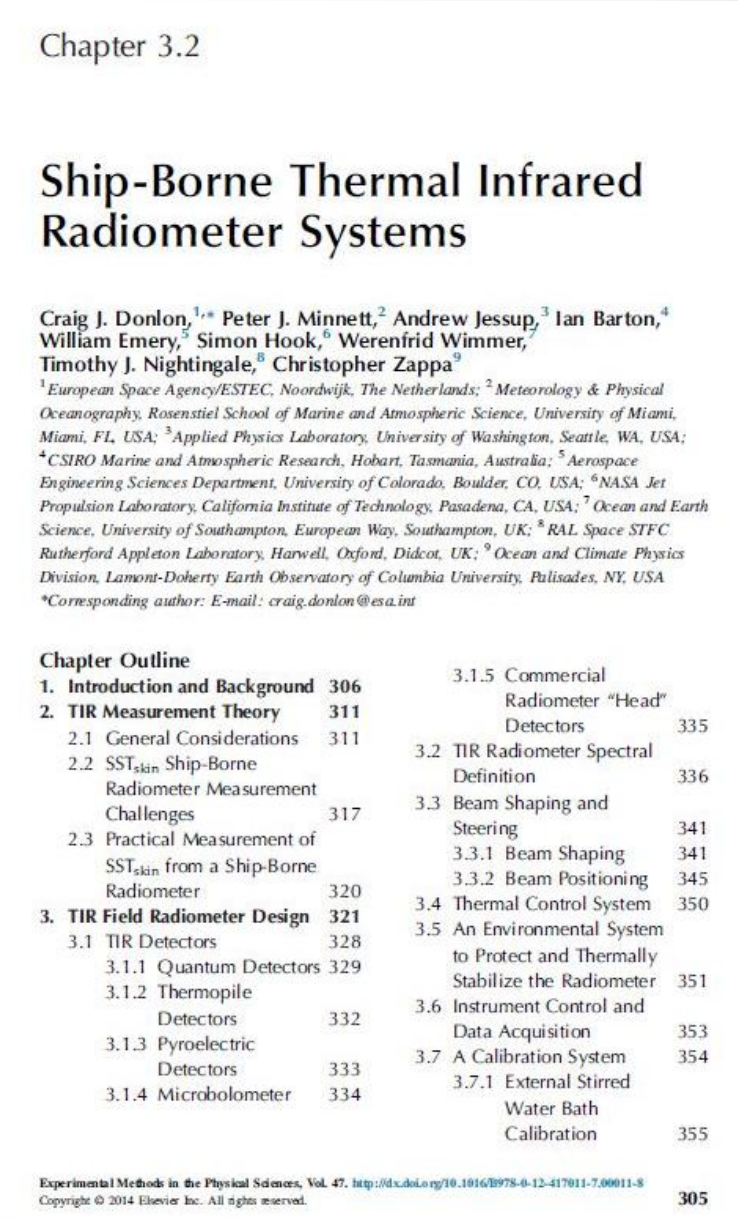
Zibordi, G., Donlon, C.J., & Parr, A.C. (Eds.) (2014). Optical Radiometry for Ocean Climate Measurements: Academic Press. 978-0-12-417011-7. pp. 723.



Ship Radiometers

Donlon, C.J., Minnett, P.J., Jessup, A., Barton, I., Emery, W., Hook, S., Wimmer, W., Nightingale, T.J., & Zappa, C. (2014). **Ship-Borne Thermal Infrared Radiometer Systems.**

In G. Zibordi, C.J. Donlon, & A.C. Parr (Eds.), *Experimental Methods in the Physical Sciences, Vol 47, Optical Radiometry for Ocean Climate Measurements* (pp. 305-404): Academic Press. 1079-4042. http://dx.doi.org/10.1016/B978-0-12-417011-7.00011-8.



Chapter 3.2

Ship-Borne Thermal Infrared Radiometer Systems

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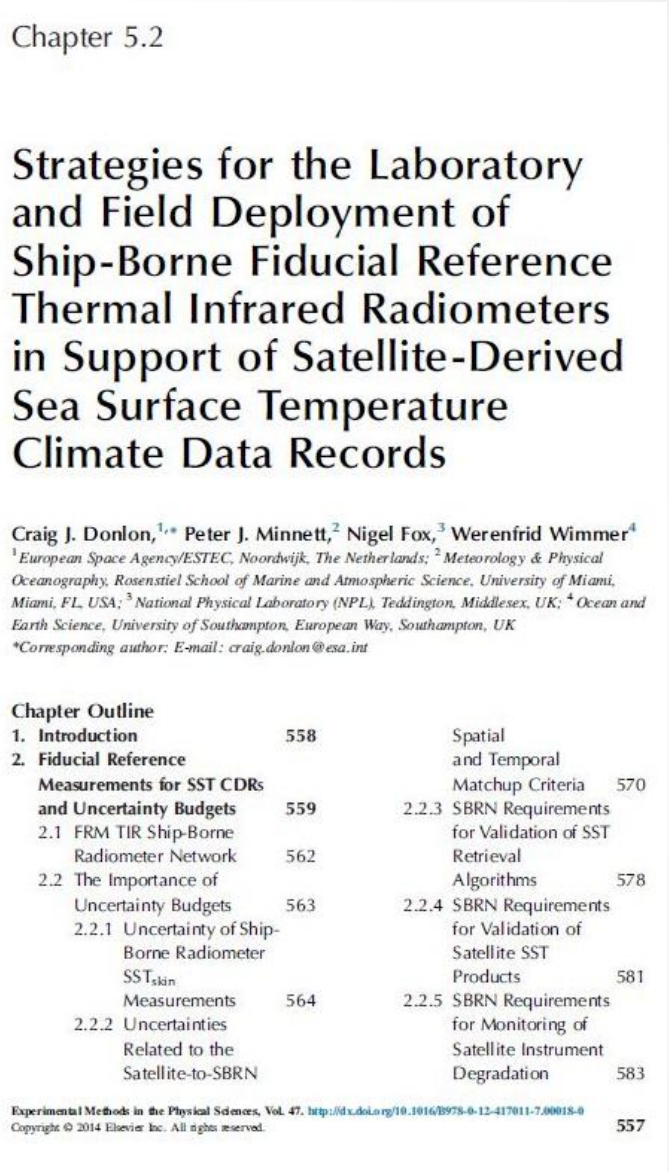
Best Practices

Donlon, C.J., Minnett, P.J., Fox, N., & Wimmer, W. (2014). **Strategies for the Laboratory and Field Deployment of Ship-Borne Fiducial Reference Thermal Infrared Radiometers in Support of Satellite-Derived Sea Surface Temperature Climate Data Records.**

In G. Zibordi, C.J. Donlon, & A.C. Parr (Eds.), *Experimental Methods in the Physical Sciences, Vol 47, Optical Radiometry for Ocean Climate Measurements* (pp. 557-603): Academic Press. 1079-4042. http://dx.doi.org/10.1016/B978-0-12-417011-7.00018-0.



Chapter 5.2

Strategies for the Laboratory and Field Deployment of Ship-Borne Fiducial Reference Thermal Infrared Radiometers in Support of Satellite-Derived Sea Surface Temperature Climate Data Records

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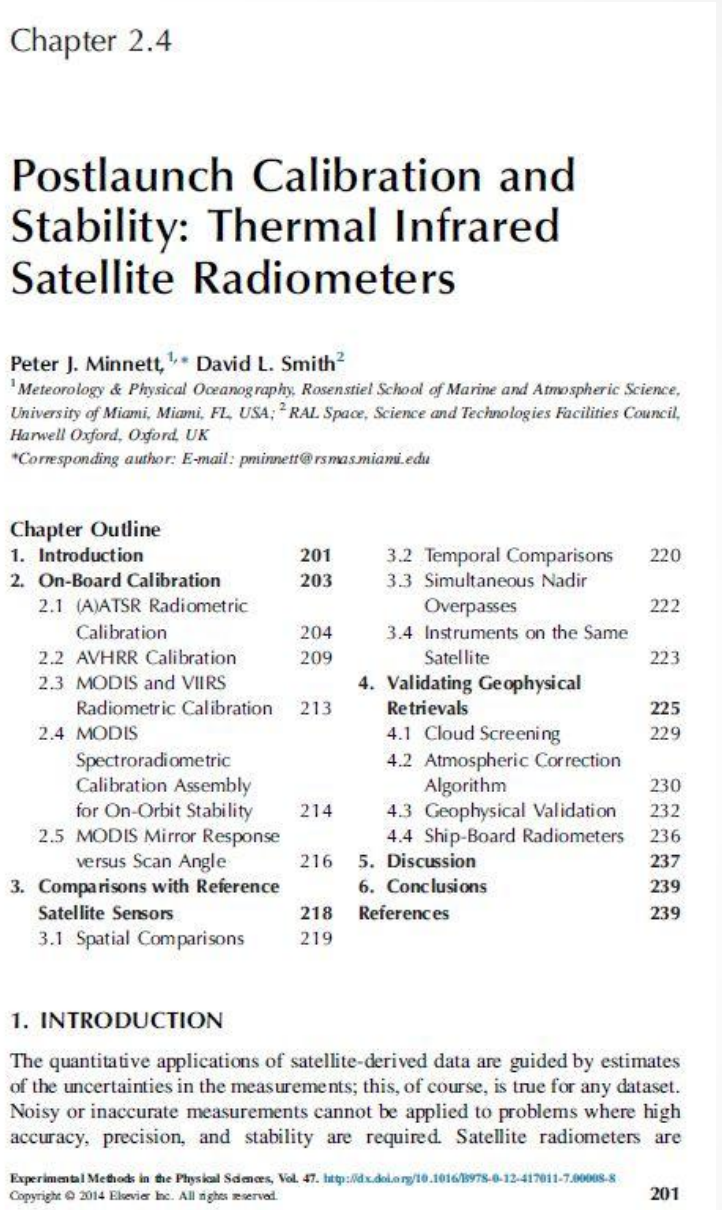
Satellite SST Uncertainties

Minnett, P.J., & Smith, D.L. (2014). **Postlaunch Calibration and Stability: Thermal Infrared Satellite Radiometers.**

In G. Zibordi, C.J. Donlon, & A.C. Parr (Eds.), *Experimental Methods in the Physical Sciences, Vol 47, Optical Radiometry for Ocean Climate Measurements* (pp. 201-243): Academic Press. 1079-4042. http://dx.doi.org/10.1016/B978-0-12-417011-7.00008-8.



Chapter 2.4

Postlaunch Calibration and Stability: Thermal Infrared Satellite Radiometers

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1. INTRODUCTION

The quantitative applications of satellite-derived data are guided by estimates of the uncertainties in the measurements; this, of course, is true for any dataset. Noisy or inaccurate measurements cannot be applied to problems where high accuracy, precision, and stability are required. Satellite radiometers are

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Satellite SST Uncertainties

Corlett, G.K., Merchant, C.J., Minnett, P.J., & Donlon, C.J. (2014). **Assessment of Long-Term Satellite Derived Sea Surface Temperature Records**.

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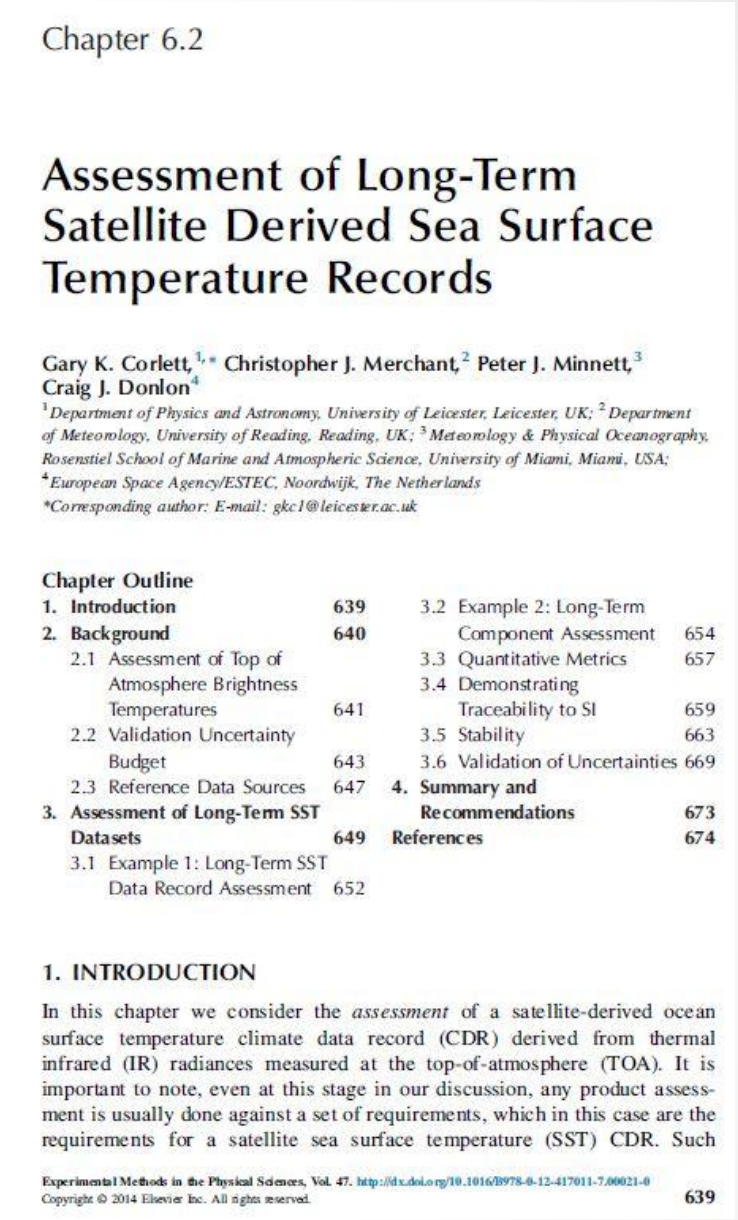

Chapter 6.2

Assessment of Long-Term Satellite Derived Sea Surface Temperature Records

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1. INTRODUCTION

In this chapter we consider the *assessment* of a satellite-derived ocean surface temperature climate data record (CDR) derived from thermal infrared (IR) radiances measured at the top-of-atmosphere (TOA). It is important to note, even at this stage in our discussion, any product assessment is usually done against a set of requirements, which in this case are the requirements for a satellite sea surface temperature (SST) CDR. Such

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