

Providing diurnal Hemispherical Cloud Fraction (HCF) data at ARM sites

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Introduction

The Solmirus Corporation has been funded by the U.S. Department of Energy to develop a diurnal hemispherical cloud fraction (HCF) data product utilizing the infrared (IR) radiometrically-calibrated data from their All Sky Infrared Visible Analyzer (ASIVA) instrument. Nighttime HCF has long been a critical programmatic gap in ARM's observational data set and is an important factor in understanding the life cycle of clouds, one of the central themes of the ASR program.

ASIVA Field Campaign

- ▶ Conducted at SGP Guest Instrument Facility
- ▶ Data collected from 21 May to 27 July 2009
- ▶ The ASIVA instrument offers a unique hatch mechanism with integrated blackbody reference for in situ calibration

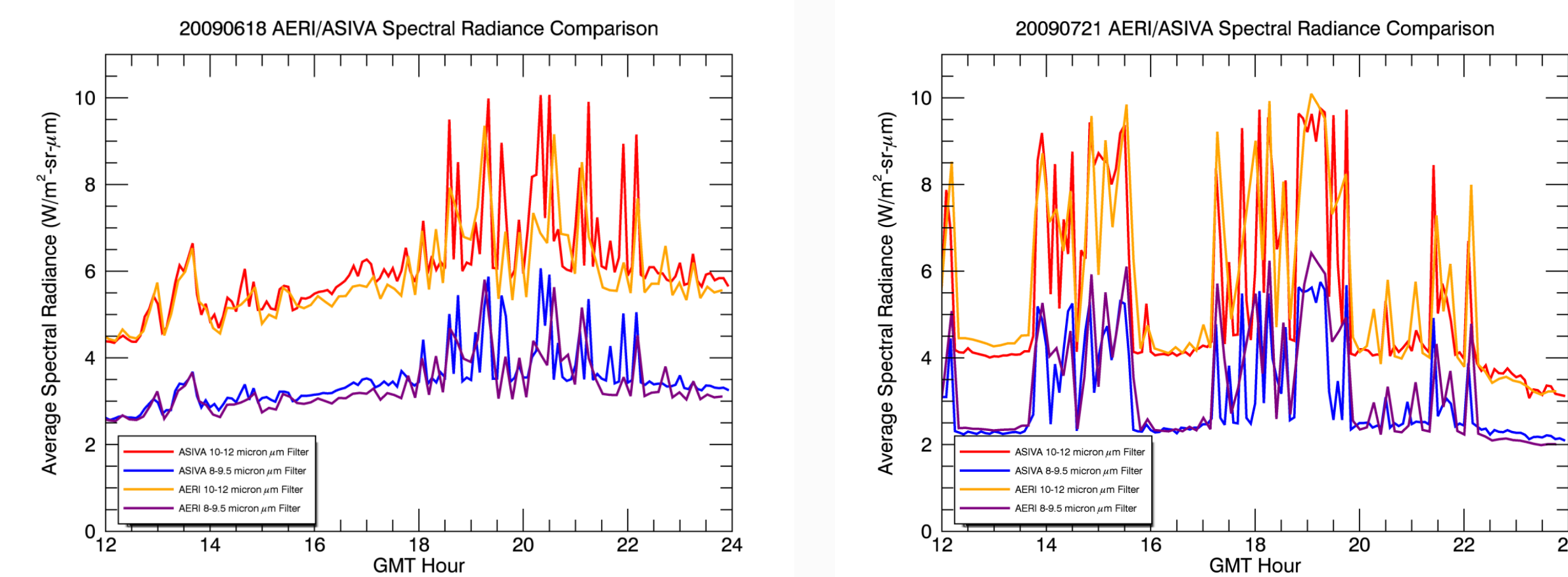


Objectives

- ▶ Perform comprehensive data analysis of observations made during the 2009 field campaign
- ▶ Develop a suite of cloud property data products for the ASIVA instrument that can be implemented in real time and tailored for cloud modelers
- ▶ Validate HCF algorithms by direct comparison of daytime ASIVA data to data retrieved from the ARM SGP Total Sky Imager (TSI) instrument.

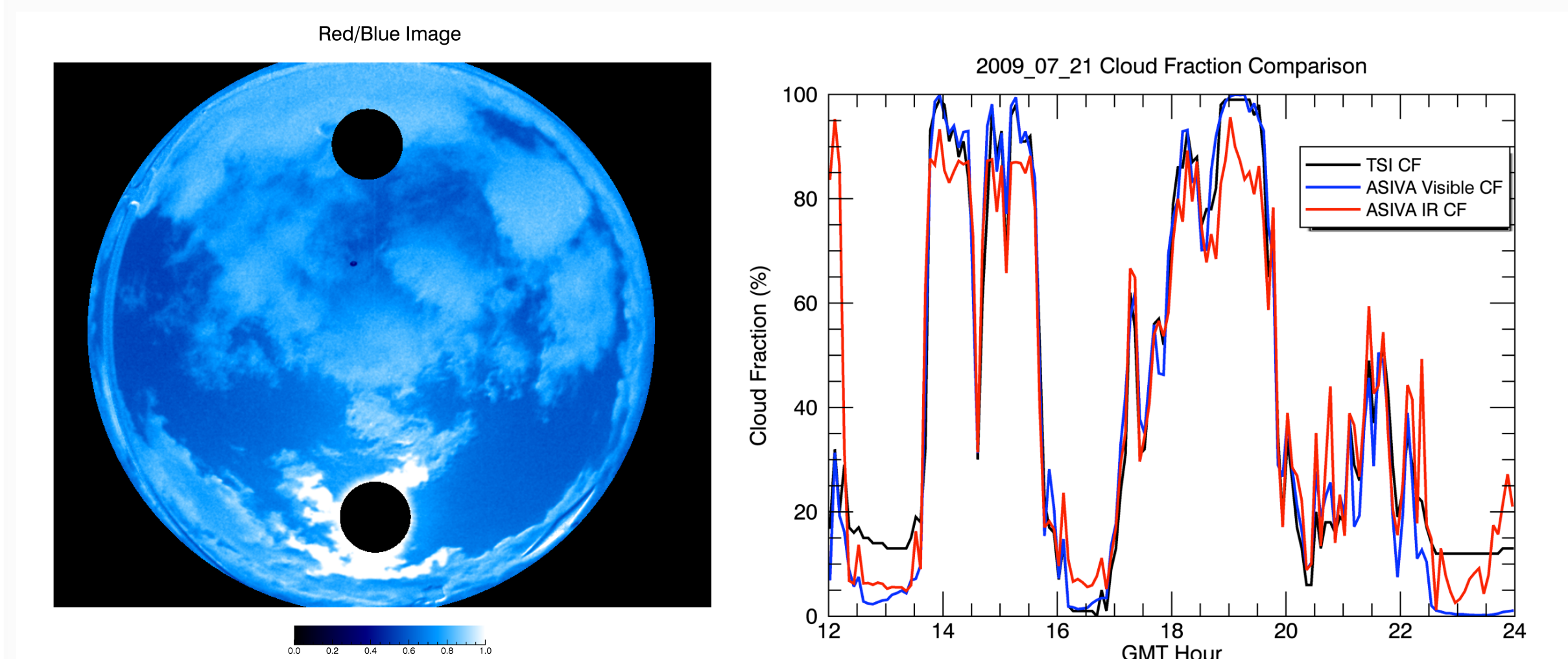
AERI – ASIVA Radiance Comparison

- ▶ AERI data has been used to validate the radiometric calibration procedures developed for the ASIVA.



Comparison with TSI data

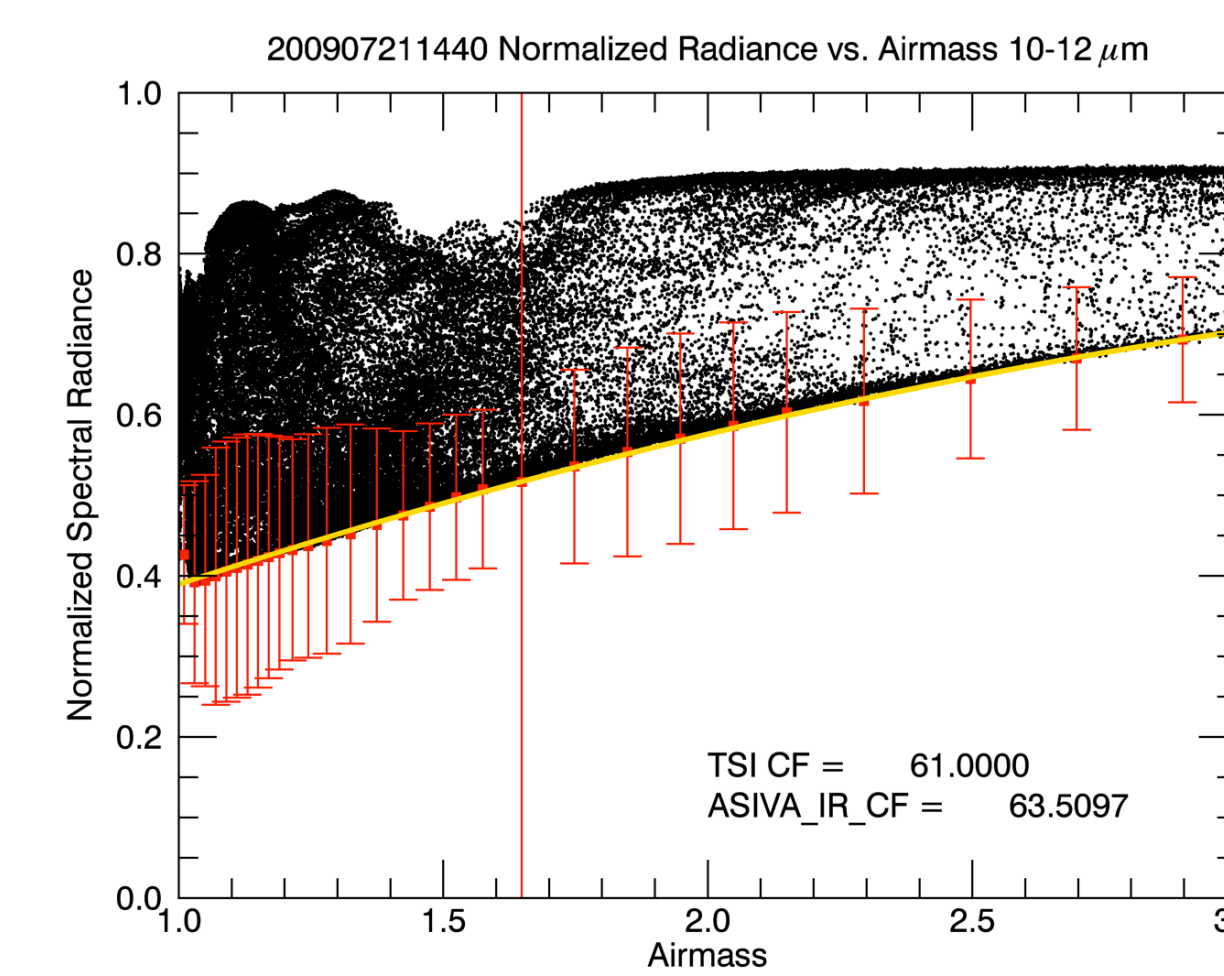
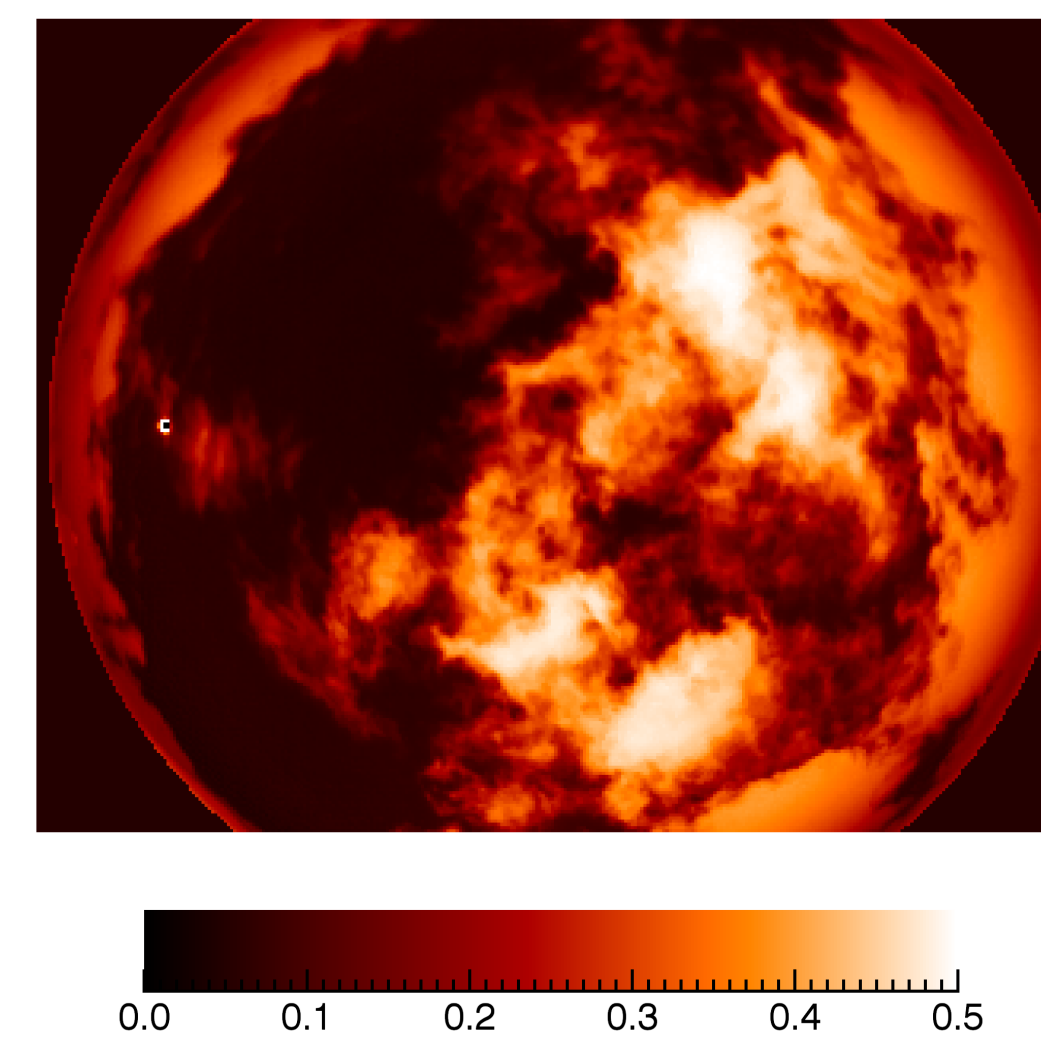
- ▶ ASIVA's visible channel is also being used to mimic the cloud fraction analysis of the Total Sky Imager.



IR Cloud Fraction Determination

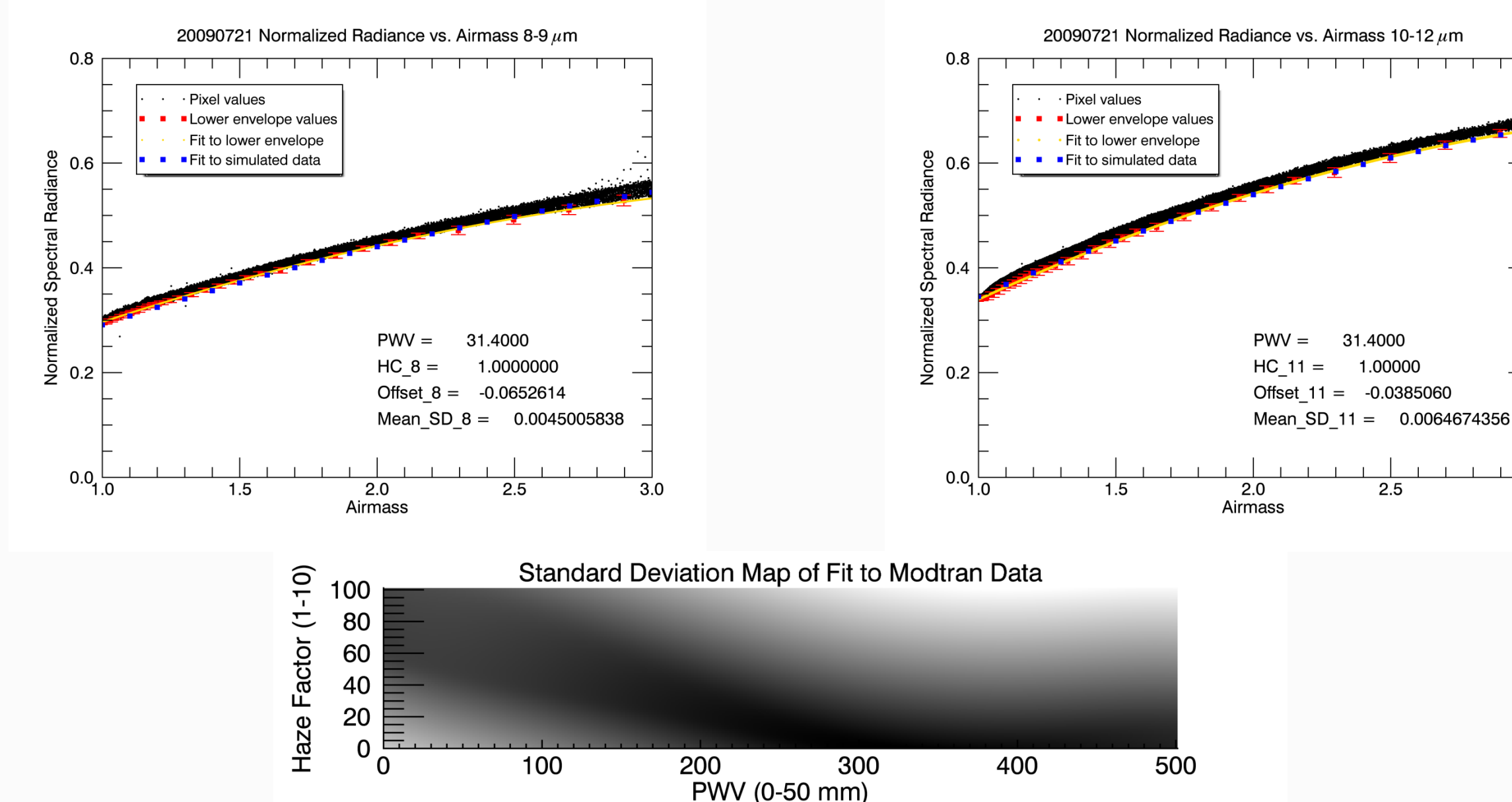
- ▶ A novel clear-sky subtraction algorithm allows for robust determination of hemispherical cloud fraction.

IR Clear-sky Subtracted Image



Modtran Analysis

- ▶ Modtran simulations have been performed to improve calibration and determine PWV and atmospheric haze.



Summary

- ▶ Calibration procedures appear to be robust.
- ▶ ASIVA cloud fraction data (both IR and Visible) correlate very well with TSI data.
- ▶ ASIVA cloud fraction data improves on TSI performance during sunrise and sunset.
- ▶ ASIVA demonstrates considerable promise in providing a diurnal cloud fraction data product as well as additional products such as determination of water vapor, cloud temperature (both color and brightness temperature), and cloud optical depth.

Acknowledgements

This research was supported in part by the U.S. Department of Energy's (DOE) Atmospheric System Research Program, an Office of Science, Office of Biological and Environmental Research program, under Grant No. DE-SC0008650. We acknowledge the cooperation of the DOE Atmospheric Radiation Measurement Climate Research Facility Southern Great Plains site and thank those responsible for the operation and maintenance of the instruments that produced the data used in this study.

Reference

Klebe et al., "All-Sky Mid-Infrared Imagery to Characterize Sky Conditions and Improve Astronomical Observational Performance", *Publications of the Astronomical Society of the Pacific*, December 2012 issue.