An Infrared Sky Imager
for the Atmospheric Radiation Measurement Program Climate Research Facility

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Poster 2

Introduction

At the U.S. Department of Energy's Atmospheric Radiation Measurement (ARM) Program Climate Research Facility, fractional sky cover has only been reliably determined during daytime hours utilizing the Total Sky Imager (TSI). Measurement of nighttime sky cover has long been a critical programmatic gap in ARM's observational data set. It is recognized that infrared sky imaging technology has held great promise in closing this gap. A request for proposals was issued for a commercially-available infrared sky imager that resulted in the purchase and deployment of a Solmirus Corporation All Sky Infrared Visible Analyzer (ASIVA) at the ARM Southern Great Plains (SGP) site.

Motivation

- Fractional sky cover is an important factor in understanding the life cycle of clouds
- Infrared sky imaging technology has the ability to characterize clouds identically for day or night conditions
- Infrared Sky Imager (IRSI) Intercomparison Studies were conducted in 2007 and 2009
- The Solmirus ASIVA daytime sky images and fractional sky cover values correlated very well with TSI and demonstrated considerable promise in providing nighttime sky cover data and additional products
- Solmirus was funded by the DOE in 2012 to develop a diurnal fractional sky cover data product utilizing the infrared radiometrically-calibrated data from their ASIVA instrument

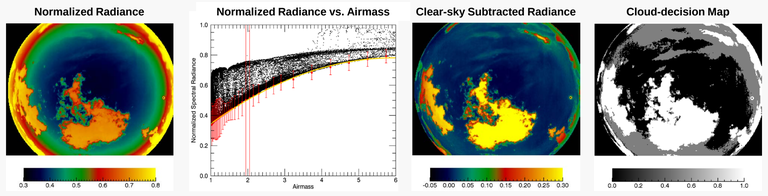
Objectives

- Produce a nighttime fractional sky cover product
- Capture hemispheric infrared images of the sky during both the day and night
- Compare the sky cover data with measurements from production TSI
- Evaluate ASIVA's performance capabilities and maintenance requirements

Deployment

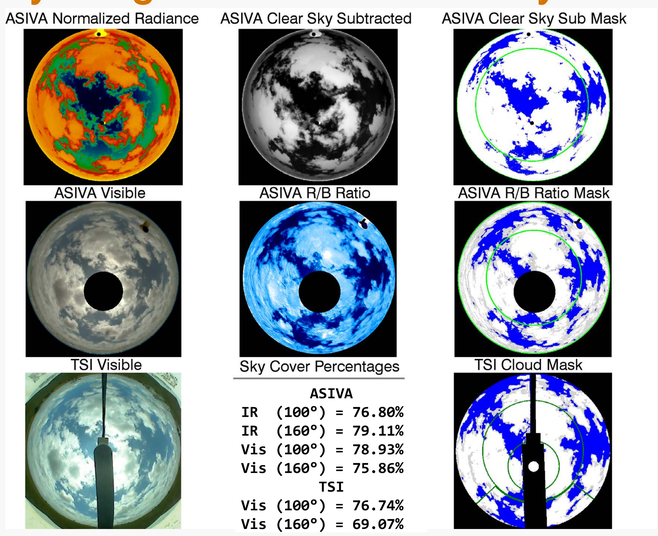
Solmirus ASIVA installed at ARM SGP site on 2 May 2014.

Infrared Sky Cover Determination



Robust determination of fractional sky cover using clear-sky subtraction.

Sky Images and Fractional Sky Cover



Comparison of infrared and visible sky images and percent total (opaque + thin) sky cover values at 100° and 160° field-of-view from the ASIVA and TSI at SGP site on 30 May 2014 at 13:30 CST.

Summary

- Infrared Sky Imager deployed at SGP site as a production instrument
- Instrument captures diurnal, hemispheric images of the sky in both the infrared and visible spectrum and provides values of fractional sky cover and precipitable water vapor
- Data collection started 20 May 2014
- Data available at ARM Archive
- Other products may include cloud/sky temperature, sky opacity/transmission, cloud height, and ozone determination

Instrument Specifications

- **Infrared subsystem**
  - **Detector:** microbolometer, uncooled
  - **Wavelength range:** 8 - 14 µm
  - **Filters:** 10 - 12 µm (sky cover) and 8 - 9 µm (color temp., PWV)
  - **Image resolution:** 644 x 512 pixel, 14-bit
  - **Field of view:** 180°
  - **Radiometric accuracy:** ± 0.2 W/m^2-µm-sr (± 1.4 K) at 300 K
- **Visible subsystem**
  - **Detector:** CCD, color
  - **Wavelength range:** 400 - 700 nm
  - **Filters:** Neutral density with 10^{2}x and 10^{4}x attenuation
  - **Image resolution:** 3296 x 2472 pixel
  - **Field of view:** 180°
- **Temporal resolution:** 0.5 s
- **Archived datastream: sgpirsiC1.b1**

Acknowledgements

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We acknowledge Solmirus Corp. the for installation, calibration, and analysis services of the ASIVA instrument.

Reference

Klebe DI, RD Blatherwick, and VR Morris. 2014. "Ground-based all-sky mid-infrared and visible imagery for purposes of characterizing cloud properties." *Atmospheric Measurement Techniques*, 7, doi:10.5194/amt-7-637-2014.

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