The Infrared Sky Imager Intercomparison Study

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Introduction

A field campaign was conducted in September 2007 at the ARM Climate Research Facility Southern Great Plains (SGP) site to compare measurements of cloud fraction from four different types of commercially-available infrared sky imagers (IRSI).

Purpose

- Produce nighttime cloud fraction product at multiple fields-of-view
- Capture hemispheric infrared images of the sky during both the day and night
- Select instrument to be deployed at all sites

Field Campaign

- IRSI Intercomparison Study conducted at SGP Guest Instrument Facility from August 28 to October 5, 2007
- Provided operational testing and evaluation period to verify reliability and performance of the systems
- Allowed comparison of cloud fraction and cloud height data with Total Sky Imager (TSI) and Ceilometer (VCEIL) measurements and Longwave Flux Analysis (LWFLUX) and Active Remotely-Sensed Cloud Locations (ARSCL) value-added product retrievals

Instrument Specifications

	Detector	Wavelength range (μm)	Field of view (°)	Min. time resolution (sec)	Min. temp. detected (C)	Image resolution (pixel)
ASTIC	Ferro-electric	8 – 14	180	30	- 30	320 x 240
ASIVA	Micro-bolometer	8 - 13	150	5	- 80	320 x 240
Nubiscope	Pyro-electric	8 - 14	140	600	-100	-
CIR-4	?	9 - 14	31	3	- 60	-

Instruments

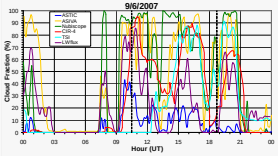
- Blue Sky Imaging All Sky Thermal Infrared Camera (ASTIC)
  - Provides hemispheric sky images and cloud fraction at four fields-of-view

- Solmirus All Sky Infrared Visible Analyzer (ASIVA)
  - Provides sky images, cloud percent, cloud/sky temperature, sky opacity, and water vapor determination

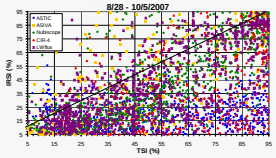
- Heitronics Nubiscope
  - Provides cloud percent, cloud/sky temperature, cloud height, sky condition, and hemispheric cloud cover representation

- Atmos Cloud Infrared Radiometer (CIR-4)
  - Provides cloud percent, cloud/sky temperature, and cloud height

Cloud Fraction Comparison

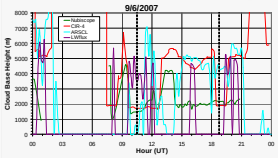


Time series of 10-minute average cloud fraction in % at SGP on 9/6/2007 from IRSIs, TSI, and LWflux.

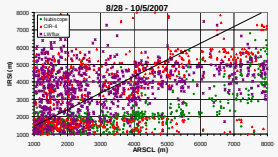


Scatter-plot of 10-minute average cloud fraction in percent at SGP from 8/28 to 10/5/2007 from IRSIs and LWflux vs. TSI.

Cloud Height Comparison



Time series of 10-minute average cloud-base height in meters at SGP on 9/6/2007 from IRSIs, ARSCL, and LWflux.



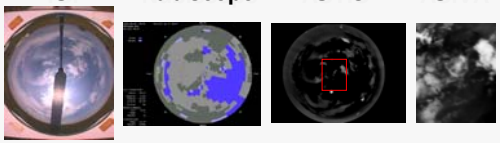
Scatter-plot of 10-minute average cloud-base height in meters at SGP from 8/28 to 10/5/2007 from IRSIs and LWflux vs. ARSCL.

Summary

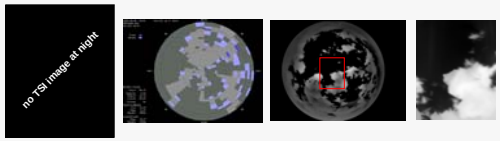
- Daytime images from ASTIC and ASIVA compare well with the TSI
- Cloud fraction data underestimate TSI values
- Nubiscope provides best comparison but has poor time-resolution
- Cloud height data from all IRSIs provide poor estimates compared to ARSCL
- Additional instrument comparisons may be required for selection process

Sky Image Comparison

TSI | Nubiscope | ASTIC | ASIVA



Daytime, 9/6/2007 13:41 CDT



Nighttime, 9/6/2007 05:32 CDT

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Reference

Genkova, I., C. Long, T. Besnard, and D. Gillotay. 2004. "Assessing Cloud Spatial and Vertical Distribution with Infrared Cloud Analyzer." In *Proceedings of the Fourteenth ARM Science Team Meeting*, U.S. Department of Energy, Washington, D.C.

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