

# Deployment of an Infrared Thermometer Network at the ARM Southern Great Plains Climate Research Facility

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## Introduction

To increase our ability to study the cloud and radiative variability across the Global Climate Model scale area and to infer information about vertical distribution and character of cloudiness across the Southern Great Plains (SGP) domain, downwelling Infrared Thermometers (IRT) were installed at the SGP Extended Facilities (EF). The sky brightness temperature measurements are sampled at a rate of 5 Hz to capture the inherent variability under cloudy and partly cloudy conditions.

## Objectives

- Apply conditional sampling of 5 Hz data
- Determine clear-sky and opaque cloud layers
- Estimate cloud radiating temperature
- Estimate cloud radiating surface height
- Infer longwave effective sky cover

Conditional Sampling Histogram



Cloud Layer Determination



## System Configuration

- Data acquisition
  - 1-minute means are ineffective for many conditions
  - Employs 5 Hz sampling strategy for clear/opaque cloud detection using conditional analysis
  - Includes IRT internal temperature from serial output
  - Uses C code and existing Extended Facility PCs
- Contamination resistant enclosure
  - EFs visited only once every 2 weeks
  - Developed enclosed positive airflow system to prevent contamination of IRT lens and gold mirror

## Testing

- Prior to deployment, fourteen new IRTs were inter-compared with AERI



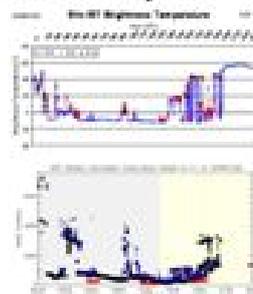
## Deployment

- New installations at eleven Extended Facilities in August 2005
- Existing IRT replaced at Central Facility in January 2006
- Additional installations at remaining EFs in FY2007



## Cloud Temperature Detection

- Conditional sampling detects clear-sky and opaque cloud data
- Detects temperature of three cloud layers
- Enhances existing surface and satellite cloud measurements
- Increases possibility of calculating broadband heating rate profiles at EFs



## Summary

- Twelve extended-range IRTs now deployed across SGP domain
- Methodology developed to account for the intervening atmosphere below cloud to infer cloud effective brightness temperatures
- High-speed serial data acquisition program, data ingest, and post processing codes developed
- Operational enclosure developed for preventing contamination of gold mirror

## Infrared Thermometer

- Provides measurements of equivalent blackbody brightness temperature of sky and cloud
- Instrument: Heitronics KT19.85II Infrared Radiation Pyrometer
- Spectral response: 9.8 to 11.5  $\mu\text{m}$
- Temperature measuring range: 173 to 473 K
- Temperature resolution (emissivity=1, response time=0.1 s):  $\pm 1.85$  K at 223 K
- Accuracy:  $\pm 0.5$  K
- Optical field of view ( $f=120$  mm):  $2.64^\circ$
- Sample rate: 5 Hz
- Operational temperature range:  $-20^\circ$  to  $60^\circ\text{C}$
- Archived datastreams: int, int200ms

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## References:

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