

Preliminary Results from the Prototype Thin-Cloud Rotating Shadowband Radiometer

BNL

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Scientific Justification

Thin clouds are prevalent while accuracies for liquid water path (LWP) drop effective radius (Reff) and cloud optical depth (COD) are low

- **At SGP 50% of clouds have LWP less than 100gm^{-2} , mode 40gm^{-2}**
- **current microwave radiometer LWP retrieval accuracy, $\pm 20\text{gm}^{-2}$ (Marchland et al., 2003)**

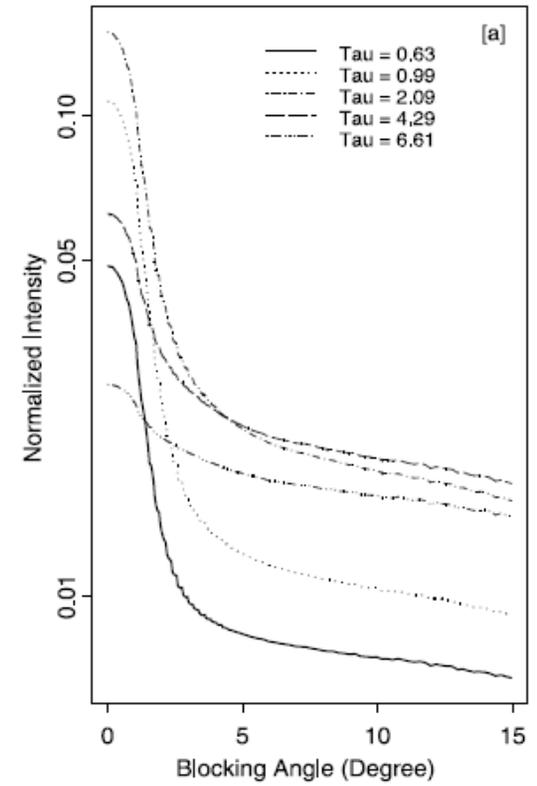
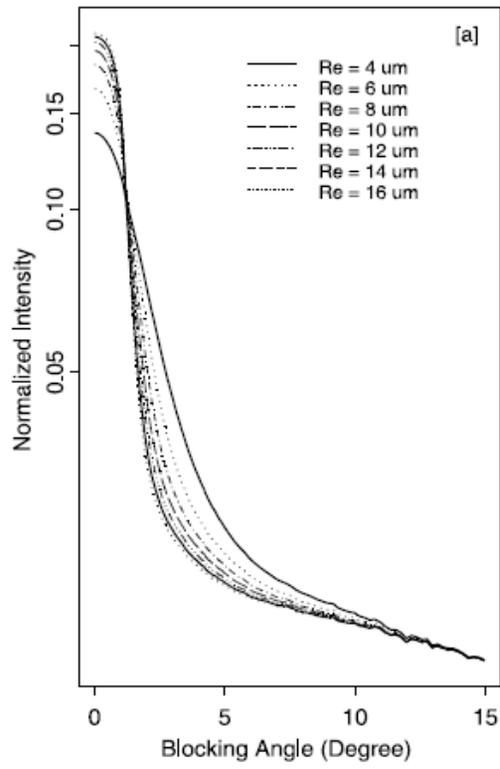
LWP uncertainty of 20gm^{-2} causes an error of greater than $100\text{W}/\text{m}^2$ in total hemispheric irradiance for an atmosphere with a 1 km thick cloud layer

(45 degree incidence angle) with 40gm^{-2} (Min and Duan, 2005)

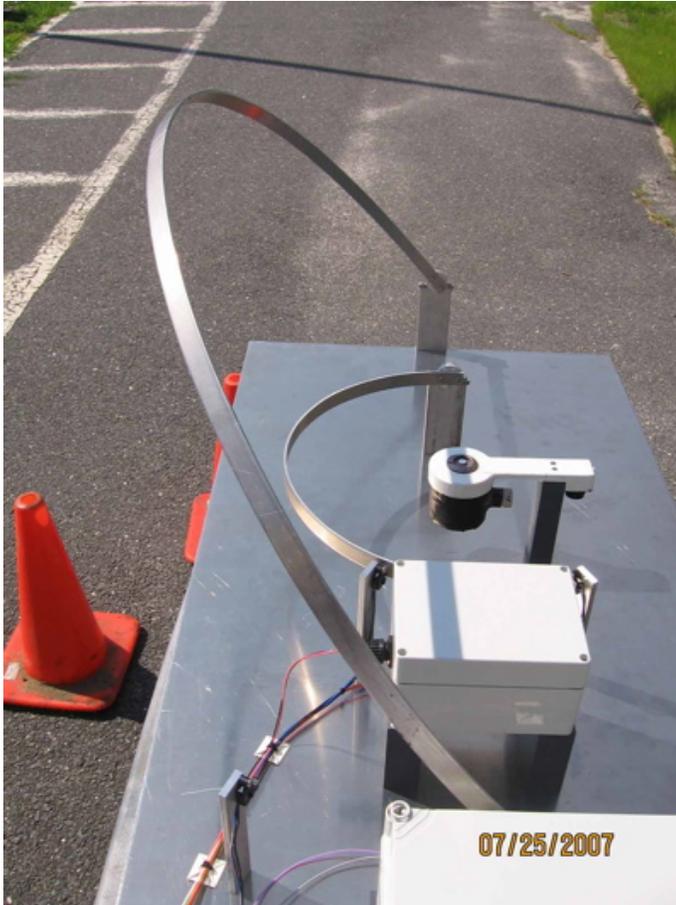
Observations of solar aureole may lead to simultaneous retrievals of LWP, Reff, and COD with the following expected accuracies

LWP, 2gm^{-2} Reff, 10% & COD, 2%

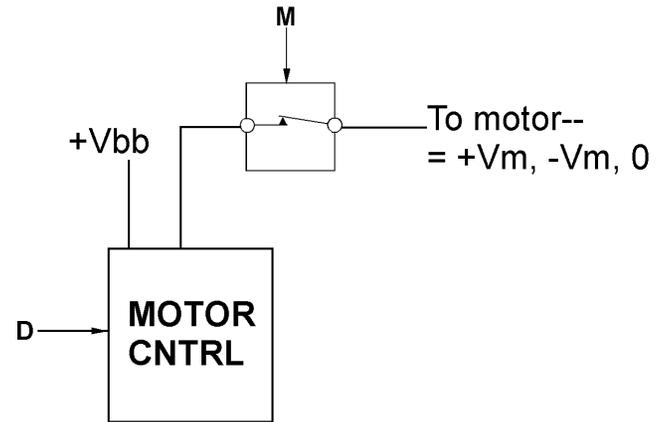
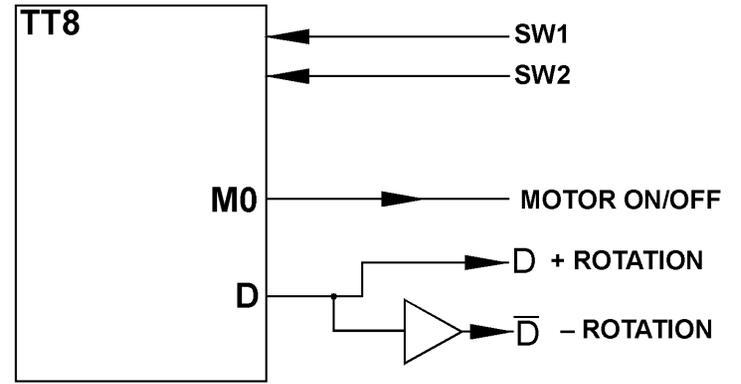
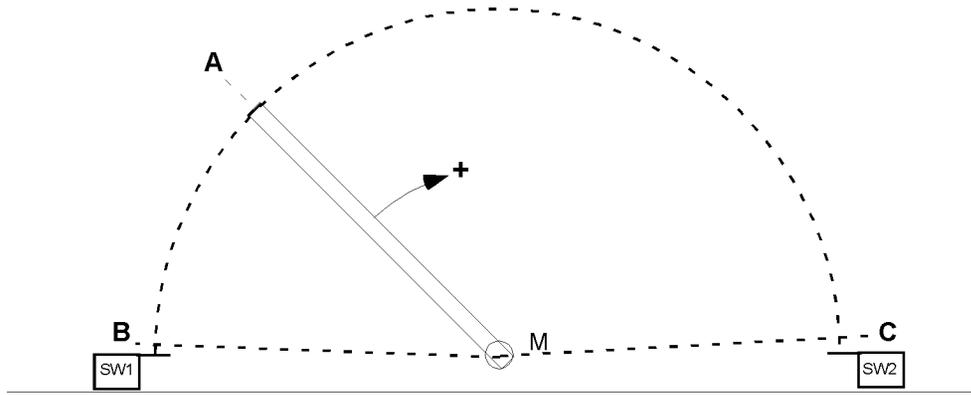
(Min and Duan, 2005)

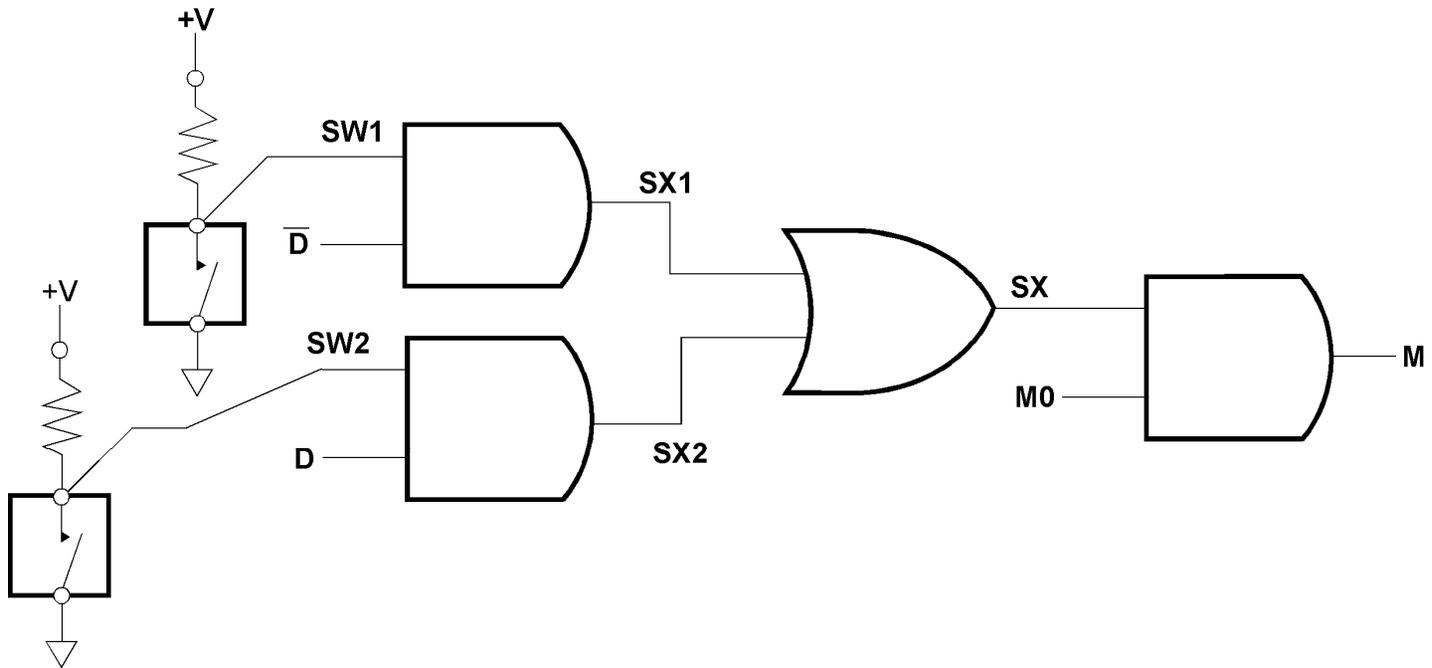
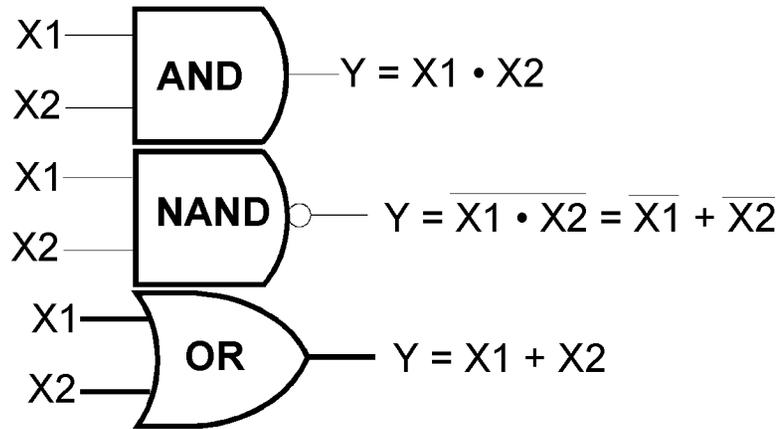


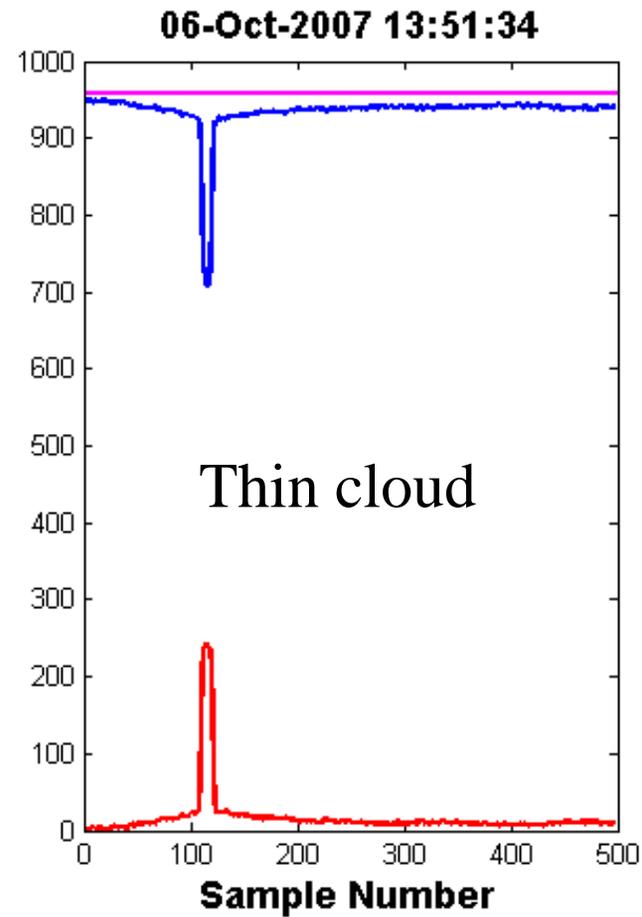
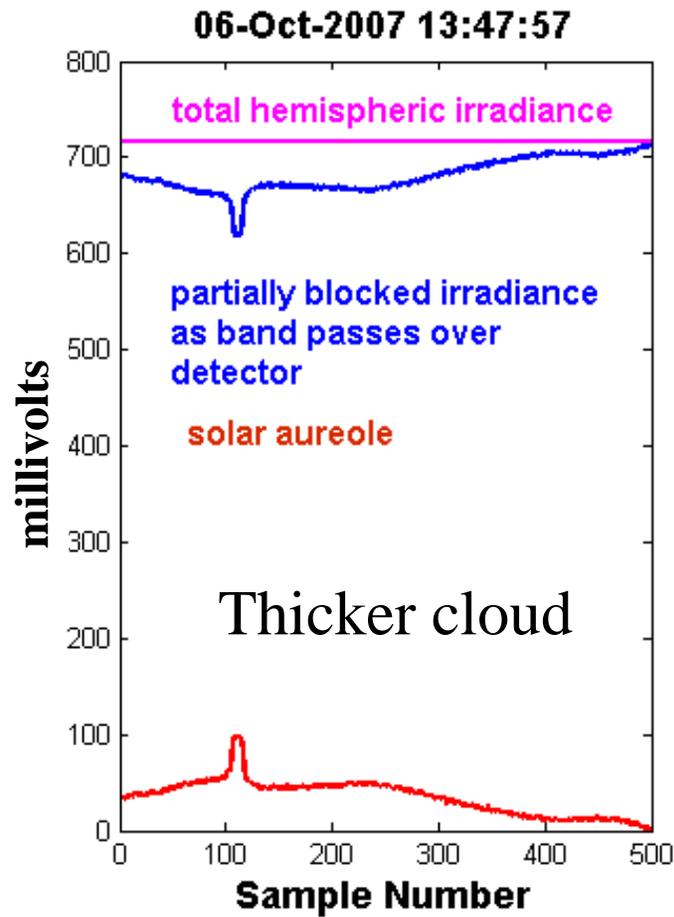
After Min and Duan, 2005



- Right at BNL
 - Above at SGP on roof of radiometer calibration facility
- Note small and large bands

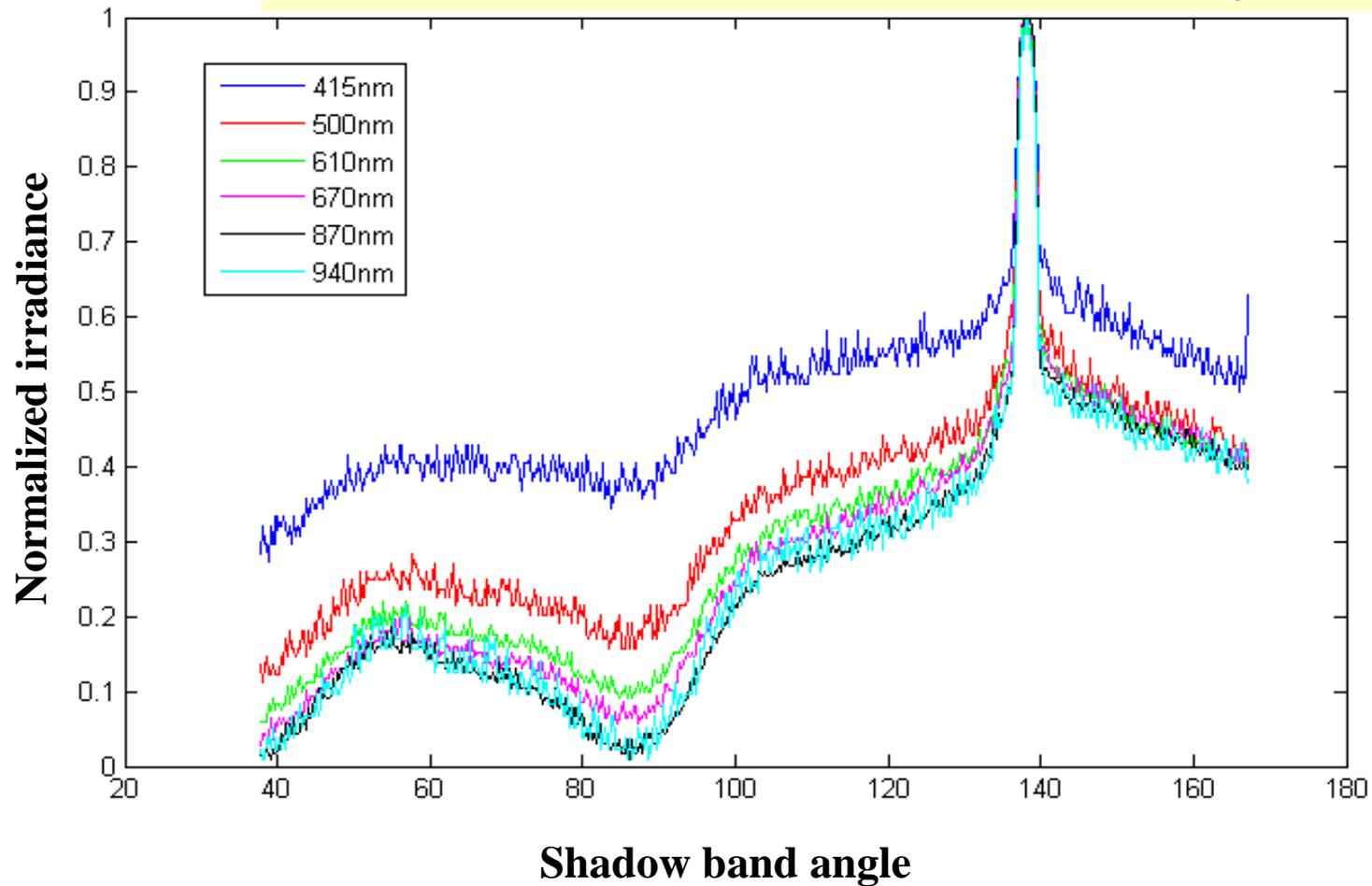






$$\text{Solar Aureole} = \text{Total Hemispheric Irradiance} - \text{Observed Partially Occulted Irradiance}$$

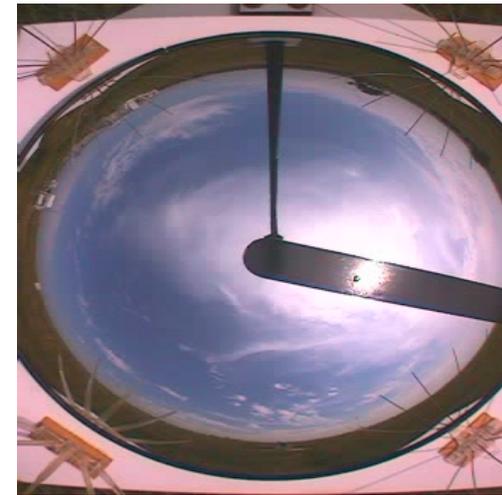
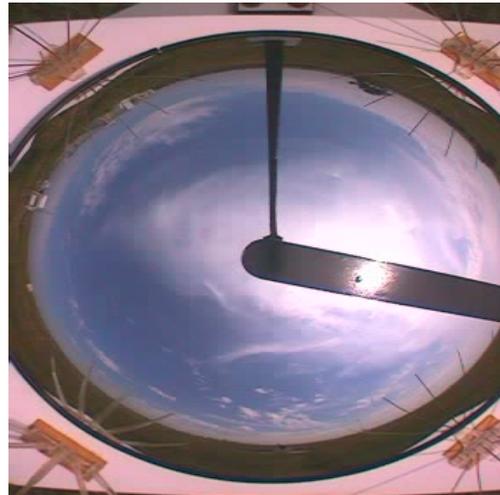
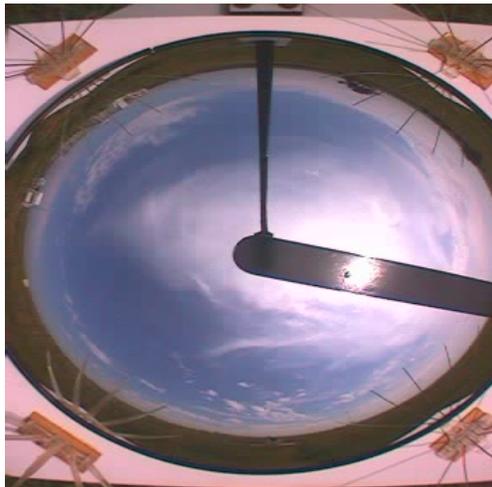
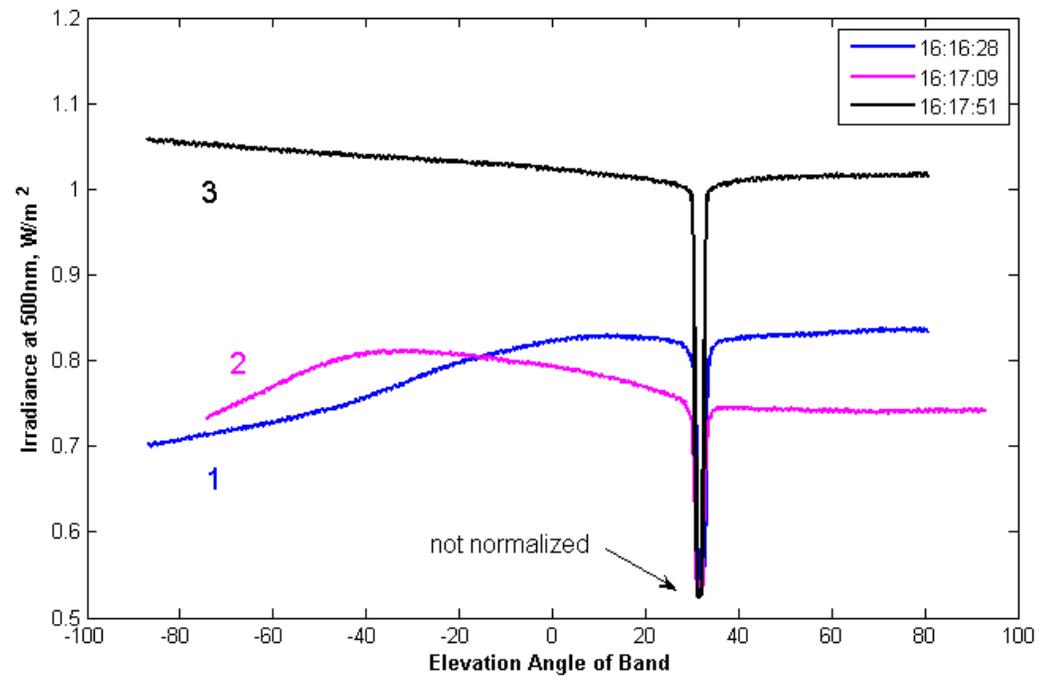
6 bands, 10nm wide, measured simultaneously



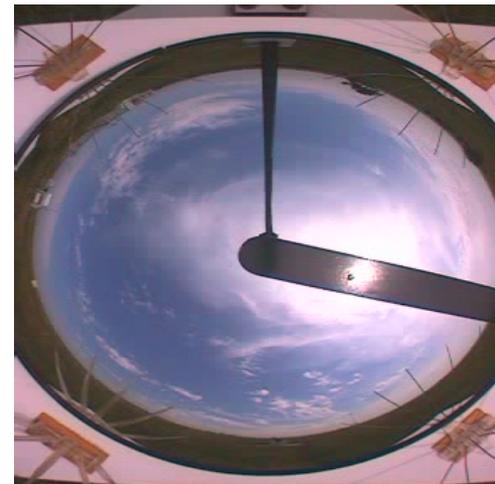
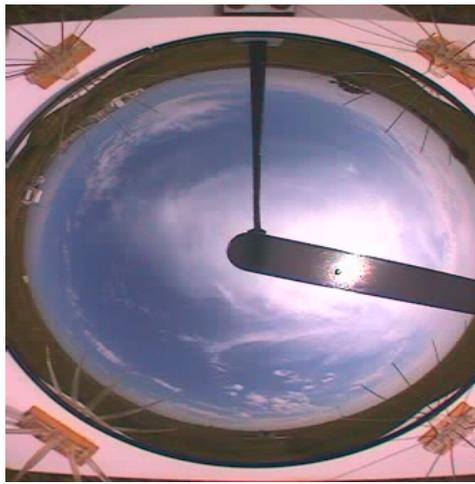
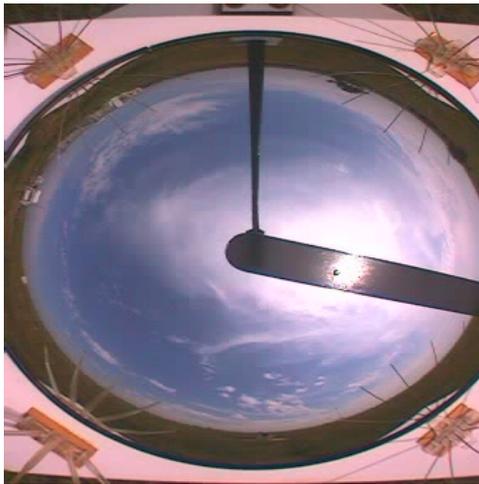
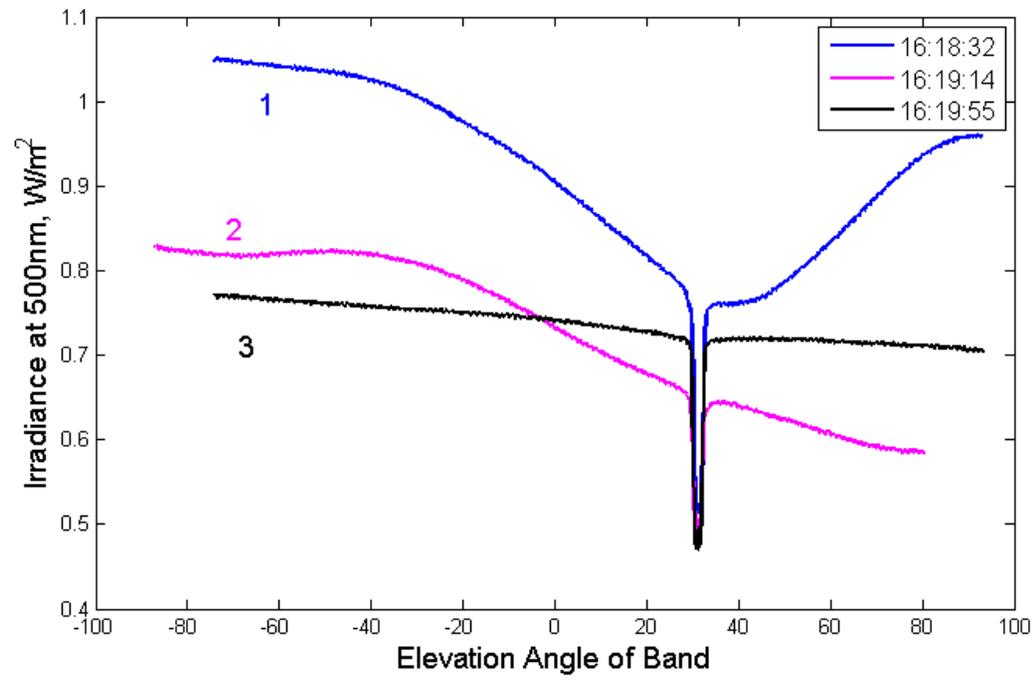
Status

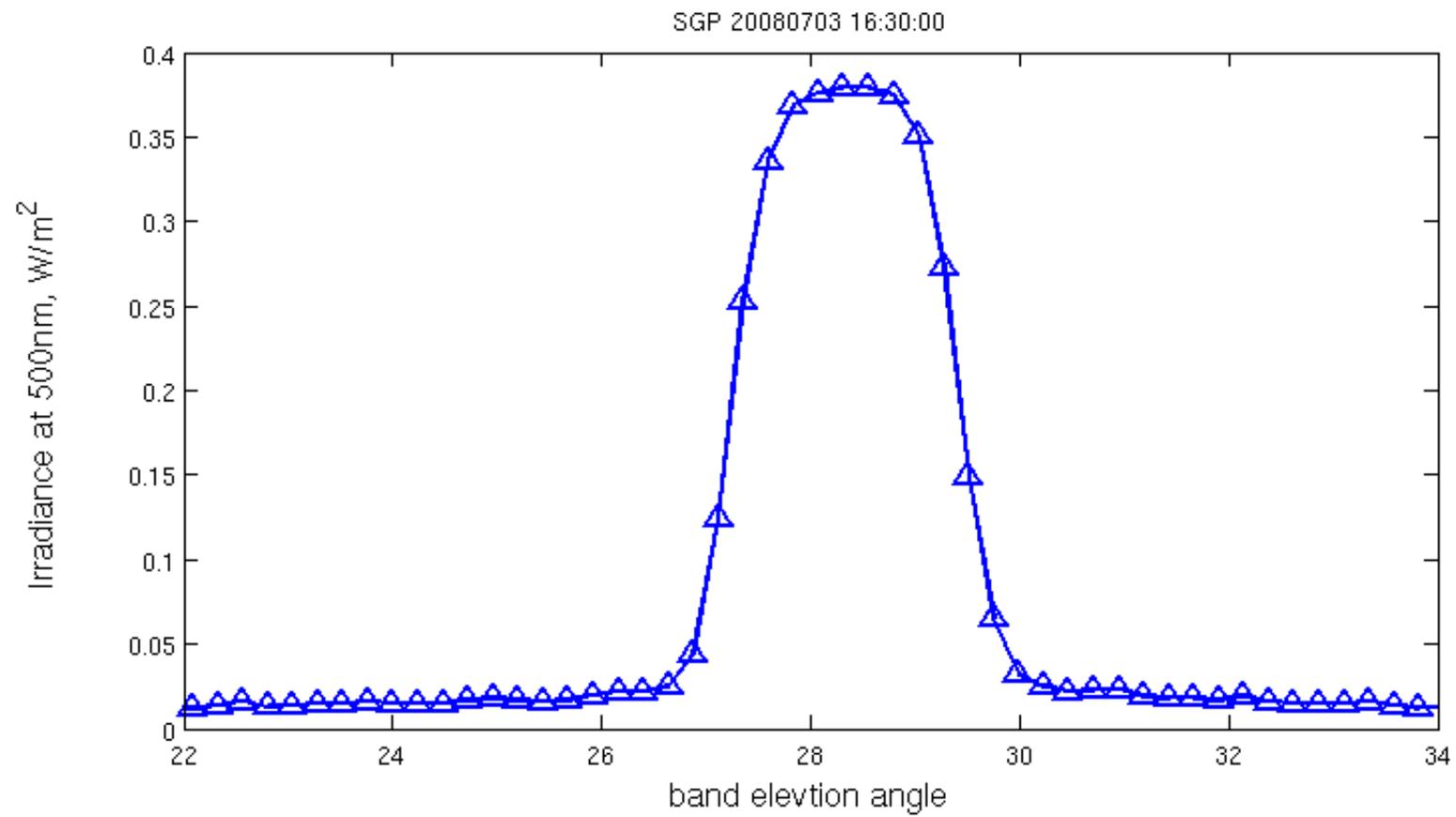
- Two trial periods at SGP
- January 7-9, 2008
 - Scans made with 500 samples per sweep
- July 3-7, 2008
 - Scans made with 700 samples per sweep
- Data processing complete
- Currently working on retrievals

SGP 20080703

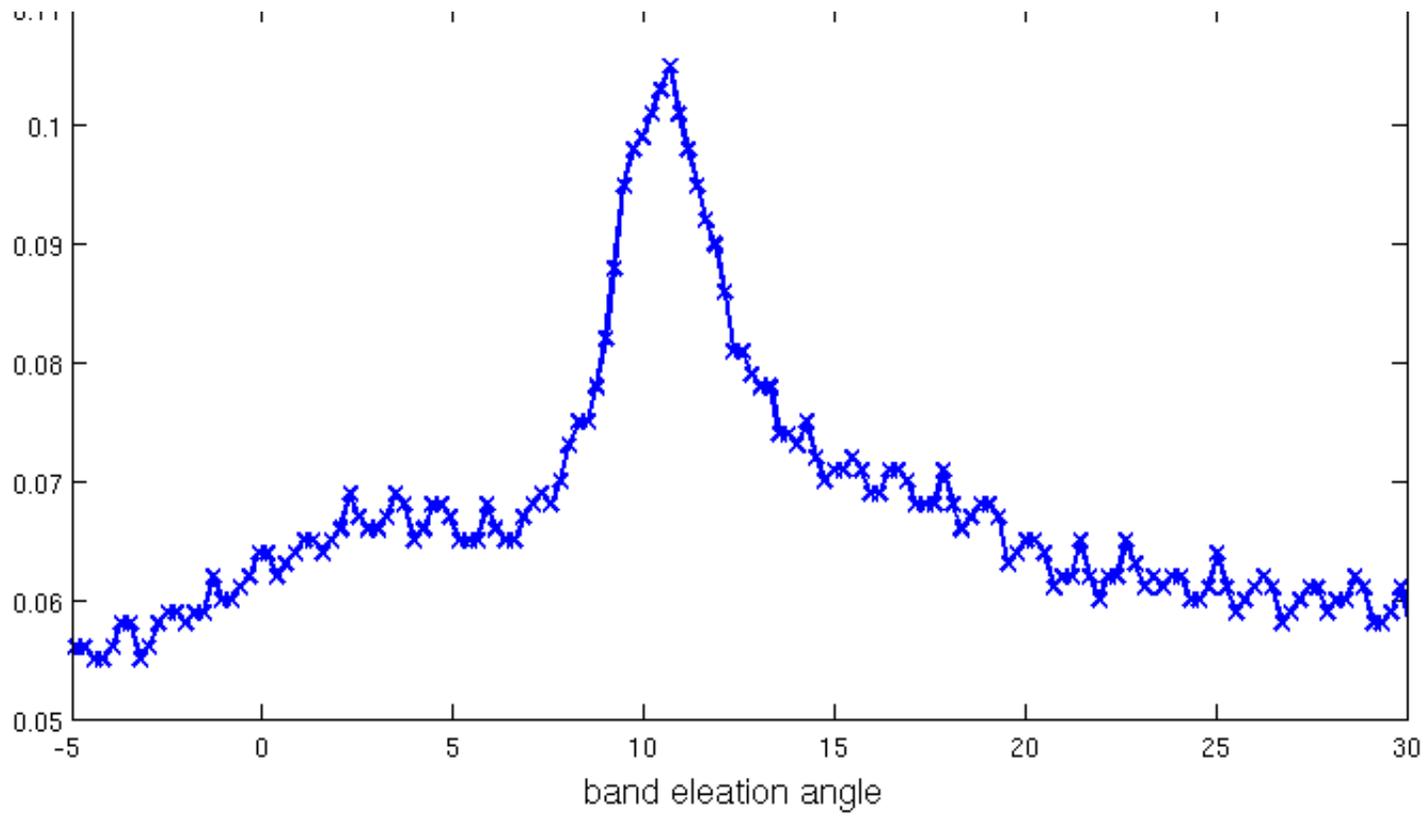


SGP 20080703





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Prototype Accomplishments

- * Mechanically sound at prototype level
 - * Software command and control
 - * Data Acquisition
 - * Data processing
- Photometric accuracy
- Obtain retrievals and validate results

Suggested Modifications

- Use a stronger, clutched motor system
- Use a more rigid band, curved rod?
- Install shaft encoders to better determine band positions
- Measure sweeps from horizon to horizon (currently limited to ~165 degrees)
- Measure total hemispheric irradiance at before and after each sweep
- Use Hall effect switches in place of contact limit switches
- Weatherproof the instrument