How can shortwave hyperspectral observations complement Phase II of MAGIC?

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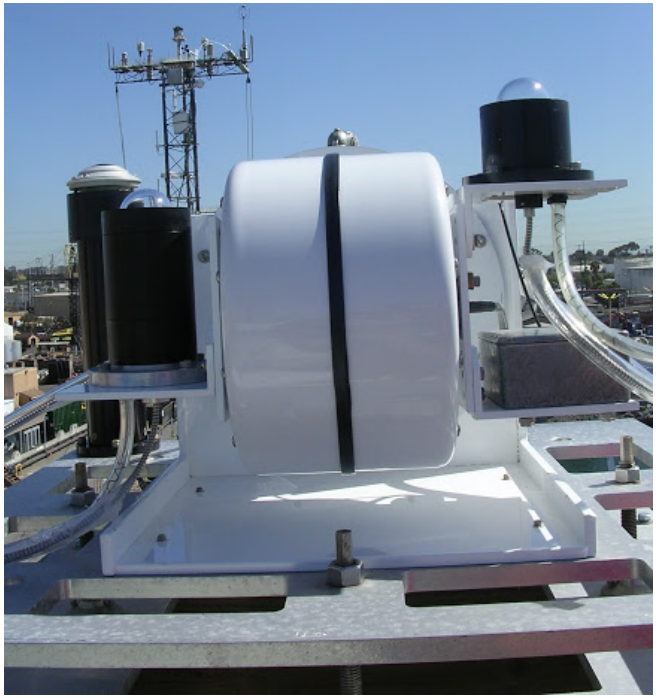
Instruments

- Shortwave Array Spectroradiometer-Zenith (SAS-Ze)

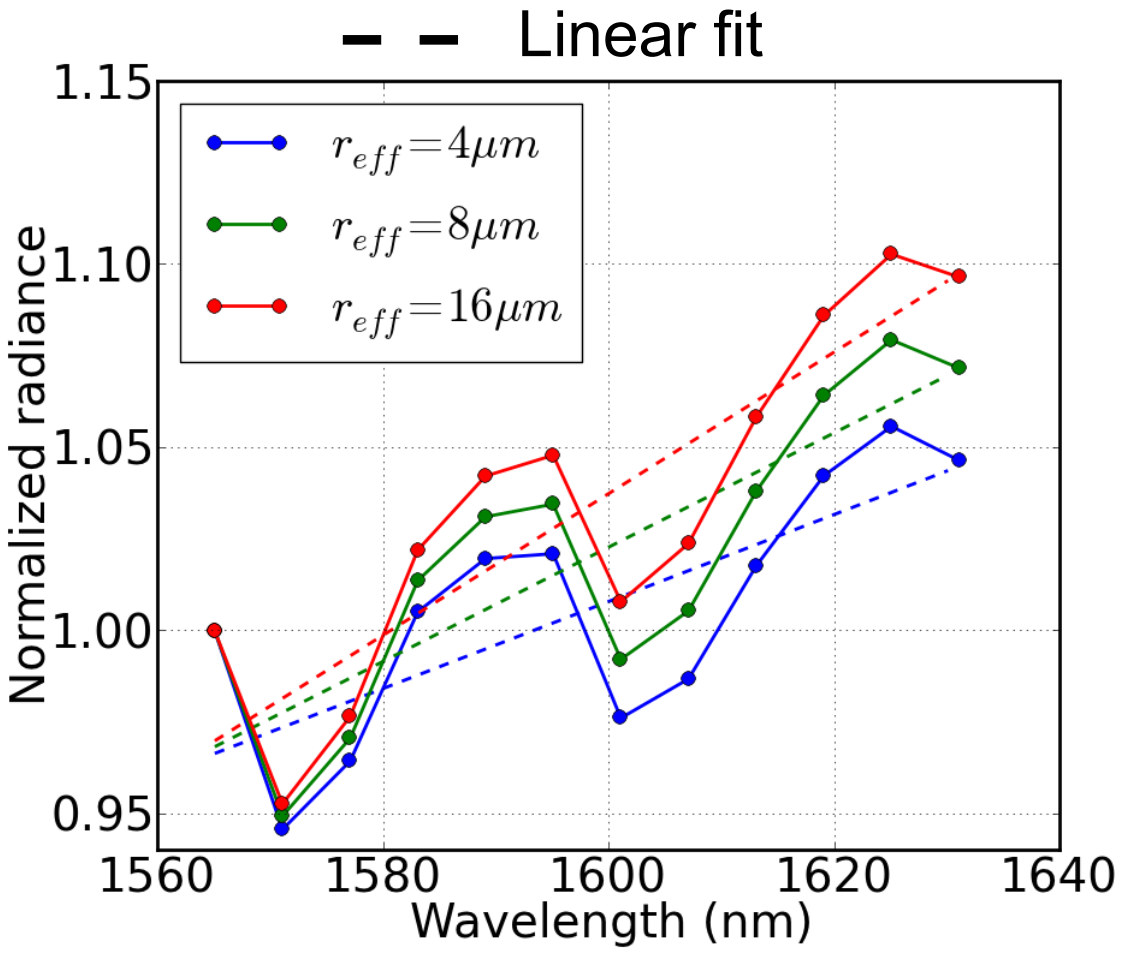
From ARM web site

- Solar Spectral Flux Radiometer (SSFR)



- Same family (NASA Ames) as the Shortwave Spectradiometer (SWS) at SGP
- Updated collimator in 2010 limiting FOV to 3^{o}
- Spectral range: 350 nm to 1700 nm
- Spectral resolution 8-12 nm
- Observations at 1 Hz

Cloud property retrievals

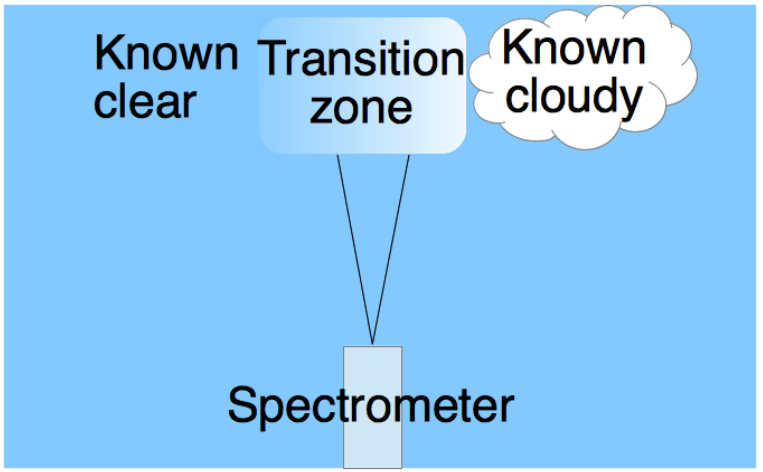


$$\text{Normalized radiance} = \frac{I\left(\lambda = 1565 \text{ nm to } 1634 \text{ nm}\right)}{I\left(\lambda = 1565 \text{ nm}\right)}$$

- Retrievals of **cloud optical thickness and effective radius**
- Effects of instrument uncertainty are reduced with the use a ratio

McBride et al. 2011, ACP

Characterizing the cloud transition zone



$$\frac{I_\lambda(t_{\text{transition\_zone}})}{I_\lambda(t_{\text{known\_clear}})} = \frac{I_\lambda(t_{\text{known\_cloudy}})}{I_\lambda(t_{\text{known\_clear}})} m + b$$

1) Can provide *qualitative* information about the cloud particles in the transition zone (with ~70% confidence)

2) Work continues on what we can say quantitatively

Marshak et al. 2009, GRL; Chiu et al. 2009, ACP

Aerosol property retrieval

Iterative approach to retrieve spectral aerosol optical thickness, single scattering albedo, and asymmetry parameter

Inputs

- Spectral zenith radiance observations
- Independent retrieval of optical thickness (AOT)

Spectral observations extend the spectral range of aerosol properties

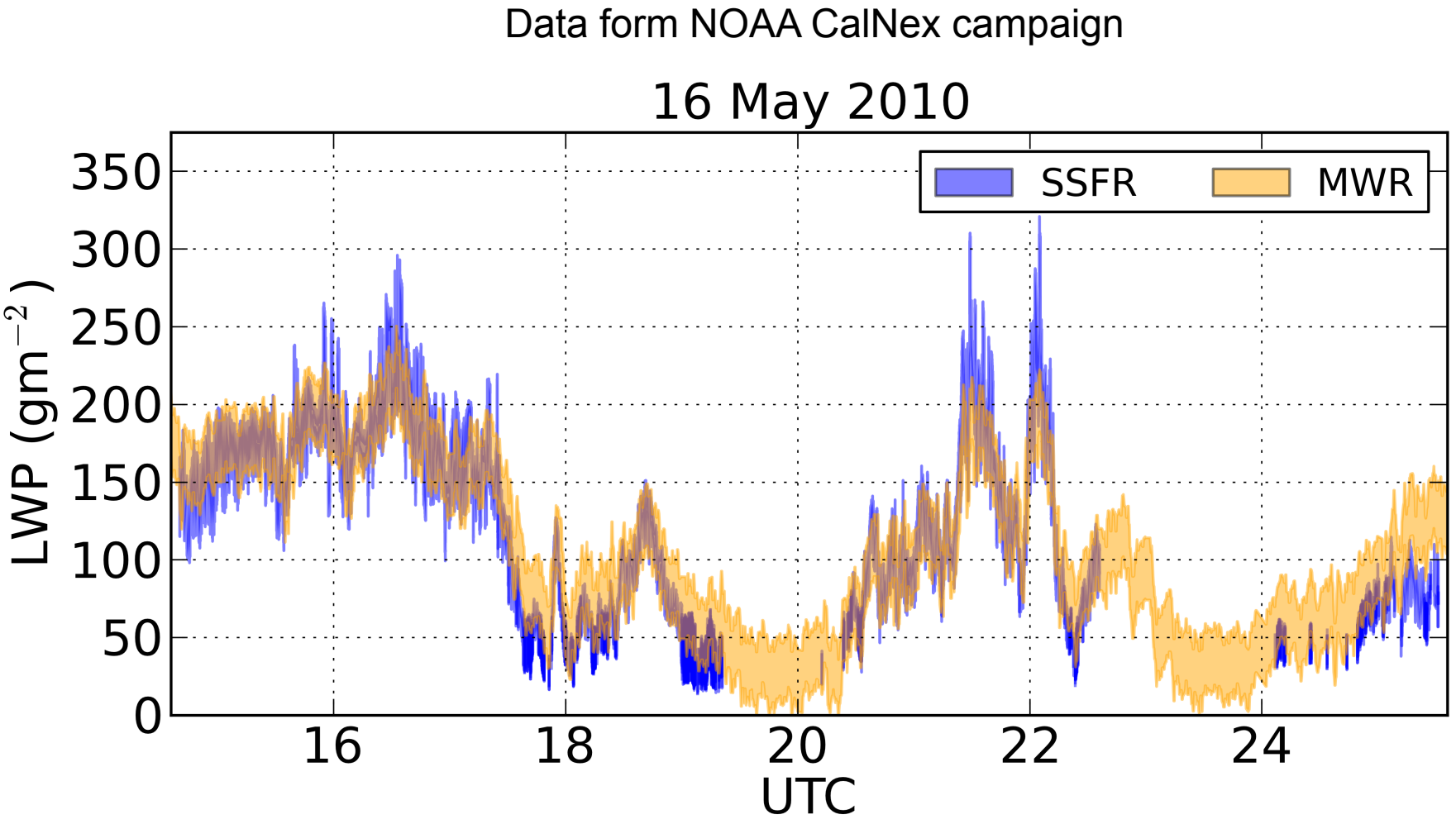
Schmidt et al. 2009, GRL; Kassianov et al. 2011, GRL

Conclusions

- Cloud optical thickness and effective particle radius will be retrieved
- Developing a method to characterize air near cloud edge
- Developing a method to retrieve aerosol property information across spectral range 350 nm to 1700 nm
- Validation – e.g. other cloud retrievals, other instruments

The end

LWP Comparison



$$SSFR\ LWP = \frac{2}{3}\tau\, r_{eff}$$

Transmittance-based cloud retrieval