VISIDYNE

Introducing SAM (Sun and Aureole Measurement), a New, Ground-based Capability for Measuring Cloud Optical Properties

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1. Sun Tracker Advantages

- **More dynamic range for measuring OD**
- **No assumptions about the scatterers**
- **Not affected by the ground albedo**

Cirrus (Ice Columns)
Solar elevation = 45 deg
Sat depression = 45 deg
Surface albedo = 0.2

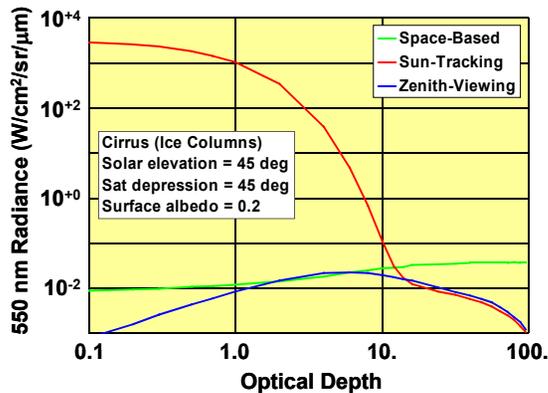Legend: Space-Based, Sun-Tracking, Zenith-Viewing

Figure 1. Model calculations of radiance versus cloud OD.

2. SAM (Sun and Aureole Measurement)

- **Similar in function to a solar coronograph**
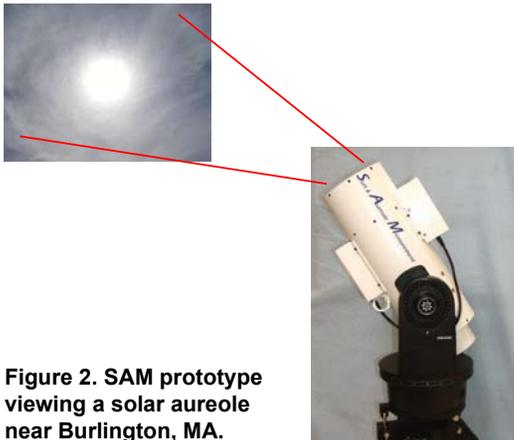- **Measures radiance in an ~ 16 deg cone**

Figure 2. SAM prototype viewing a solar aureole near Burlington, MA.

3. Example Dataset

- **Note large dynamic range**
- **OD ~ 1.3 (uncorrected)**
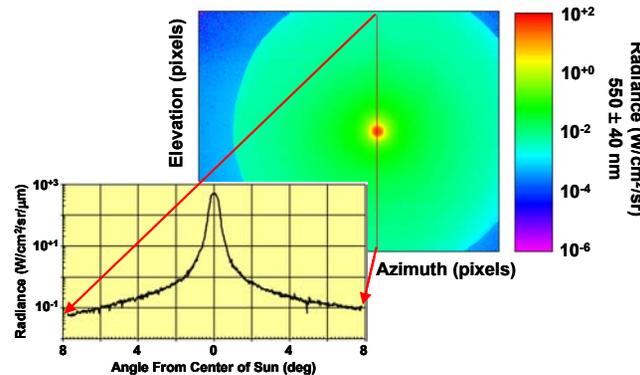- **Corresponds to picture in Figure 2**

Figure 3. SAM radiance profile for the aureole in Figure 2.

4. Model Matching

- **Data profile is consistent with cirriform particles**
- **OD is underestimated without forward scattering**

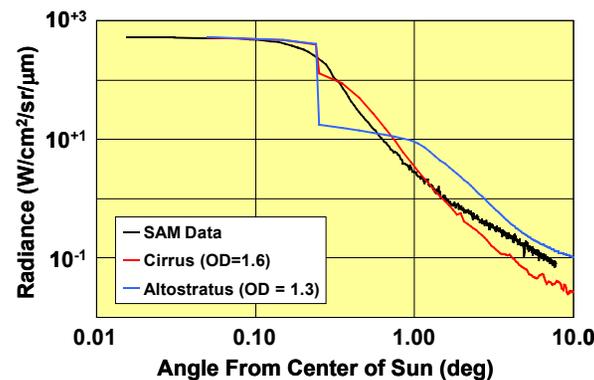Legend: SAM Data, Cirrus (OD=1.6), Altostratus (OD = 1.3)

Figure 4. Comparison of model calculations with SAM data.

Conclusion – SAM Applications

- **Satellite cloud algorithm calibration/validation**
- **Complementing AERONET**
  - **For extending and detecting thin cirrus**
- **Climate modeling**
- **Cloud physics research**

5. Particle Size Distribution

- **Diffraction model (analytic solution)**
- **Power-law model agrees with diffraction model**

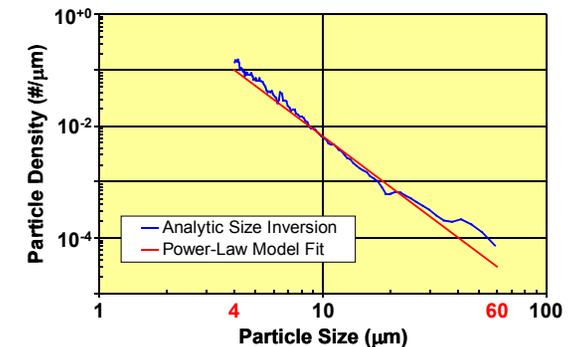Legend: Analytic Size Inversion, Power-Law Model Fit

Figure 5. Comparison of analytic and model size spectra.

References

Auer, A.H. and D.L. Veal, 1970, "The Dimension of Ice Crystals in Natural Clouds", *J. Atmos. Sci.*, *27* (9), pgs 919-926. (Shape)

Heymsfield, A.J. and C.M.R. Platt, 1984, "A Parameterization of the Particle Size Spectrum of Ice Clouds in Terms of the Ambient Temperature and the Ice Water Content", *J. Atmos. Sci., 41*, pgs 846-855. (Cirrus size distribution)

Liou, K.N., 1992, *Radiation and Cloud Processes in the Atmosphere, Theory, Observation, and Modeling*, Oxford University Press, New York. (Altostratus size distribution)

Macke, A., 1993, "Scattering of Light by Polyhedral Ice Crystals", *Applied Optics, 32* (5), pgs 2780-2788. (Phase function code)