



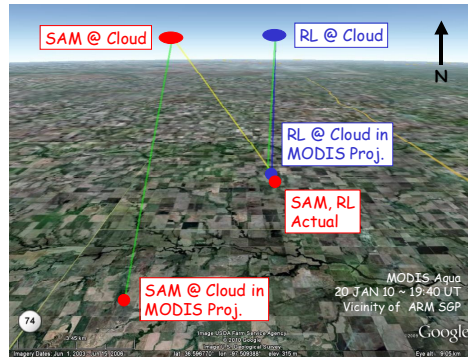
# Using Sun and Aureole Measurements (SAM) to Check MODIS COD and $R_{eff}$ Retrievals for Cirrus

J.G. DeVore, A.T. Stair, A.J. LePage, D. Villanucci, ...



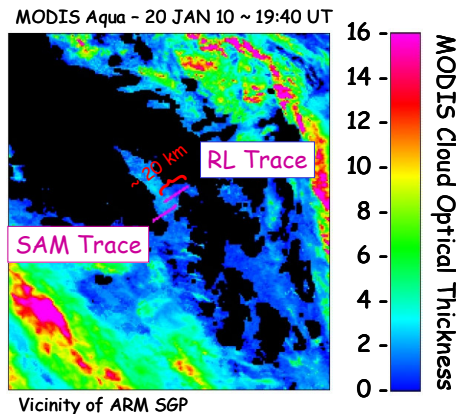
## (1) Introduction

Cirrus is important for climate but its effects are poorly understood in part because in-situ measurement is difficult. Sun and Aureole Measurement with Visidyne's SAM instrument<sup>1</sup> provides a new validation tool for MODIS cloud property retrievals<sup>2</sup>.



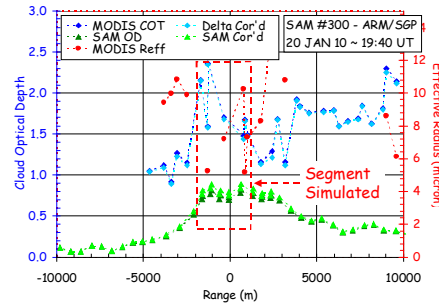
## (2) 20 JAN 10 ~ 19:40 UT

Consider the MODIS-Aqua cloud retrieval over the ARM SGP site near SAM and the Raman Lidar (RL). To compare with MODIS "image" measurements we extend the ground-based "point" time series measurements using the wind (from NCEP) at cloud height (from RL) assuming advection dominates evolution over short periods of time.



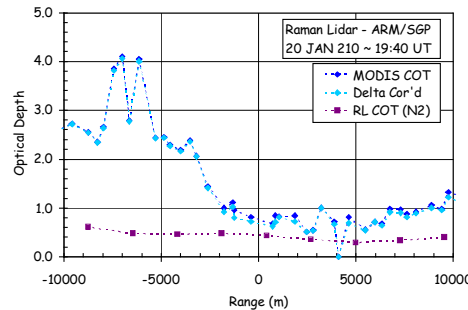
## (3) SAM-MODIS Comparison

Along the advection trace SAM OD (Optical Depth) and MOD06 Collection 5 COT (Cloud Optical Thickness) retrievals show significant differences. SAM corrections for forward scattering and MOD06 corrections for "delta photons" are small for small particles.



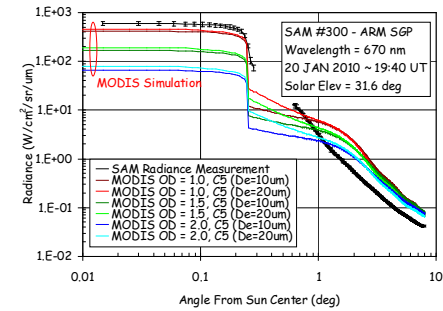
## (4) RL-MODIS Comparison

Comparison of RL  $N_2$  backscatter  $COT^3$  and MOD06 COT shows similar differences with the latter being significantly higher.



## (5) SAM-MODIS Closure

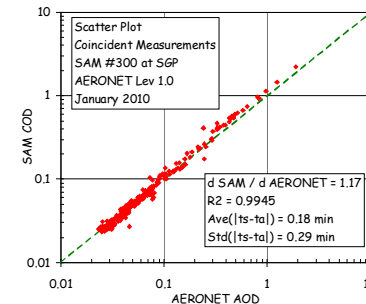
Another way to check MOD06 retrievals is to compare them with SAM radiance measurements. We did this using Monte Carlo scattering calculations over the range of MOD06 COT values from 1.0 to 2.0 using Yang-Baum phase functions selected based on the retrieved  $R_{eff}$  values.



MOD06 COT values underpredict the SAM solar disk radiance measurements. Moreover, differences in the aureole radiance profiles below  $\sim 2.5^\circ$  indicates that scattering is more forward directed than MOD06 predicts.

## (6) SAM-AERONET Comparison

SAM solar disk radiance values compare well with CSPHOT (AERONET) values as seen in OD data for the month of January.



As OD increases, SAM values tend to be slightly larger (fit slope = 1.17) as expected since its effective field of view (half angle) is  $0.25^\circ$  compared with  $0.6^\circ$  for CSPHOT.

## (7) Conclusion

SAM is a new Cal/Val technique. The authors suggest:

- Independent analysis
- Yang and Baum are roughening crystal surfaces for MODIS phase functions
- Develop SAM OD correction
  - Using aureole measurements
  - Verify and validate with RL