Aerosol and Water Vapor Variability Near Clouds Measured by the Upgraded SGP Raman Lidar

Richard Ferrare[1], David Turner[2], Marian Clayton[3], Rob Newsom[4], Chitra Sivaraman[4]

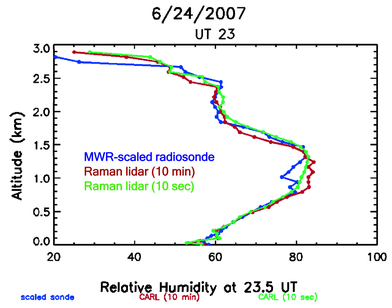
[1]NASA Langley Research Center [2]University of Wisconsin-Madison [3]Science Systems and Applications, Inc. [4]Pacific Northwest National Laboratory

INTRODUCTION:

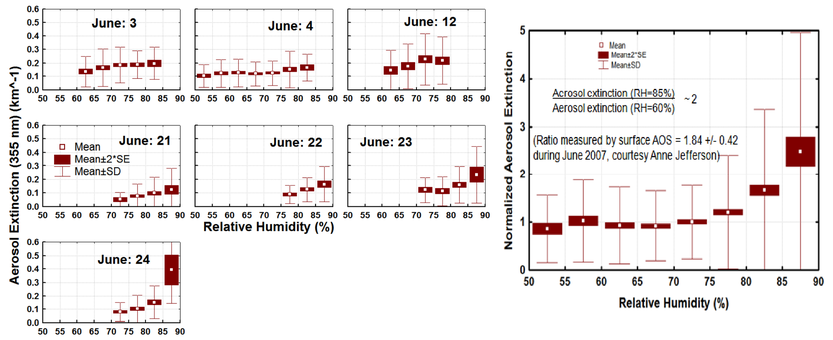
The ARM Climate Research Facility (CRF) Raman lidar (CARL) measures profiles of aerosols, clouds and water vapor in the low to mid troposphere throughout the diurnal cycle over the ARM Southern Great Plains. With these data we can investigate the behavior of aerosol backscattering and extinction and their correlation with water vapor and relative humidity.

CARL UPGRADES:

Upgrades to CARL performed in 2004, including a new boresight alignment system and modifications to the raw signal-processing software, permit a much more detailed view of the variability of aerosols and water vapor near clouds or near the top of the Planetary Boundary Layer (PBL). CARL can now provide 10 second profiles of aerosol backscattering, water vapor mixing ratio, and relative humidity, and 1 minute profiles of aerosol extinction in the PBL.



CARL measurements of aerosol hygroscopicity during CLASIC/CHAPS mission, June 2007



- Increases in aerosol extinction and backscatter with increasing RH were commonly observed by Raman lidar
- Average aerosol humidification factor [f(RH)] derived from Raman lidar is slightly higher but consistent with surface AOS measurements

Summary

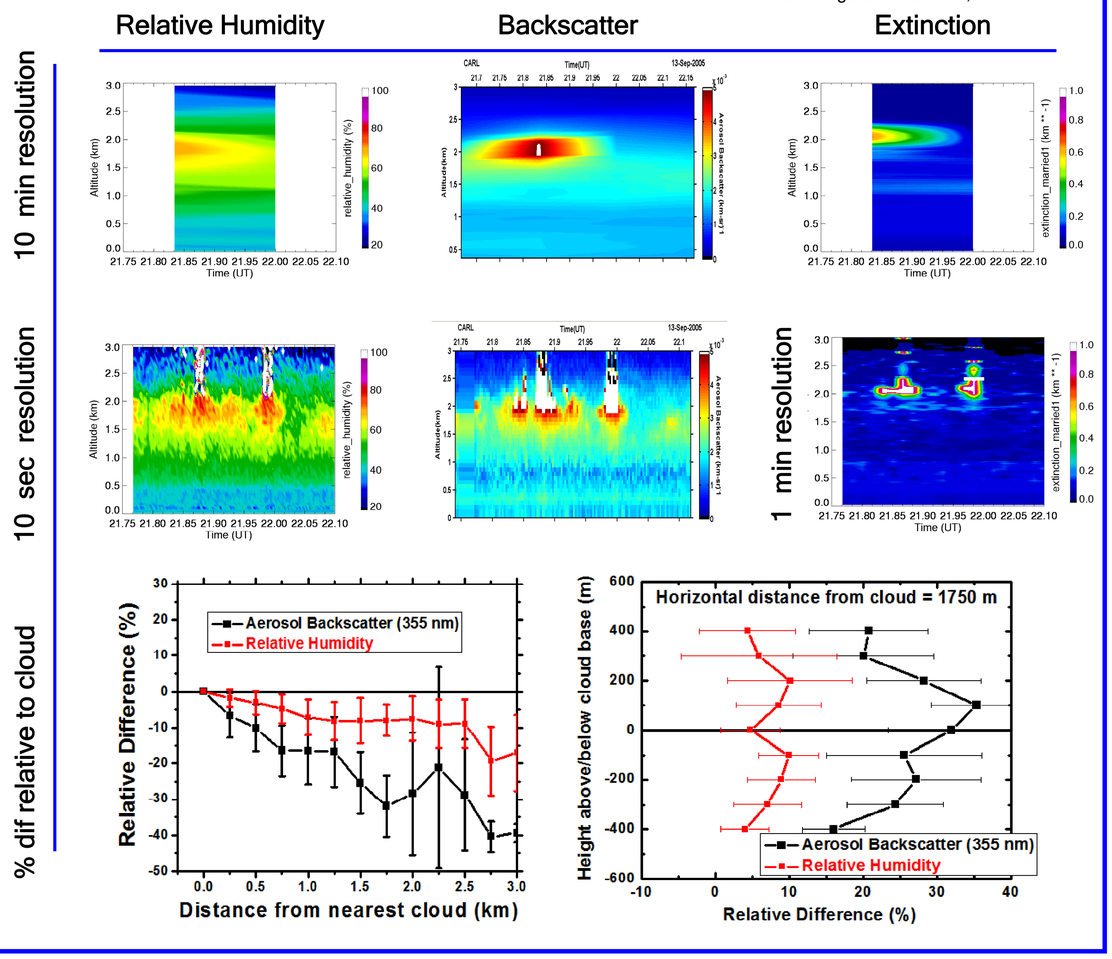
- As distance from cloud increases, significant (25-40%) decrease in aerosol backscattering within a few kilometers from the cloud
- Relative humidity also decreases 5-15% within a few kilometers from cloud
- Variations are confined to altitudes within a few hundred meters from cloud base

Acknowledgements

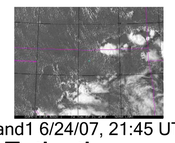
We thank Chris Martin, SGP site operations, for his hard work in keeping the Raman lidar operating; John Goldsmith for his help in modifying and upgrading the lidar, and the DOE ARM program for supporting the Raman lidar operations and this research.

CARL water vapor and aerosol data during ALIVE mission, September 13, 2005.

TSI cloud image on 9/13/2005, 21:56:30 UT



CARL water vapor and aerosol data during CLASIC mission, June 12, 2007.



GOES-8, band1 6/24/07, 21:45 UT