Retrieving Liquid Water Content Profiles Using ARM Dual-frequency Cloud Radars

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INTRODUCTION

Progress has been made characterizing cloud liquid water path using microwave radiometry and infrared interferometry but less progress has been made characterizing cloud liquid water content. Differential attenuation techniques have been used in the past to infer cloud liquid water content but large errors can arise from precision of the reflectivity measurements.

OBJECTIVE

Retrieve accurate cloud LWCs of boundary-layer stratus and stratocumulus via an improved dual-frequency attenuation approach using data from four ARM Program facilities.

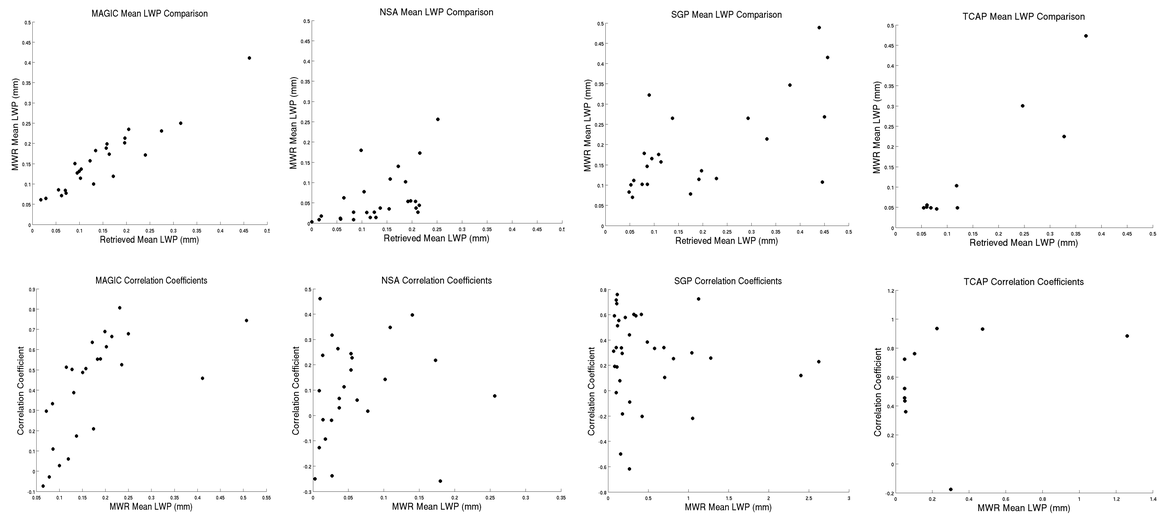
METHODOLOGY

- Interpolate Ka-band and W-band data to same time and space grid (a. panels)
- Use reflectivity differences (dfr) (b. panels) to estimate attenuation due to liquid water
- Use total regularization techniques to decrease error sensitivity due to radar noise in liquid water content retrievals (c. panels)
- Compare LWP retrievals with MWR (d. panels

SOURCES OF ERRORS/DIFFERENCES

- Precision of reflectivity measurements
- Overlap of sample volumes
  - Radar separation
  - Radar pointing differences
  - Radar range gate offsets
- Accuracy of radiosonde measurements
- Temperature dependent absorption coefficients of oxygen, water vapor, and liquid water
- Cloud drop-size assumption
- Precision of LWP measurements
- Beam-filling effects

MEAN LWP COMPARISONS AND CORRELATION COEFFICIENTS FOR ALL CASES



CONCLUSIONS

Differences arise between LWPs using this dual-frequency retrieval approach and a MWR. More work and analysis is on-going to fully understand reasons for these differences to correct for them

FUTURE WORK

Once accurate LWC measurements are achieved and corresponding retrieved LWPs are comparable to MWR LWPs, we will extend this approach to retrieve LWCs in multiple directions in support of radiative transfer studies.