

## Contributors

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## Research Highlight

A comprehensive characterization of all hydrometeors in the vertical column is an important task, which is crucial for model parameterization and validation purposes. For many years, the remote sensing efforts within the Atmospheric Radiation Measurement (ARM) Program were focused primarily on either non-precipitating or only weakly-precipitating (e.g., drizzling) cloud retrievals. The simultaneous retrievals of cloud and precipitating hydrometeor parameters of cloud systems producing significant rainfall are generally more challenging because radar reflectivity measurements are dominated by precipitation and optical instrument measurements do not penetrate far into precipitation.

The non-traditional attenuation-based approach that uses the ARM vertically pointing 8-mm cloud radar (MMCR) and the W-band (3 mm) cloud radar (WACR) allows separation of the liquid cloud (suspended small liquid droplets) and rainfall (precipitating large liquid drops) components even if they co-exist in the same volume. This approach is based on the spectral wavelength differences of 8-mm and 3-mm radiation attenuations due to small and large drops. The ice hydrometer parameters are retrieved based on the absolute MMCR measurements that are corrected for the combined attenuation effects in the liquid and mixed hydrometer layers using constraint measurements from the weather surface scanning precipitation radars operating at non-attenuating (or weakly attenuating) frequencies.

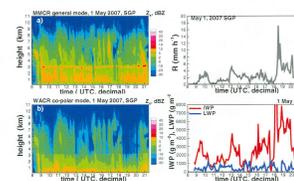
The current version of simultaneous retrievals of cloud and rainfall parameter is applicable to stratiform precipitating events when ground-based ARM radar measurements detect the bright band (i.e., the melting layer) thus offering a clear vertical separation among the liquid, mixed, and ice phase hydrometeors. Time series of the cloud liquid water path (LWP), ice water path (IWP), and the mean rainfall rate are retrieved for the vertical column above the SGP Central Facility. Rainfall estimates from the impact Joss-Waldvogel disdrometer (JWD), which is collocated with the ARM radars, are used to constrain retrievals and reduce the retrieval variability due to assumptions about drop size distributions.

Reference: Matrosov, SY. 2009. "A method to estimate vertically integrated amount of cloud ice and liquid and mean rain rate in stratiform precipitation from radar and auxiliary data." *Journal of Applied Meteorology and Climatology* in press (available on the AMS Early Online release web site: <http://ams.allenpress.com/EOR>).

## Reference(s)

## Working Group(s)

Cloud Properties



An example of MMCR (a) and WACR (b) ARM radar measurements of a stratiform precipitating event and the corresponding estimates of mean rain rate (c) and cloud IWP and LWP (d).