

Estimates of Cloud and Precipitation Parameters above the SGP site during spring-summer



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Objectives

To provide cloud and precipitation parameters retrieved simultaneously in a vertical column above the SGP site

To evaluate relations between cloud and rain water and also between cloud ice amount and precipitation intensity

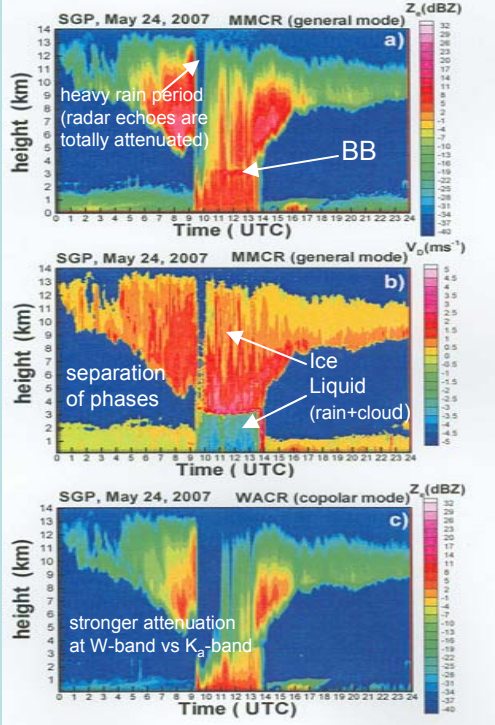
Approach

A combination of absolute and differential radar measurements at 3 different frequencies (MMCR - $\lambda \approx 8$ mm, WACR - $\lambda \approx 3$ mm, and KVNx NEXRAD - $\lambda \approx 11$ cm) and ground-based disdrometer measurements are used to retrieve rainfall rate (R), rain water path (RWP), cloud liquid water path (LWP) and cloud ice water path (IWP).

Conclusions

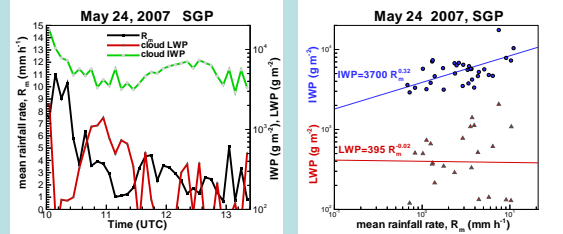
Simultaneous retrievals of cloud and rainfall parameters show that IWP in stratiform precipitation systems are usually much larger than LWP (by one order of magnitude or so). There is some weak-to-moderate correlation between cloud IWP and resultant rain rate ($r_{R-IWP} \sim 0.3 - 0.5$). The correlation between LWP and R is often insignificant ($r_{R-LWP} < 0.3$).

A typical precipitation event as seen by the ARM radars



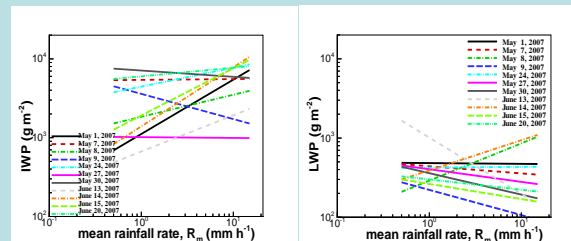
Retrievals are applicable to stratiform rainfall events, with rain rates that are less than about 10 -15 mm/h. The radar bright band (BB) (i.e., the melting layer) separates liquid and ice phases in such events.

Retrieval results for the case study



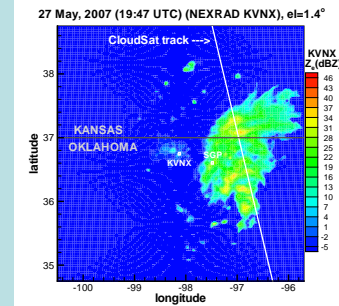
Time series (left) and scatter plots (right) of cloud LWP and IWP and the mean rain rate for the case of 07/05/24. Data represent 5 min averages. Retrievals for this case are available after 10:00 UTC when radar signals are not totally attenuated in the liquid layer (liquid cloud + rain).

Relations between cloud & rain parameters for 2007 precipitation events (at SGP site)

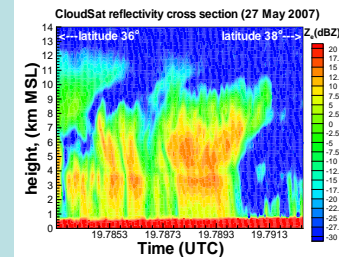


Best fit IWP-R (right) and LWP-R (left) power-law relations are shown for the spring-summer 2007 SGP events that allowed the BB separation between ice and liquid phases

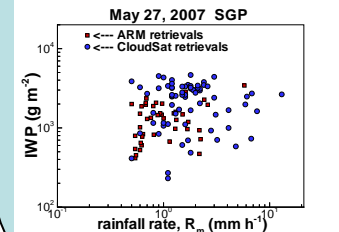
Comparisons with CloudSat



The nearest to the SGP site CloudSat orbit passes at ~56 km from the Central Facility. An example of the CloudSat overpass during a stratiform rainfall event is shown in figure on left.



Measurements of W-band CloudSat reflectivity along the orbit path reveal bright band features (at ~3.6 km) separating ice and liquid. CloudSat retrievals of only R_m and IWP are available.



Statistical comparisons of IWP and R_m derived from ARM sensors and CloudSat Show similar R-IWP scatter plots for the same event (although ARM and CloudSat data are not collocated).