

# A Comparison of Observed Cloud Microphysical Quantities with Predictions From The ECMWF Forecast Model

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## Motivation

Cloud forecasts generated by the European Center for Medium-Range Weather Forecast (ECMWF) model are evaluated using ARM observational data measured at the Southern Great Plains (SGP) site. The observations, collected from remote sensing instruments such as radar, lidar, microwave radiometer and radiosonde, are used to derive the cloud microphysical quantities of liquid (LWC) and ice water content (IWC). The derived quantities are retrieved by three different retrieval schemes (Microbase, Cloudnet and Mace), each employing unique parameterizations. We average each set of derived LWC and IWC quantities to the same height grid as the ECMWF model and apply a temporal averaging which closely approximates the horizontal grid-box size of the model given the wind speed at each height. These observational products are compared directly with cloud forecasts generated by the model.

**ECMWF Model**  
(12-35 hour forecasts)

## Results

- The ECMWF model predicts the mean LWC fairly well when compared with all retrieval observations however it over predicts the occurrence of cloud liquid water at an altitude of between 2 to 6 km.
  - The instances of greater LWC clouds are underrepresented and those of lesser LWC overrepresented in the model as compared to all three retrieval observations.
  - All retrievals are tuned to the microwave radiometer, liquid water path (LWP) values which the model predicts closely when the instrument is working optimally.
  - The model significantly under predicts the observed mean IWC values at all heights and from all retrievals.
  - The model predicts the frequency with which ice clouds occur fairly well but underestimates the amount of IWC particularly in the 3 to 7 km height range.
- Note: The ECMWF did not under predict the IWC in clouds over Europe.\*

## Mace Retrieval

## Microbase

## Cloudnet

