Motivation

Weather Research and Forecasting model coupled with chemistry (WRF-Chem) is a regional model which is widely used to study aerosol-cloud-rainfall-climate feedbacks. In this study, we are using unique in situ flight measurements obtained during CAIPEEX (Cloud Aerosol Interaction and Precipitation Enhancement Experiment) to evaluate the model’s performance in reproducing vertical distribution of moist thermodynamics and cloud microphysics over Indo Gangetic Plains, located in Northern India.

Flight path and Model set-up

Figure 1 shows the flight path on 24th and 25th in black dots. The colored dots are total hydrometeor mass conc. (g/cubic metre). Two regions (pink boxes) are studied where aircraft measurements are made.

Methodology

1. Cloud resolving nested model is set up using WRF 3.5 for the 2 regions. (Model details in Table 1).
2. Performance of Morrison and Lin microphysics in WRF only simulations are evaluated to identify the better performing scheme.
3. WRF-Chem simulated profiles of microphysical variables are evaluated against measured variables (see Table 2).

Comparison of vertical profiles from CAIPEEX (black line) flight measurements with WRF-Chem (red dots) simulated cloud droplet mass conc. (b) mean cloud droplet number conc., (c) mean cloud particle mass conc. and (d) mean cloud particle number conc. on 24th Aug (Figure 4) and 25th Aug (Figure 5). Altitude is in Km.

Conclusion

WRF-Chem is able to simulate cloud at ~9/10 locations corresponding to CAIPEEX flight measurements.

Over 2.5 km model is under predicting cloud droplet number and mass concentration while over predicting cloud particle’s number and mass concentration.

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