Evaluating cloud parameterizations using SCAM and ARM TWP-ICE measurement

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Objective

■ **Evaluate convection and microphysics schemes in NCAR SCAM**

Data

■ **Model forcing data from variational analysis (Xie)**

■ **Cloud fraction -- ARSCL**

■ **LWP from MWRRET (Turner) & radar/lidar retrievals (McFarlane)**

■ **LWC from radar/lidar retrievals (McFarlane)**

■ **IWC from radar/lidar retrievals (McFarlane) & Satellite data (G. Liu) averaged over 200X200 km² centered at Darwin**
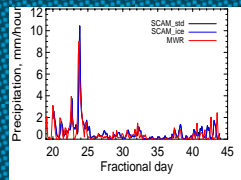
Model

■ **Current standard single column CAM (SCAM_std)**

■ **SCAM with inclusion of ice microphysics (SCAM_ice) (Liu et al., 2007, J Climate)**

■ **A series of 36 hour forecasts were performed with the model initialized at 03 Z every day for the entire period of TWP-ICE. 12-36 hour forecasts are analyzed.**
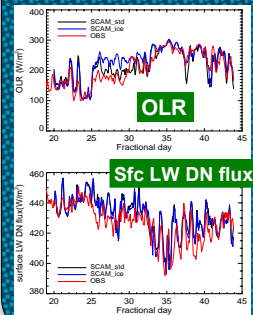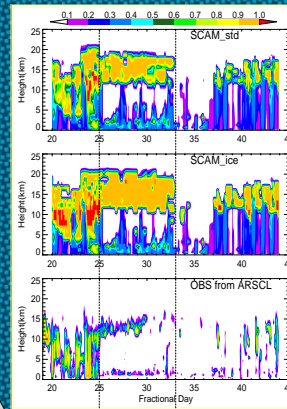
Results

1. Precipitation

2. Radiative fluxes

OLR

Sfc LW DN flux

3. Cloud Fraction

SCAM_std

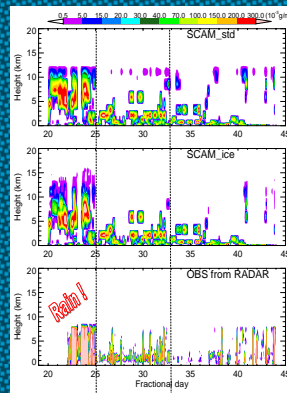SCAM_ice

OBS from ARSCL

Monsoon · Suppressed · Break Period

● Models nicely simulate cloud time-height distribution qualitatively

● CF increases becasue SCAM_ice allows ice super-saturation while CF is still based on RH. CF Improvement is underway

● Deep convection is too strong during break period or falsely triggered

4. Comparison of LWP and IWP
under non-precipitating conditions

	SCAM_std	SCAM_ice	OBS
LWP (g/m²)	162	160	42 (MWR) 165 (radar/lidar)
IWP (g/m²)	11	13	66 (Satellite) 64 (radar/lidar)

5. Liquid water content

SCAM_std

SCAM_ice

OBS from RADAR

Rain !

Monsoon · Suppressed · Break Period

● Note radar LWC is less reliable during period w/ significant rain

● Models' LWC lower than Radar's

● Improved! SCAM_ice simulates larger LWC at 4-8 km, and closer to OBS than SCAM_std during Monsoon

6. Ice water content

SCAM_std

SCAM_ice

Rain !

Radar

Satellite

Monsoon · Suppressed · Break Period
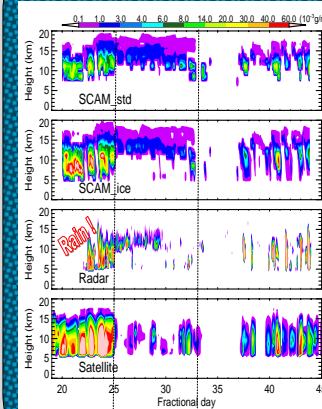
● Note radar IWC is less reliable during period w/ significant rain

● **Significant Improvement** in IWC by SCAM_ice compared to radar and Satellite data during monsoon and break periods

7. LWC, IWC, CF profiles

Monsoon · Suppressed · Break
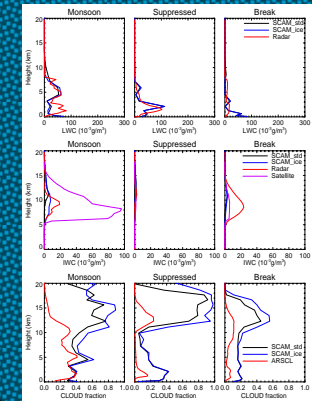
● Vertical profiles during non-precipitating hours for three priods

● SCAM_ice gives better IWC results during monsoon compared to Radar

● Cloud fraction is significantly overestimated by models, particularly at high levels

Conclusion

■ **With ice microphysics, LWC and IWC are improved**

■ **Problems: overestimated cloud fraction, too strong deep convection, ……**

■ **Ongoing and future work: convection triggering function; cloud fraction parameterization, microphysics**