A Comparison of the Water Budgets between Clouds from AMMA and TWP-ICE

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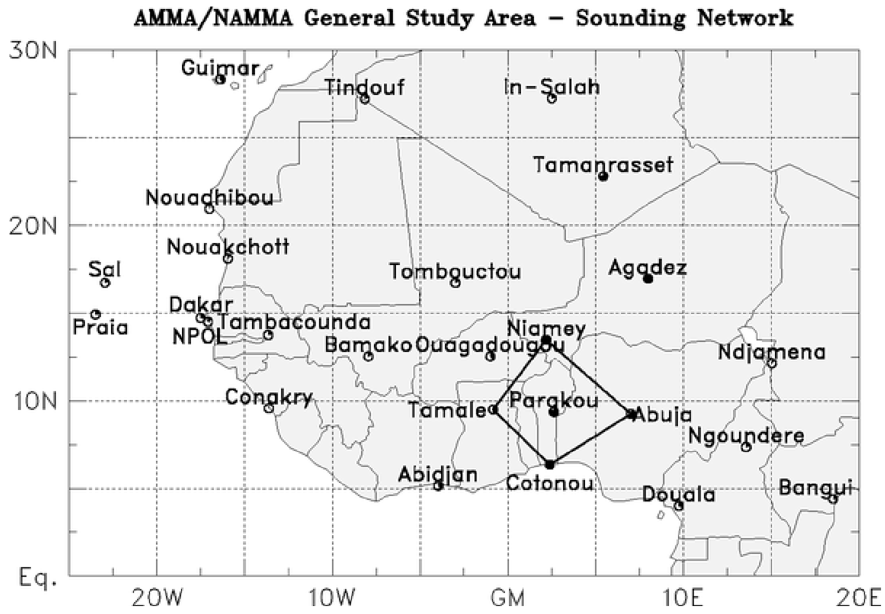
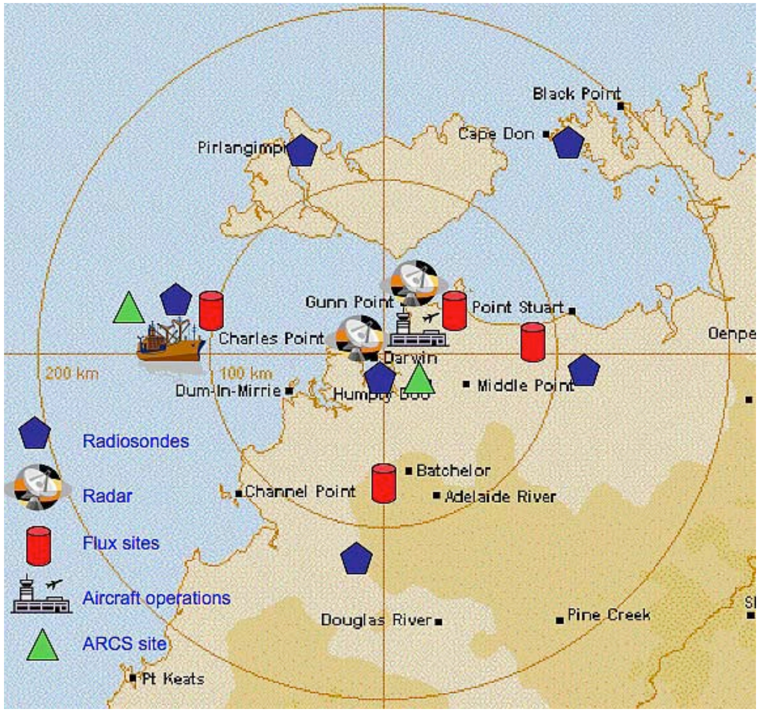
DOE ASR Meeting on March 14, 2012

AMMA and TWP-ICE Campaigns





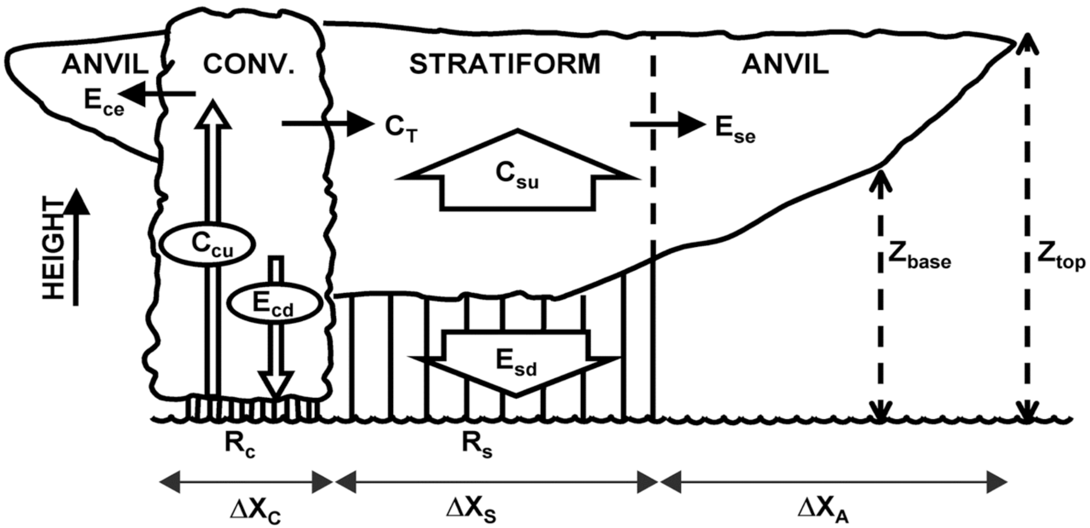
OBSERVATIONS:

- Ice cloud occurrence is more frequent at Darwin

  (Cetrone and Houze 2009, Protat et al. 2010, …)
- MCSs contribute to most of the precipitation at AMMA summer

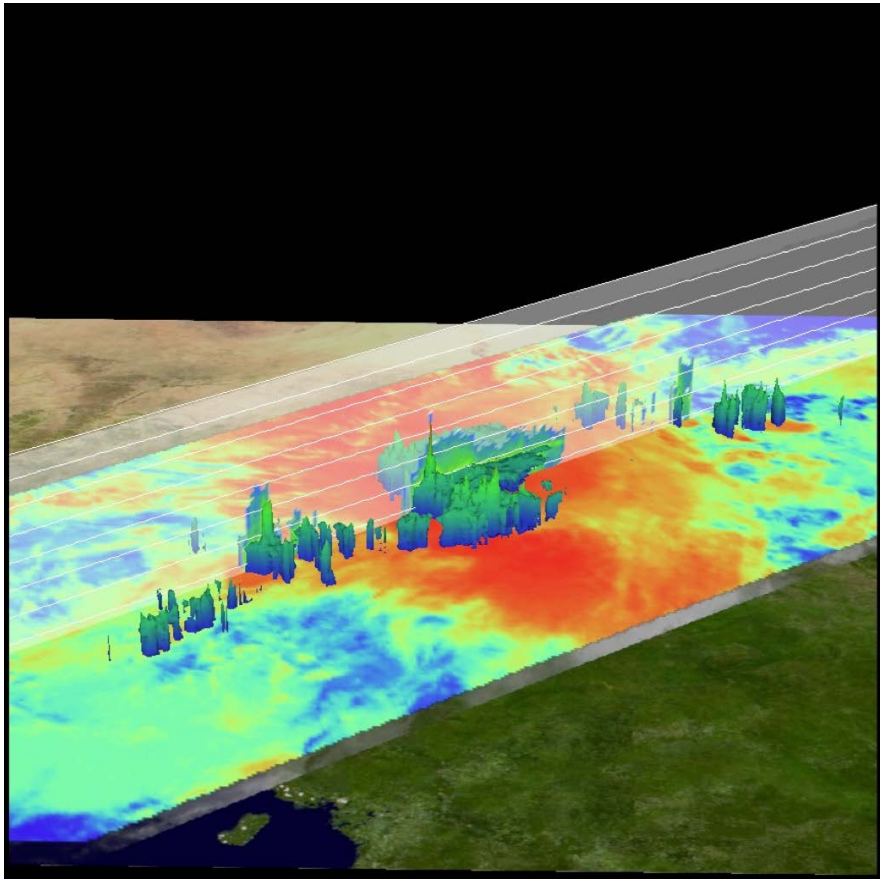
  (May et al. 2008, Guy et al. 2011, …)

Water Budget Analysis

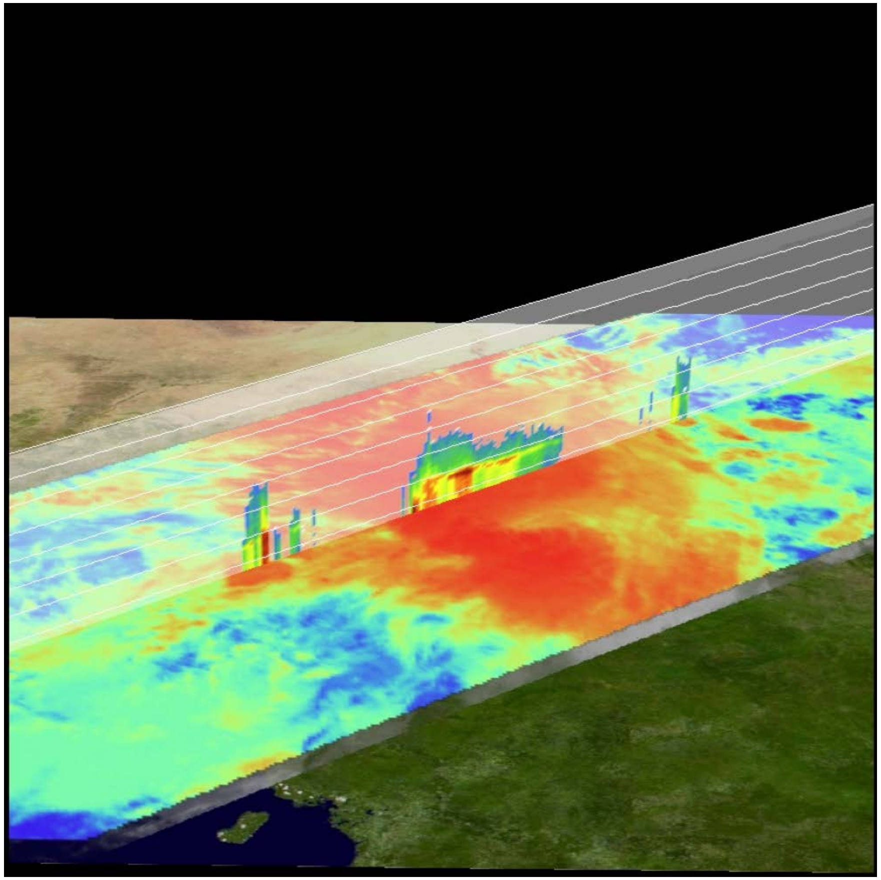


Schematic of an idealized MCS (mesoscale convective system)
From Houze et al. (1980)

A TRMM Survey of AMMA MCS Structure

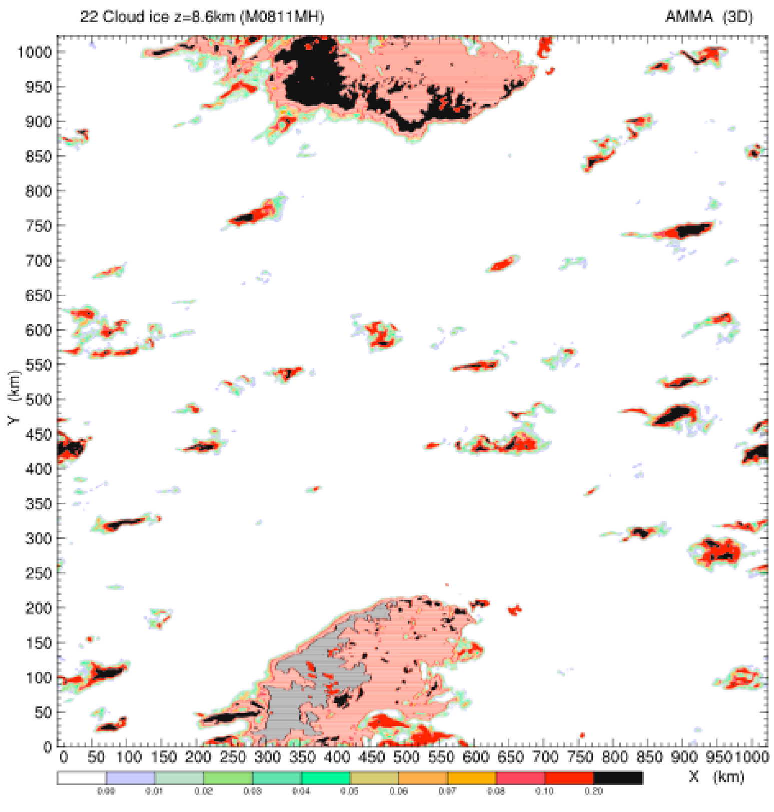


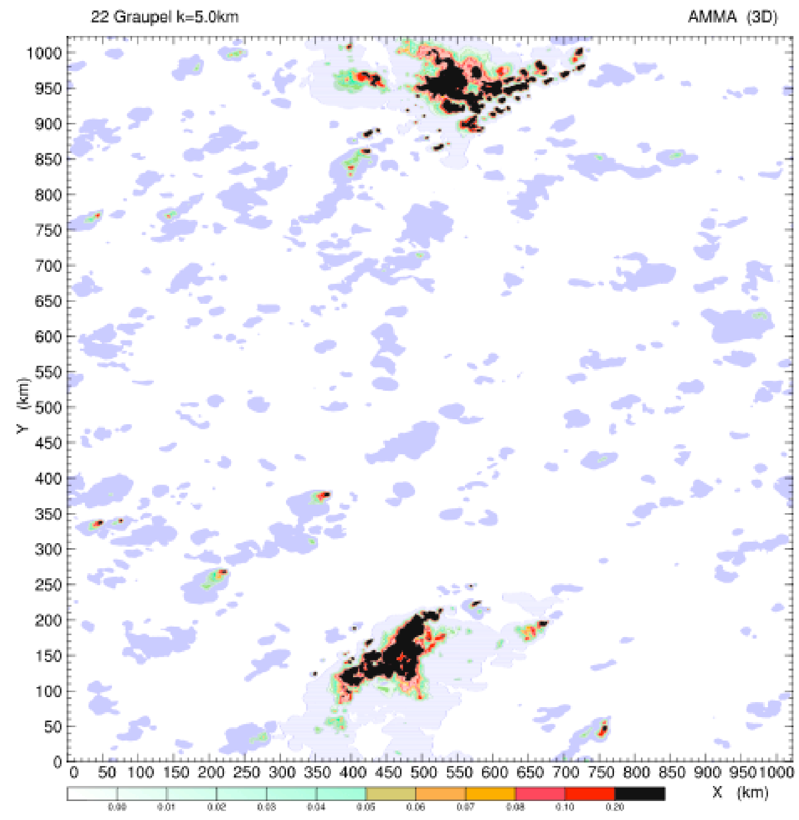
3D (30-dBZ surface) image from TRMM PR data overlaid on an infrared image
Green : convective cores
Red : cloud anvil



Vertical cross section of the dBZ within the highest cloud.

An AMMA Simulation

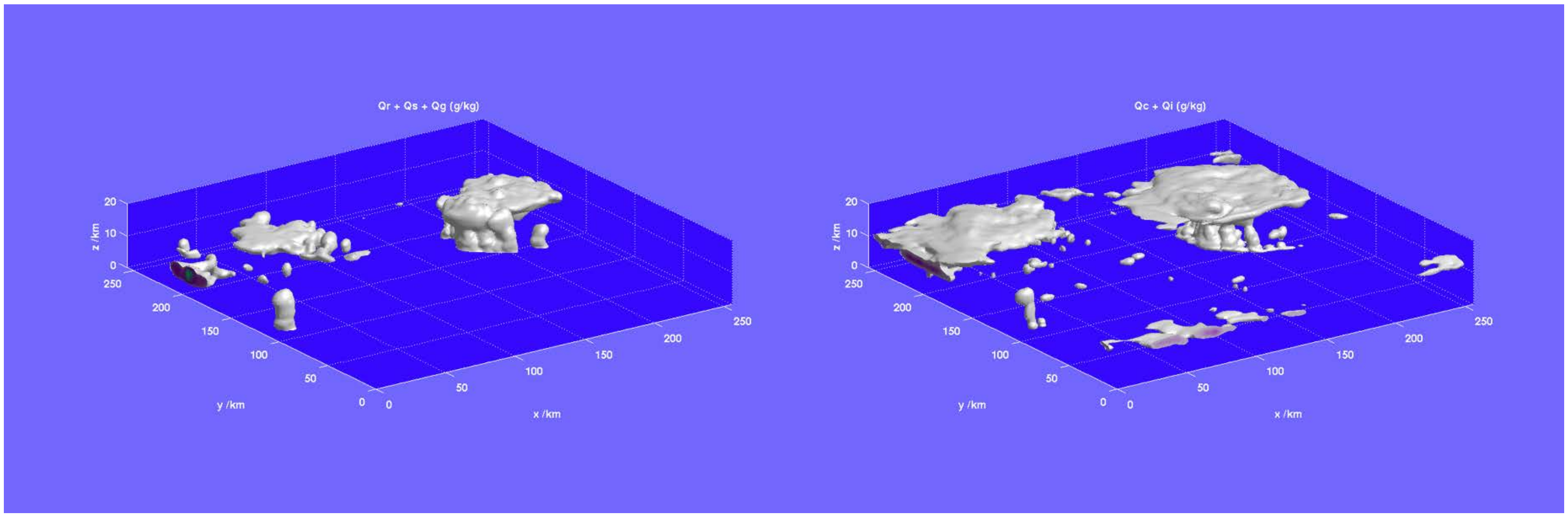




Cloud ice mixing ratio at 8.6 km that represents **cloud anvil**

Graupel mixing ratio at 5 km that represents **convective cores**

A TWP-ICE Simulation



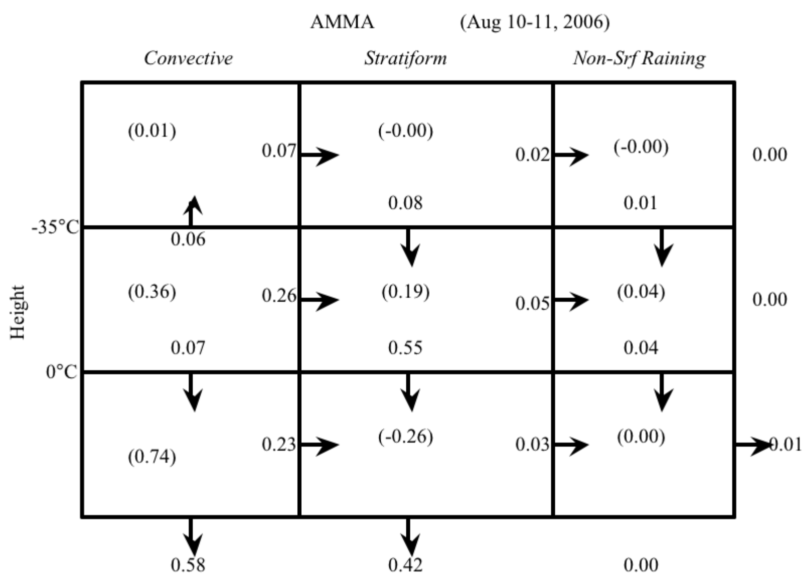
Outline of **precipitating** particles

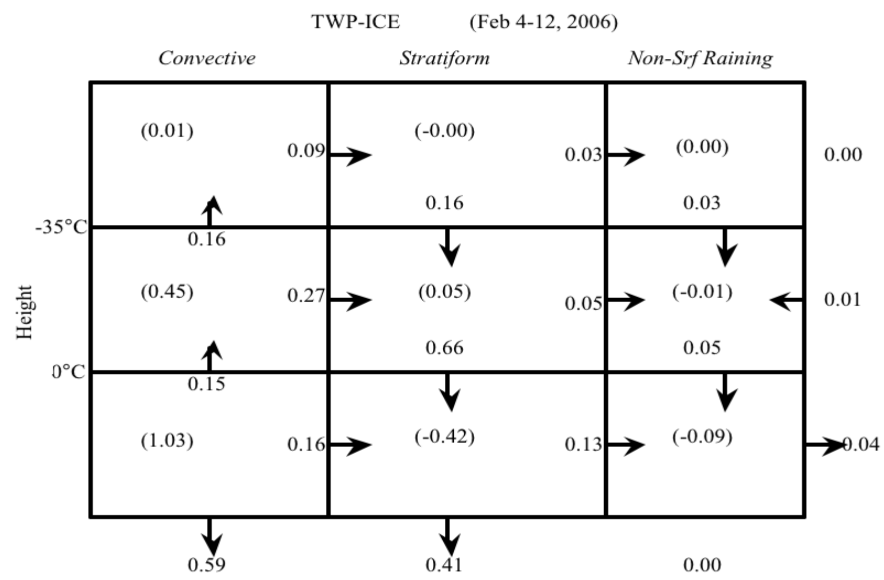
Outline of **non-precipitating** particles

Water Budget

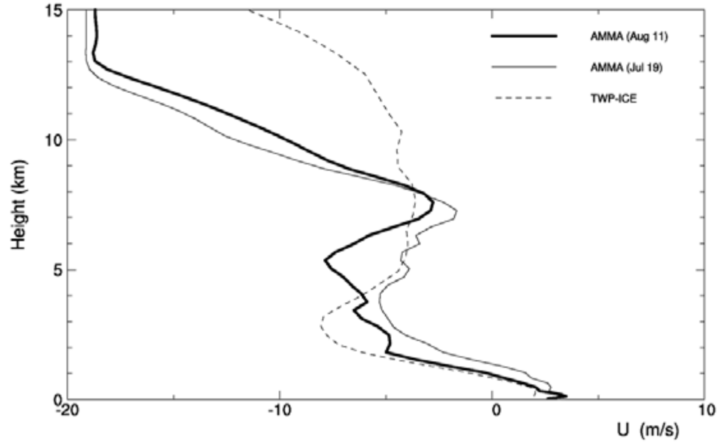
Table 2 Stratiform/anvil clouds versus convective clouds

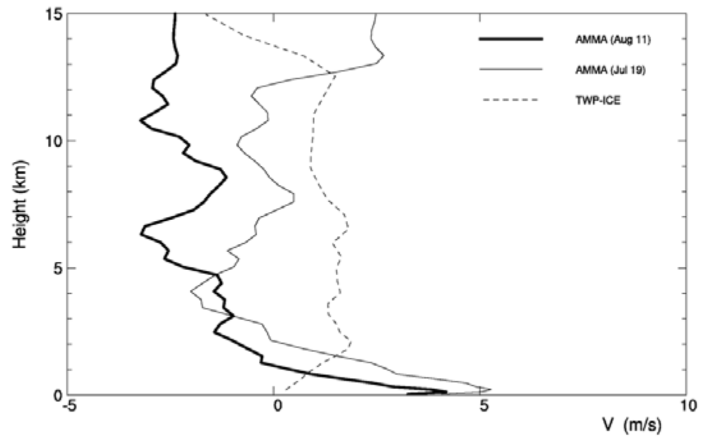
Case	*Percentage of Stratiform Rain*	*Ratio between stratiform and convective cloud areas*	*Ratio between anvil and convective cloud areas*
M0811MH	51.4%	4.1	1.8
M0719MH	59.5%	14.0	7.5
T06MH	41.4%	5.0	15.5





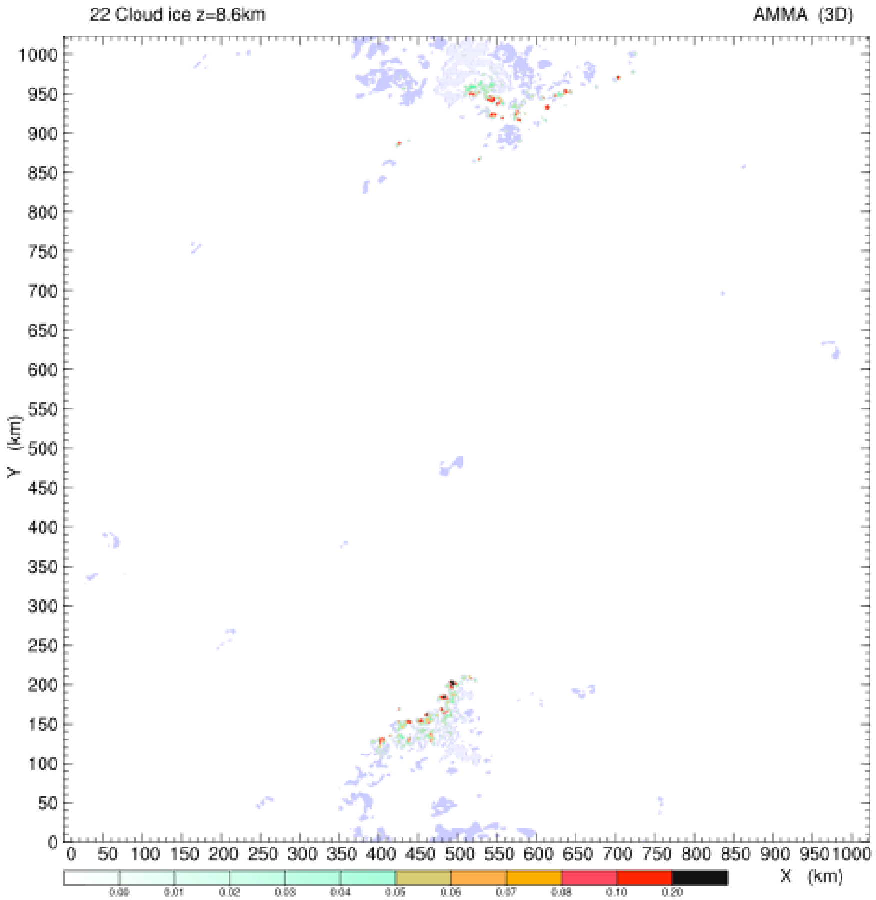
Vertical Wind Shear



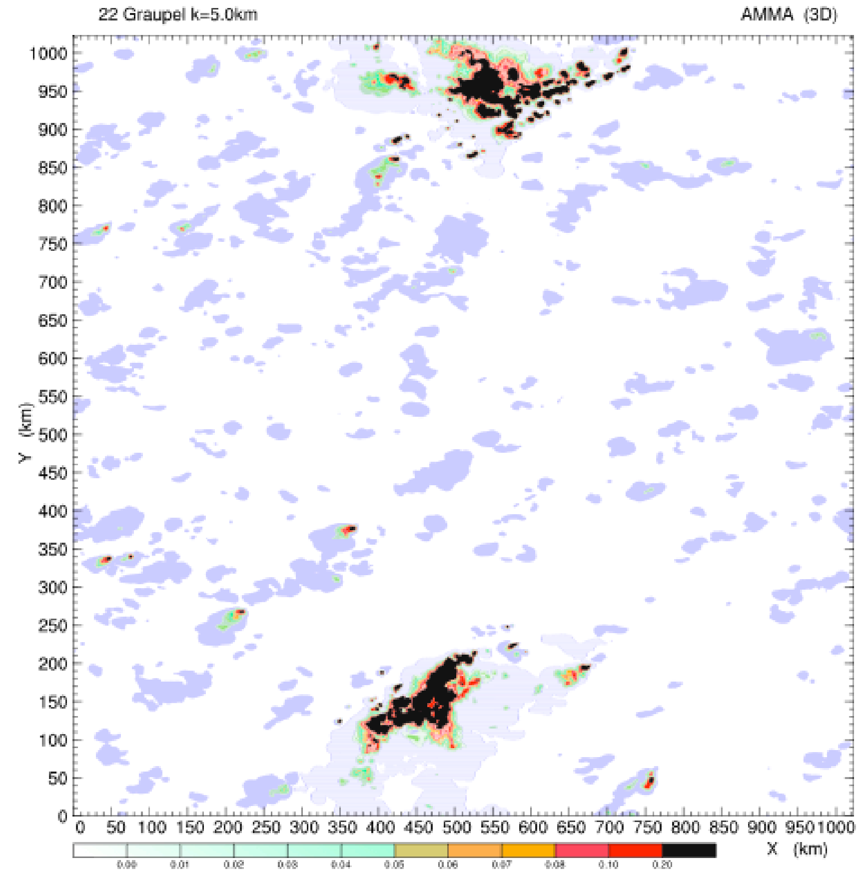


Vertical profiles of U (left) and V (right) from AMMA and TWP-ICE observations

Another AMMA Simulation with low IN (Ice Crystal) Concentration



Cloud ice mixing ratio at 8.6 km that represents **cloud anvil**



Graupel mixing ratio at 5 km that represents **convective cores**

Conclusions & Future Work

- CRM simulations can successfully duplicate MCS from AMMA and TWP-ICE;
- Convective clouds in TWP-ICE are stronger, mesoscale ascent outside convective clouds is stronger in AMMA;
- Strong vertical wind shear in the upper troposphere brings about broad anvil clouds in TWP-ICE;
- High ice crystal concentrations are one of key factors that contribute to large AMMA MCSs;
- More TWP-ICE and AMMA cases will be studied to expand the statistical comparison between AMMA and TWP-ICE MCSs.

Acknowledgement

- ASR financial support so that observational and modeling scientists sat together;
- Project and field campaign scientists of TWP-ICE and AMMA who provided high-quality data;
- NASA supercomputer centers that provided a lot of computer time.