Boundary Layer and Precipitation Studies Using ISS, Radar and Disdrometers During SoWMEX/TiMEX

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Part I:
The microphysics structure of different Precipitation Types

Part II:
The Impacts of Radar Data Assimilation on Maiyu Front Simulation
Part I: The microphysics structure of different Precipitation Types

Experiment

- 2008 SoWMEX/TiMEX
- Supersite observations (ISS and 2DVD)

Precipitation Type

- Deep Convective precipitation
- Stratiform Precipitation
- Cumulus Cloud
Deep Convection
2008/06/02

- strong reflectivity reach high level
- Heavy Rainfall

Wind profiler observations

**Vertical velocity**

2008/06/02 Vertical Motion (m/s)

**Reflectivity**

2008/06/02 SN Ratio (dB)

**Spectrum width**

2008/06/02 Standard Deviation (m/s)

**Blue bar: rainfall per minute**

Supercell Wind Profiler

Time (UTC)
Deep Convection

Radar Spectrum at each time

- Strong upward motion at the higher level
- Max. Rain Drop Sizes exceed 4.5 mm

X: vertical velocity
Y: Height
Shaded: signal power
Time interval 3~4 min

DSD

Deep Convection Radar Spectrum at each time

- Strong upward motion at the higher level
- Max. Rain Drop Sizes exceed 4.5 mm

DSD
Stratiform Precipitation

Wind profiler observations

2008/06/16 Vertical velocity

2008/06/16 Vertical Motion (m/s)

- obvious bright band
- Sustained Rainfall

Blue bar: rainfall per minute

2008/06/16 SN Ratio (dB)

2008/06/16 Standard Deviation (m/s)
Stratiform

Radar Spectrum at each time

• Max. Rain Drop Sizes are smaller than 4.0 mm

X: vertical velocity
Y: Height
Shaded: signal power
Cumulus Cloud

2008/06/01 04:31~04:50

• Radiation decreased
Cumulus Cloud

Radar Spectrum at each time
2008/06/01 04:31~04:50

- Max. upward motion at 1.5 ~ 2 km (max. speed 6~7 m/s)
- larger turbulence in the cloud (large spectrum width)

X: vertical velocity
Y: Height
Shaded: signal power
Part II: The Impacts of Radar Data Assimilation on Maiyu Front Simulation

Case 1
- 2003 6/14
- NCU RADAR

Case 2
- 2010 5/23
- RCCG RADAR
Case 1: 2003/06/14
Assimilation and Simulation Processes

CTL
06/14 00Z

Vr0
06/14 03Z
Vr + GTS

CYC
06/14 06Z
Vr + GTS
Vr 3DVAR
3hr Accumulated Precipitation

2003/06/14 06Z

The simulations with Vr-3DVAR could obtain better rainfall, especially near the terrain where have high radar reflectivity.
The wind shear line of Vr0 and CYC are more closer the real location which is retrieved from dual-Doppler radar.
Case 2: 2010/05/23
Assimilation and Simulation Processes

CTL
05/23 00Z

Vr0
Vr 05/23 03Z

CYC
3hr Vr 3DVAR 05/23 06Z
Reflectivity at 3 km

- The simulated front movement is slower (about one hour) than observation.
- The simulated high reflectivity line located at the north of observation.
One hour accumulated rainfall

- overestimate the rainfall in coast area at 07 UTC
- overestimate the rainfall over the mountain area at 08 UTC
One hour accumulated rainfall

- decrease the rainfall overestimation in coast area at 07 UTC
- still overestimate the rainfall in the mountain area at 08 UTC
One hour accumulated rainfall

• decrease the rainfall overestimation of coast area at 07 UTC

• improve the rainfall overestimation at 08 UTC
Summary

- Some types of precipitation (Deep convective, stratiform precipitation and cumulus cloud) were observed in SoWMREX using UHF radar and distrometers, and show some quite different vertical structure of reflectivity, vertical motion and surface DSDs distribution.

- The radar data assimilation help to revise the simulated front position, rainfall pattern and wind shear structures. The results showed the effective period of radar data assimilation is about 3-6 hours for forecasting.
THE END