

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

Supersite



ISS

MRR

POSS

Gage

2DVD

JWD

VertiX

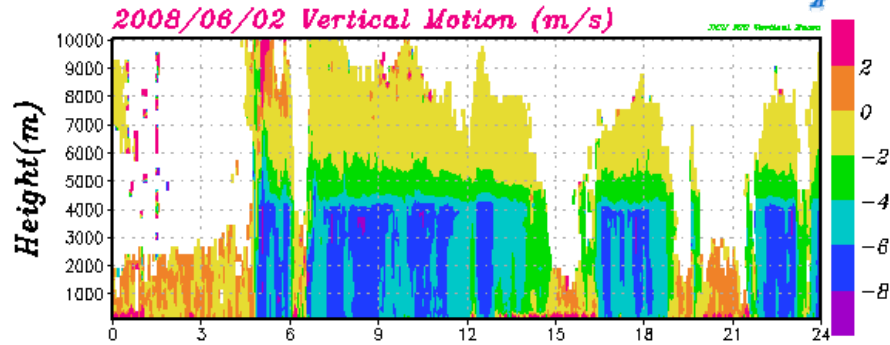
23.05.2008

Deep Convection

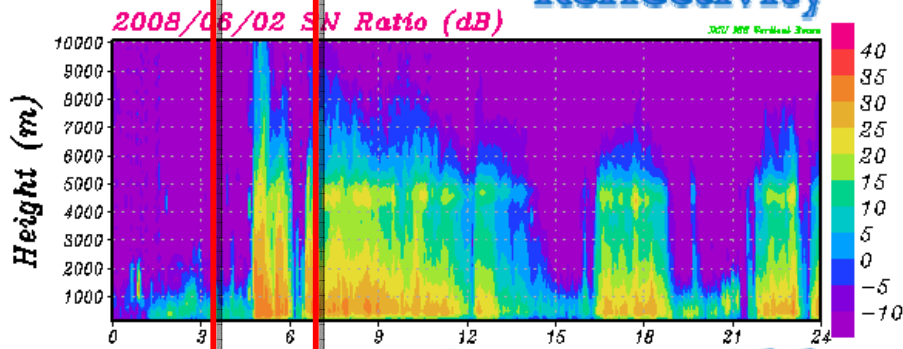
2008/06/02

Wind profiler observations

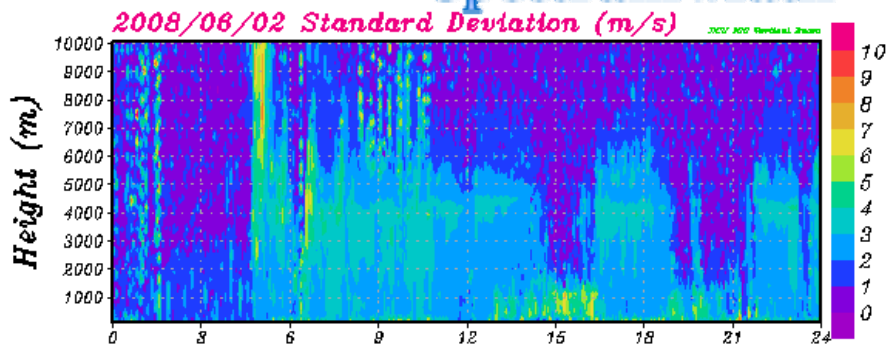
Vertical velocity



Reflectivity



Spectrum width

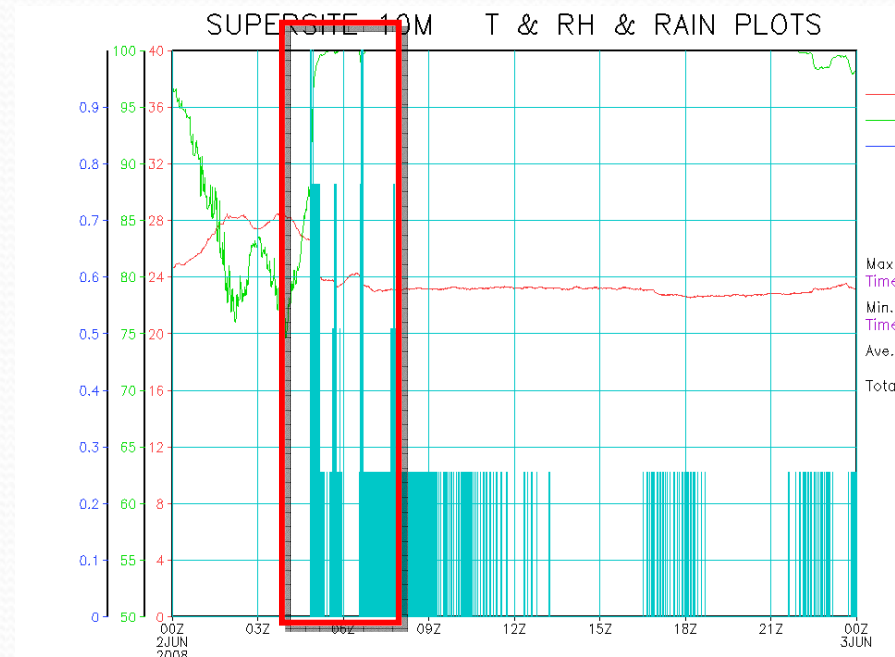


Time (UTC)

NCUISS Group

- strong reflectivity reach high level
- Heavy Rainfall

Blue bar: rainfall per minute



Deep Convection

Radar Spectrum at each time

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

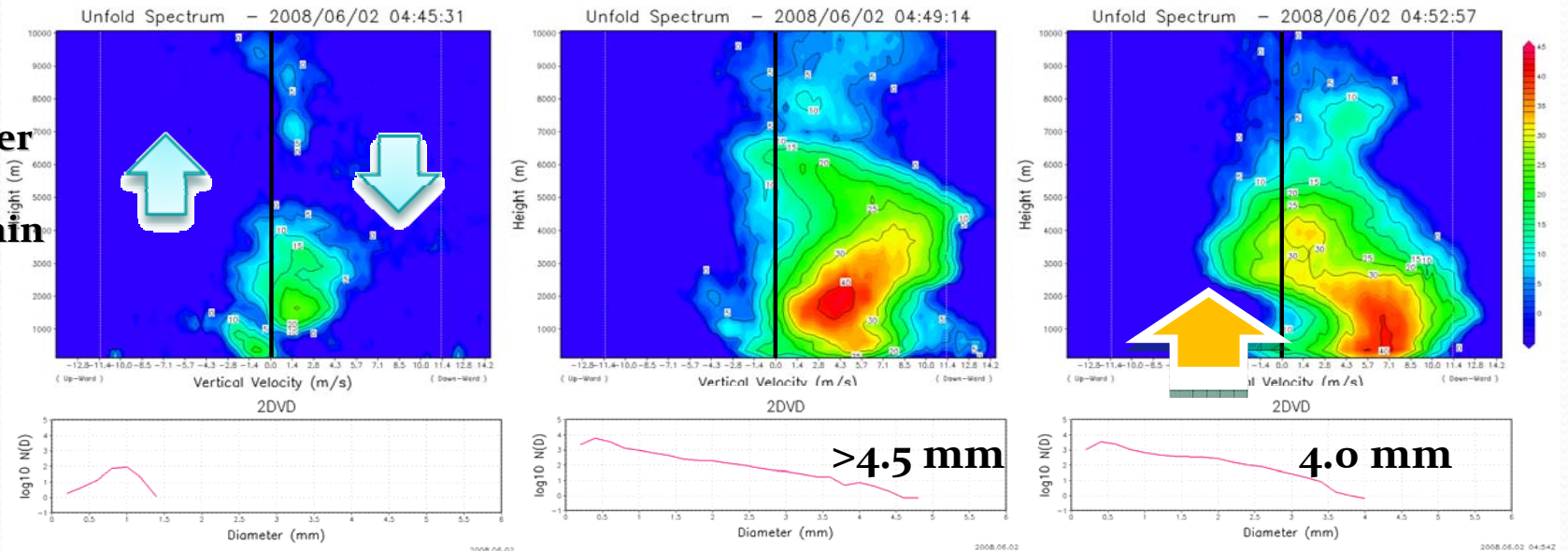
X: vertical velocity

Y: Height

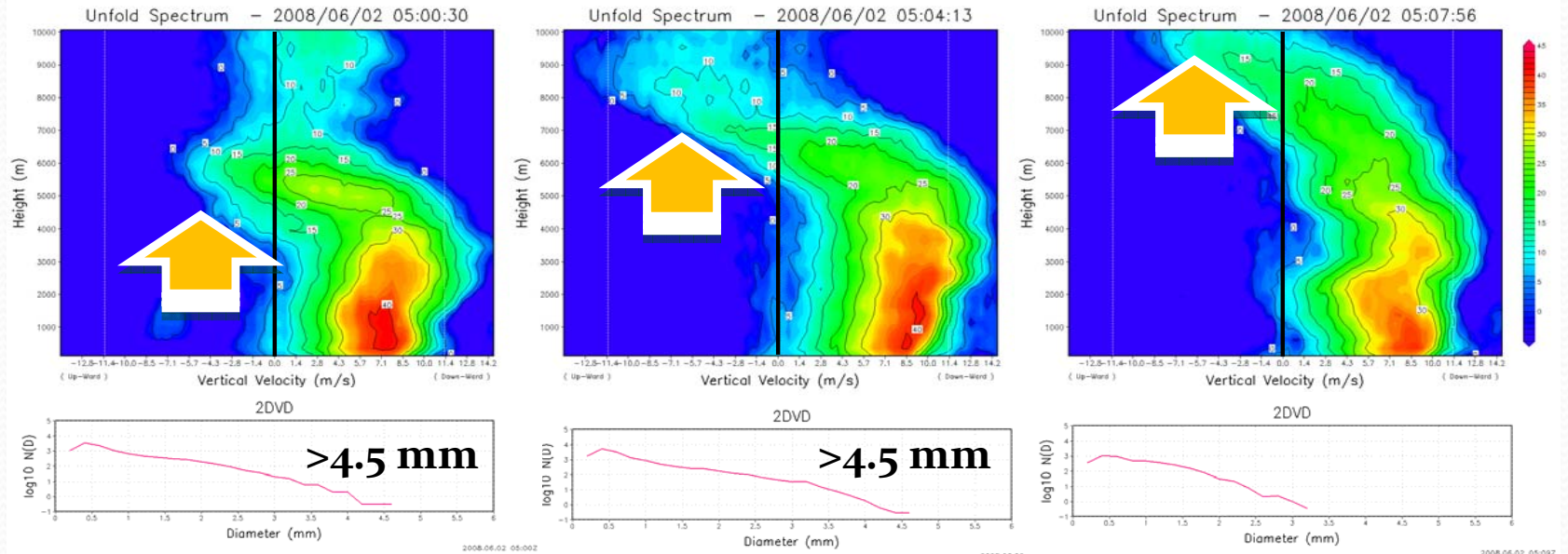
Shaded: signal power

Time interval 3~4 min

DSD



DSD

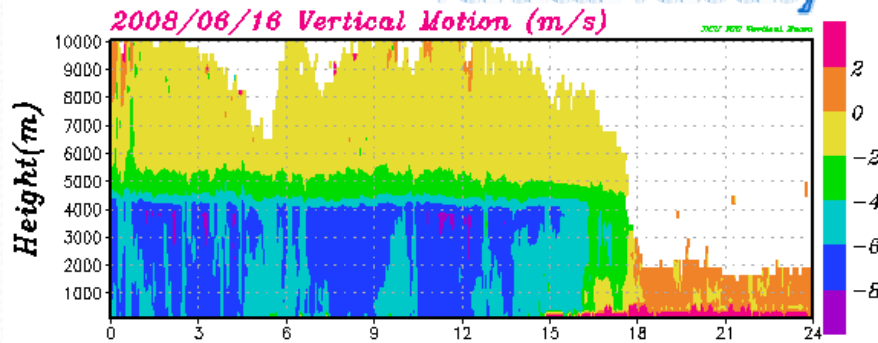


Stratiform Precipitation

2008/06/16

Wind profiler observations

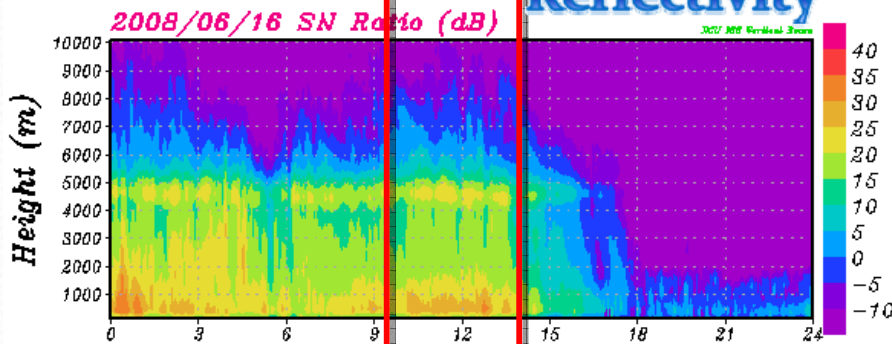
Vertical velocity



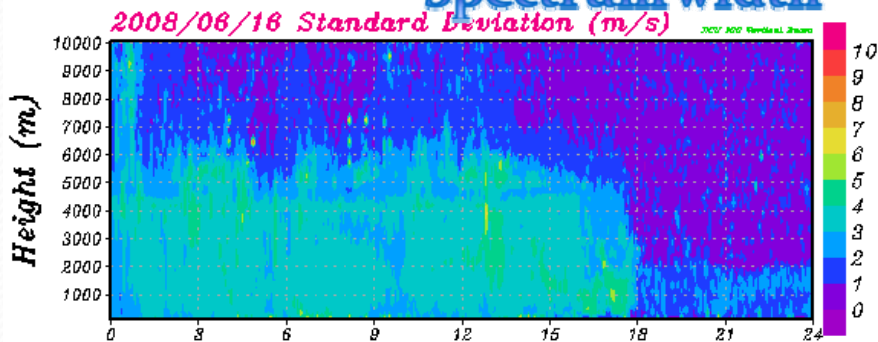
- obvious bright band

- Sustained Rainfall

Reflectivity



Spectrum width

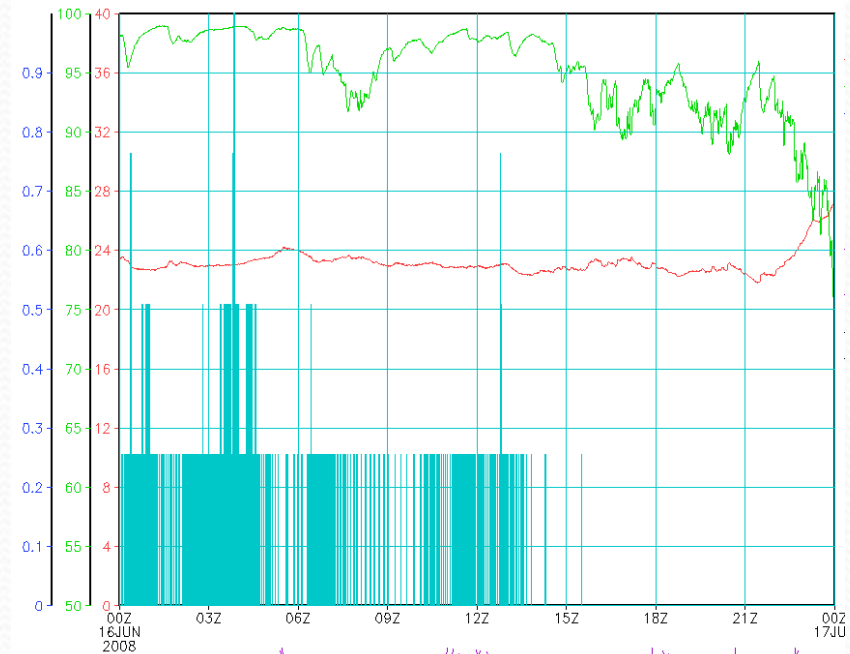


Time (UTC)

NCUISS Group

Blue bar: rainfall per minute

SUPERSITE 10M T & RH & RAIN PLOTS

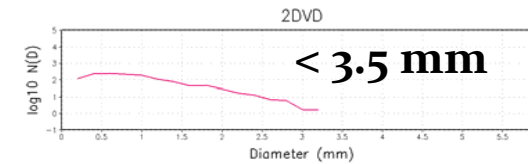
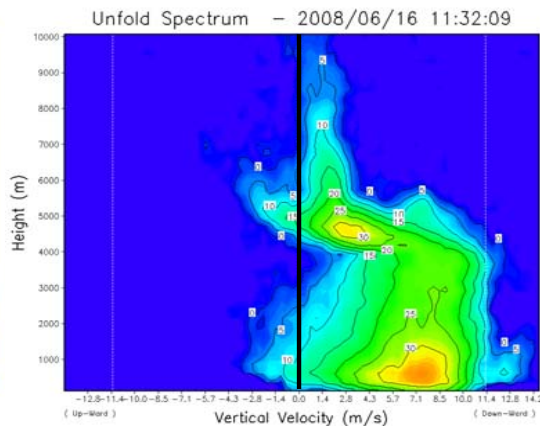
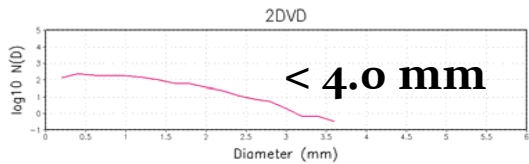
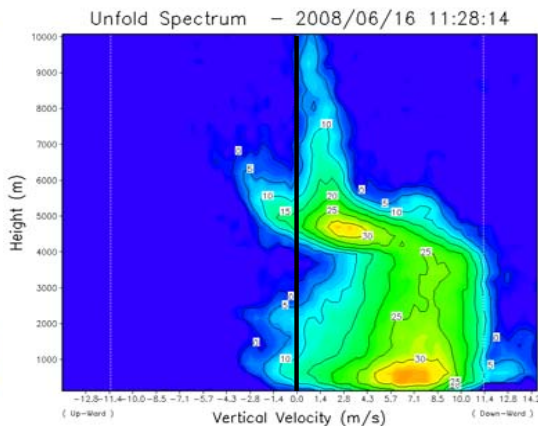
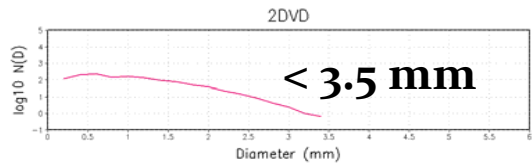
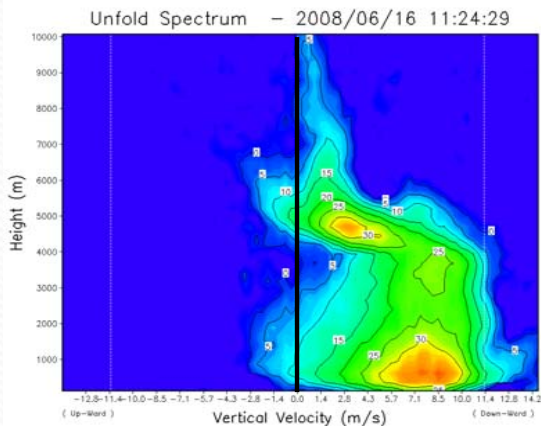
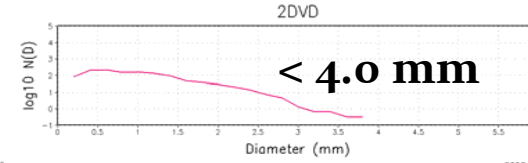
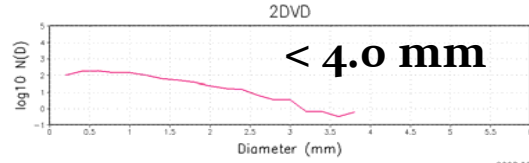
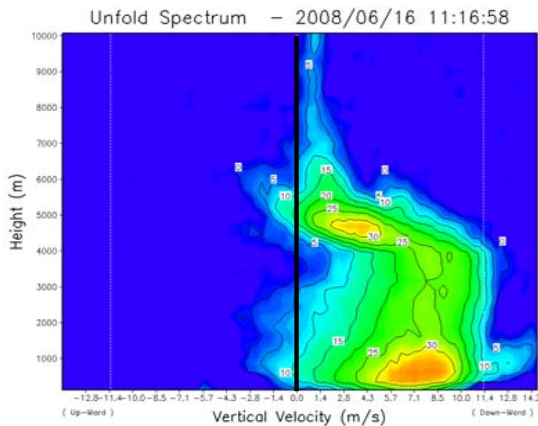
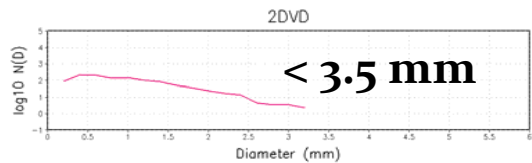
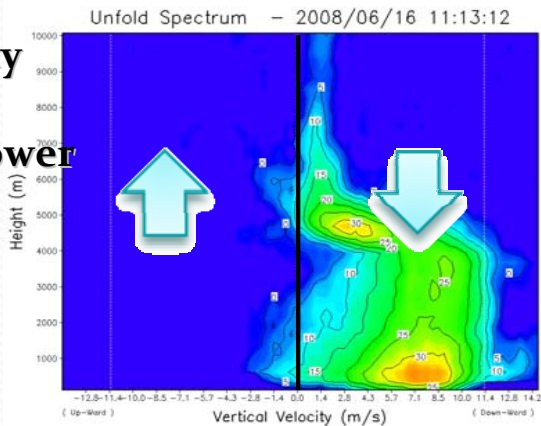


Radar Spectrum at each time

- Max. Rain Drop Sizes are smaller than 4.0 mm

X: vertical velocity
Y: Height
Shaded: signal power

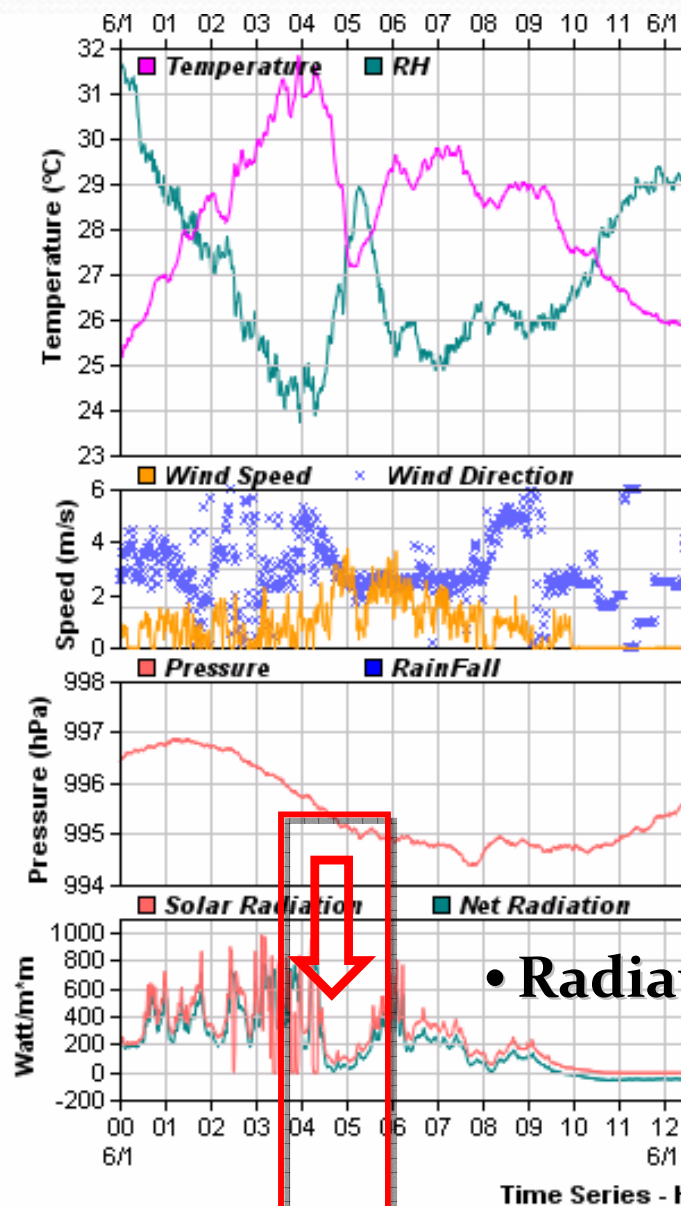
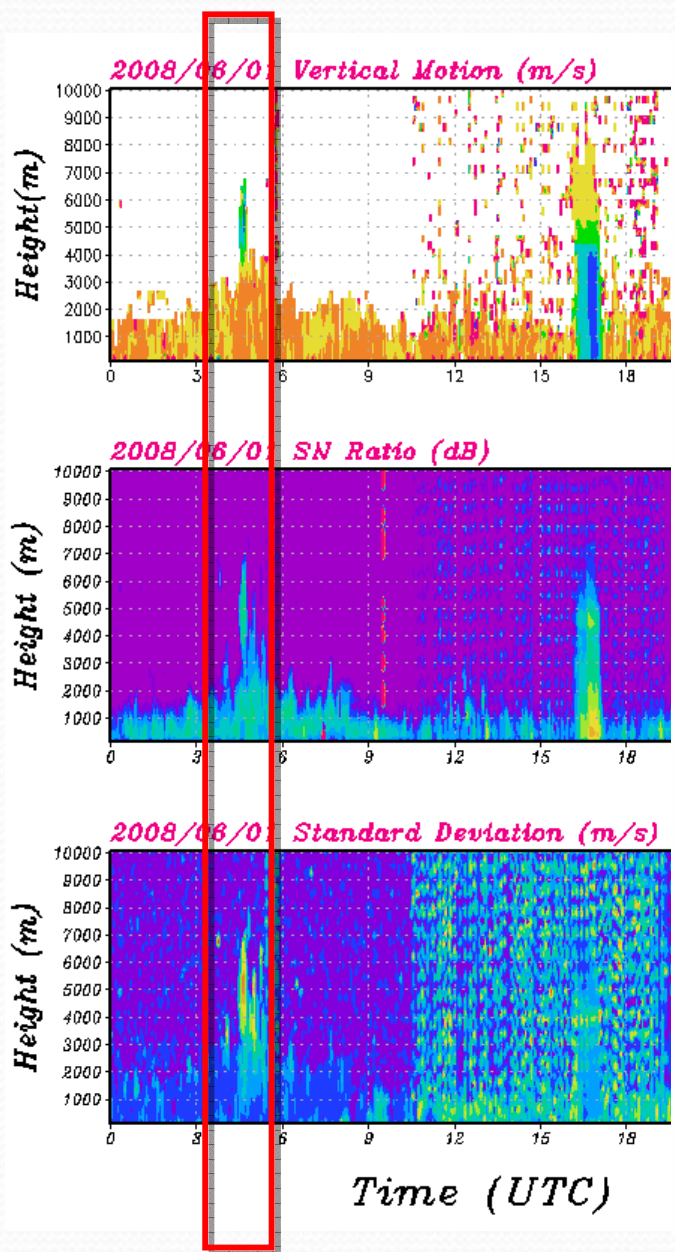
DSD



DSD

Cumulus Cloud

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



• Radiation decreased

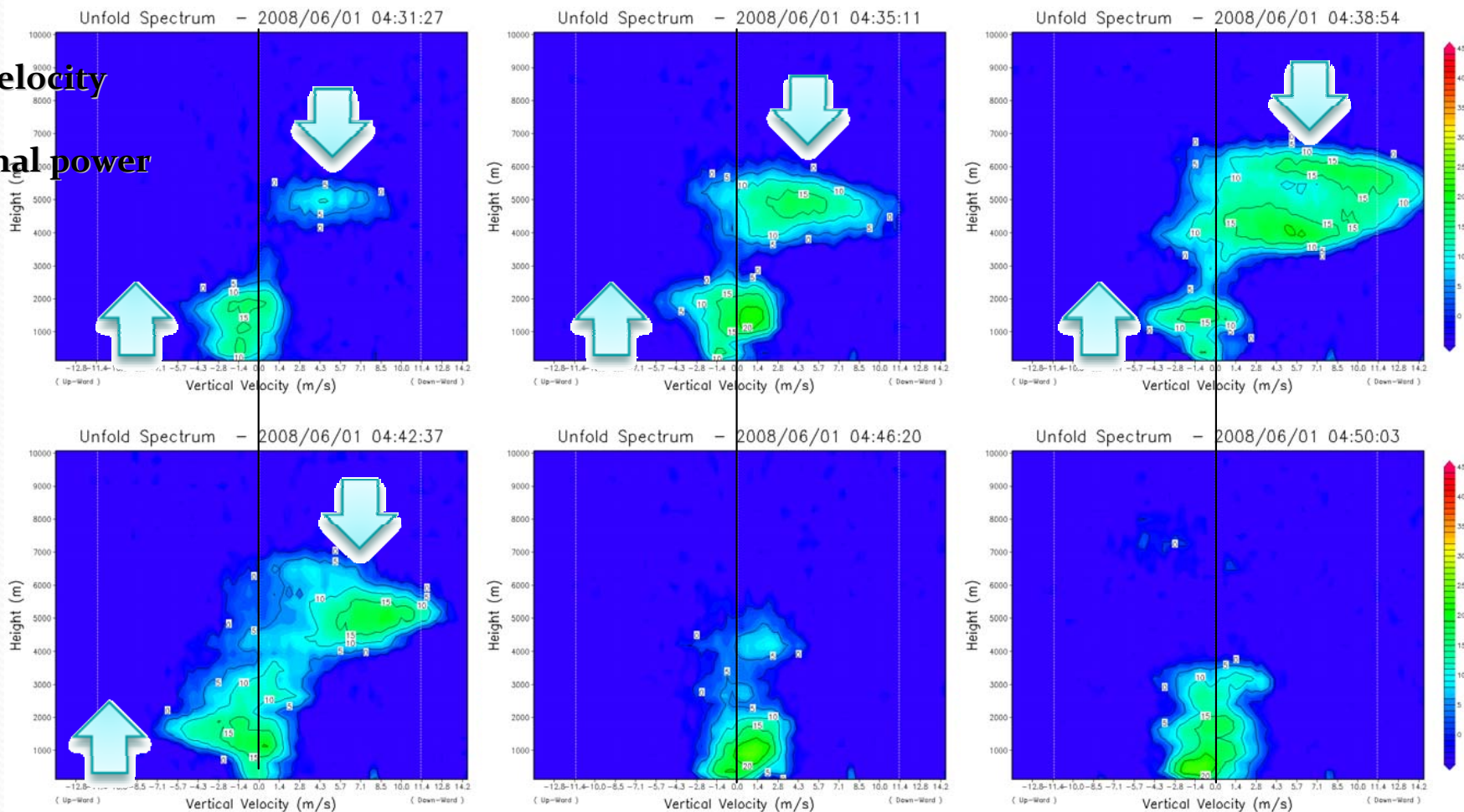
Cumulus Cloud

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:

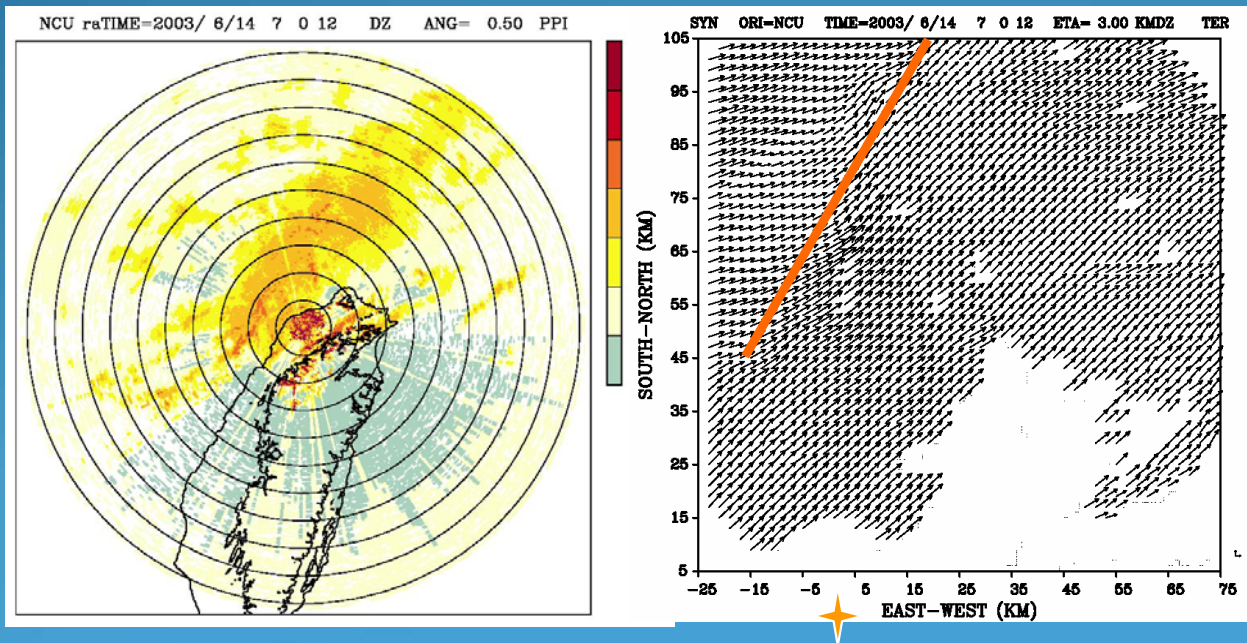
The Impacts of Radar Data Assimilation on Maiyu Front Simulation

Case 1

- 2003 6/14
- NCU RADAR

Reflectivity

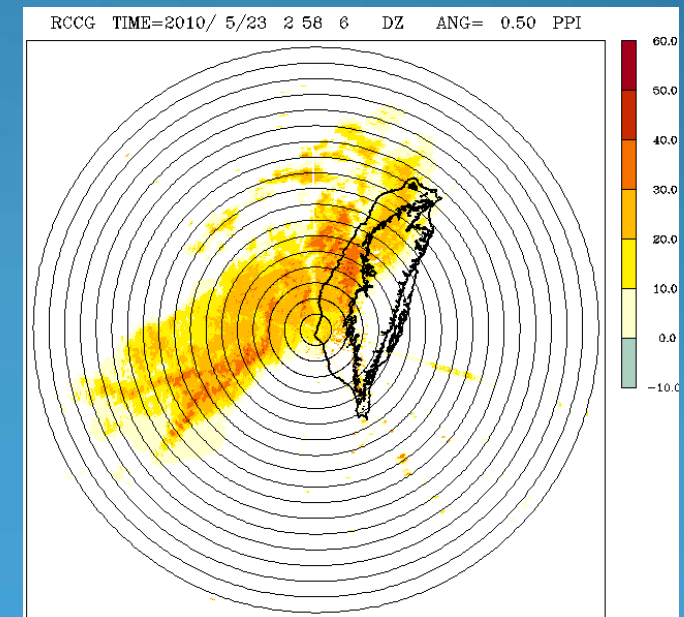
Dual-Radar Wind



Case 2

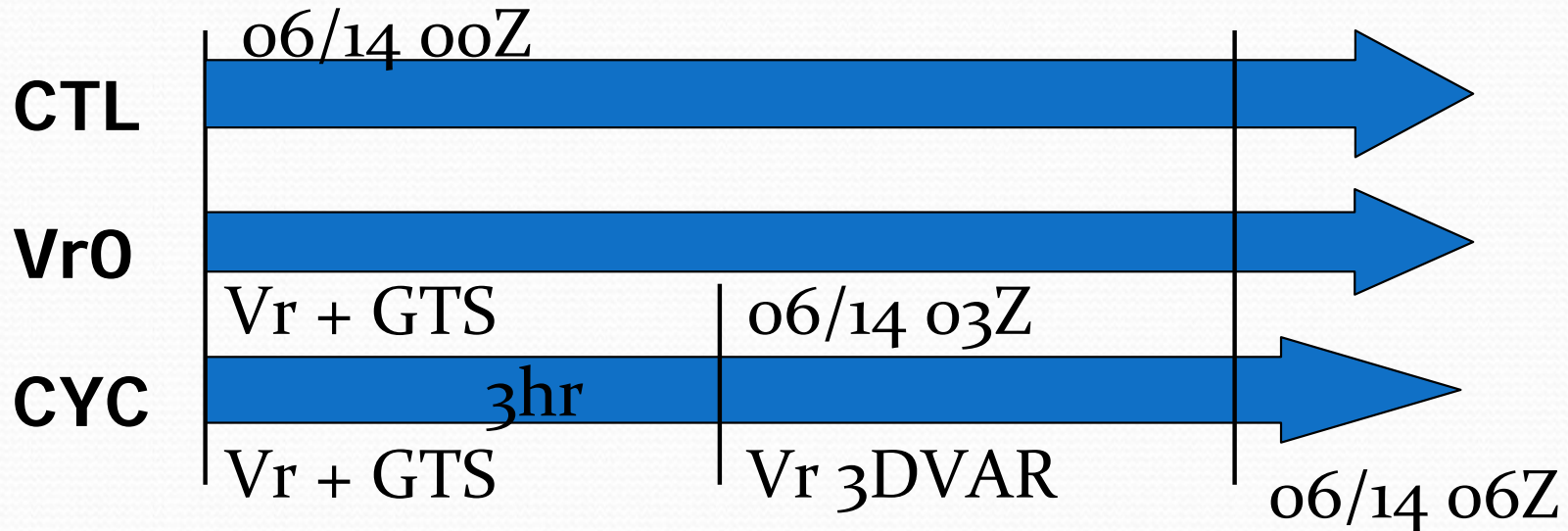
- 2010 5/23
- RCCG RADAR

Reflectivity

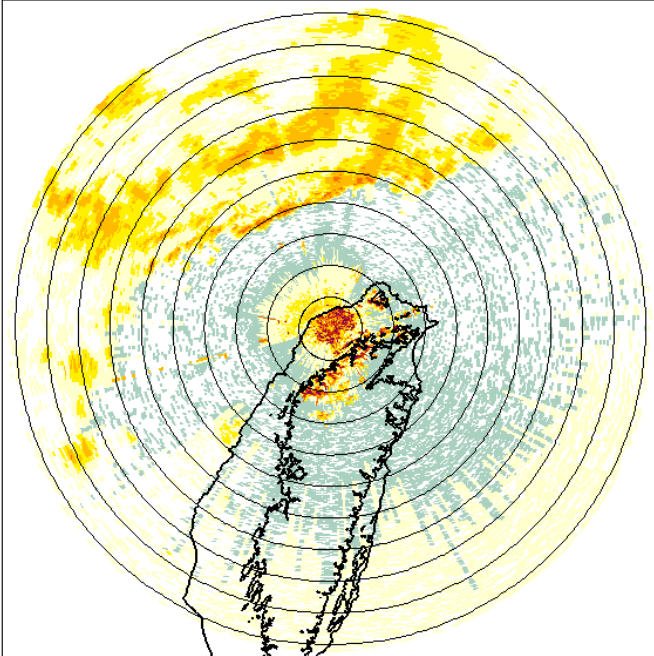


Case 1: 2003/06/14

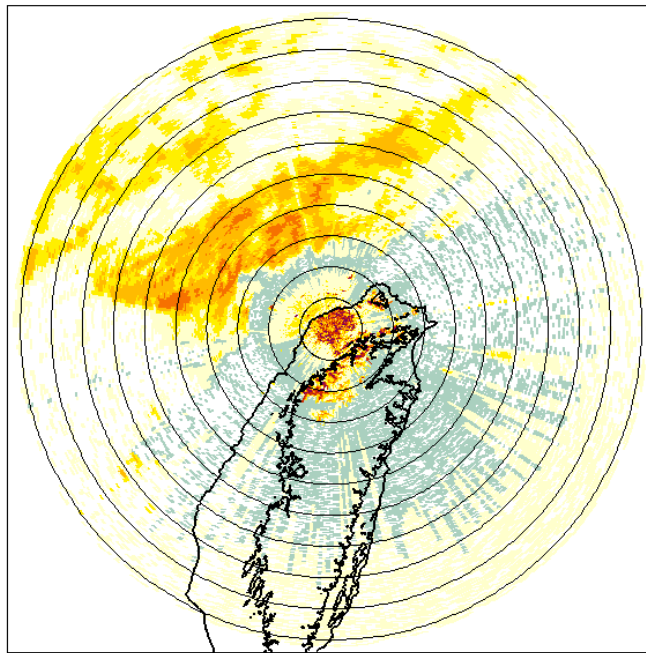
Assimilation and Simulation Processes



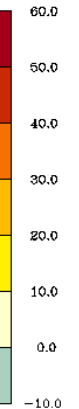
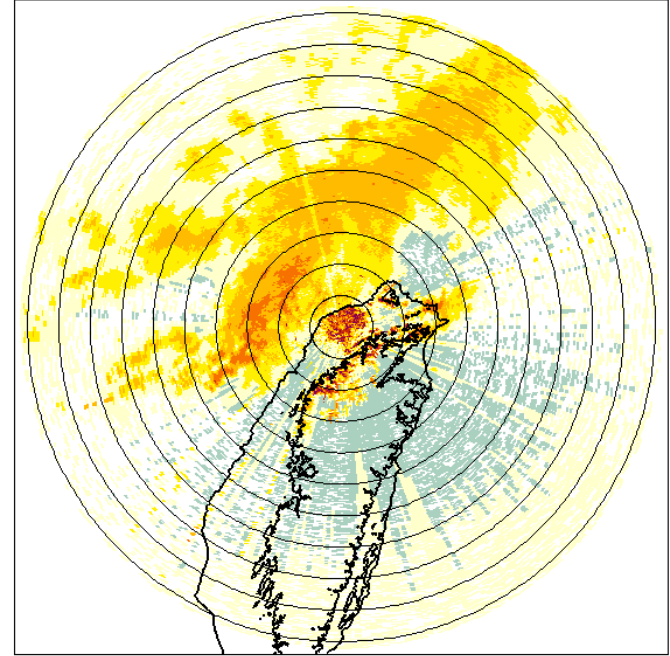
NCU raTIME=2003/ 6/14 0 4 58 DZ ANG= 0.50 PPI



NCU raTIME=2003/ 6/14 2 47 27 DZ ANG= 0.50 PPI



NCU raTIME=2003/ 6/14 6 0 1 DZ ANG= 0.50 PPI

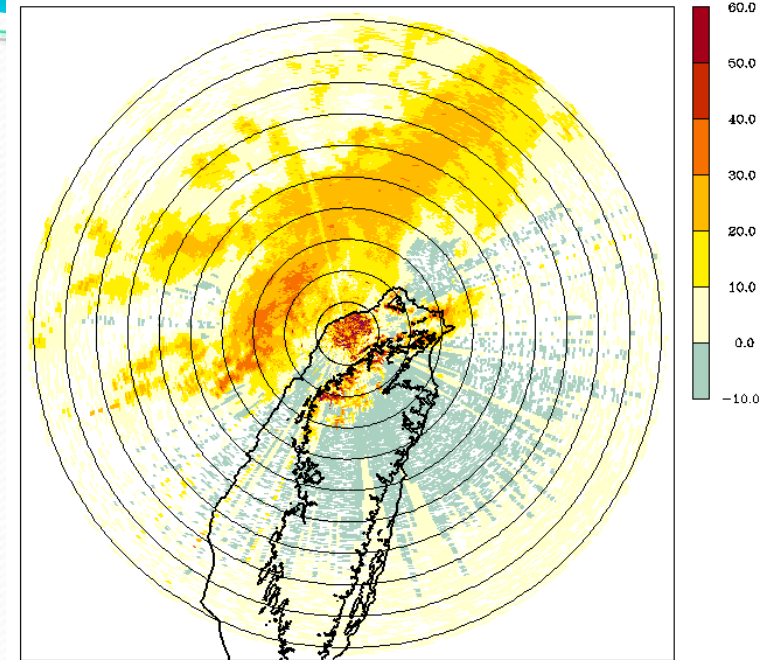


3hr Accumulated Precipitation

2003/06/14 06Z

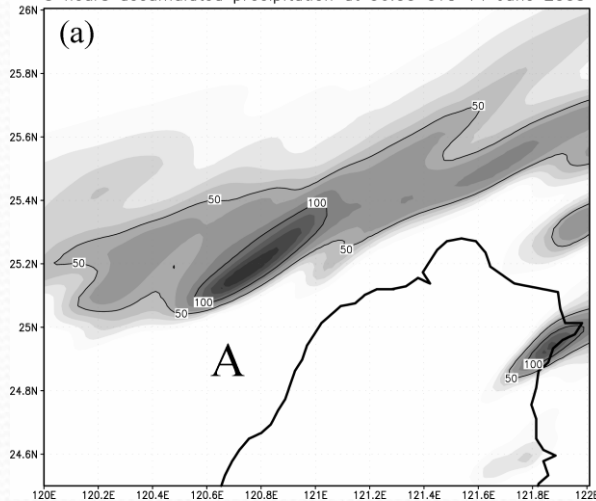
The simulations with Vr-3DVAR could obtain better rainfall, especially near the terrain where have high radar reflectivity.

NCU raTIME=2003/ 6/14 6 0 1 DZ ANG= 0.50 PPI



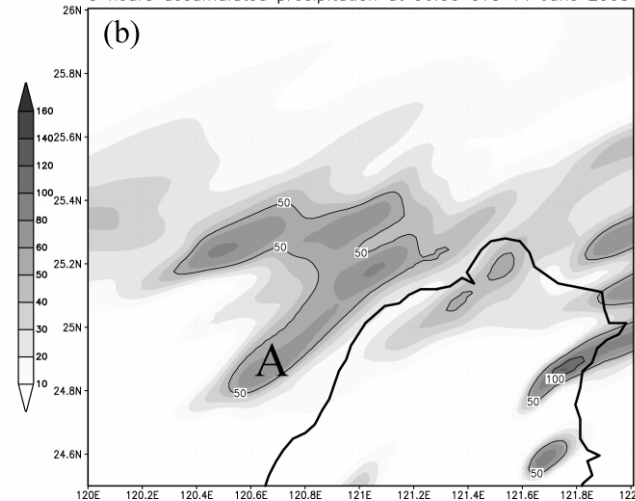
CTL

RUN1
3 hours accumulated precipitation at 06:00 UTC 14 June 2003



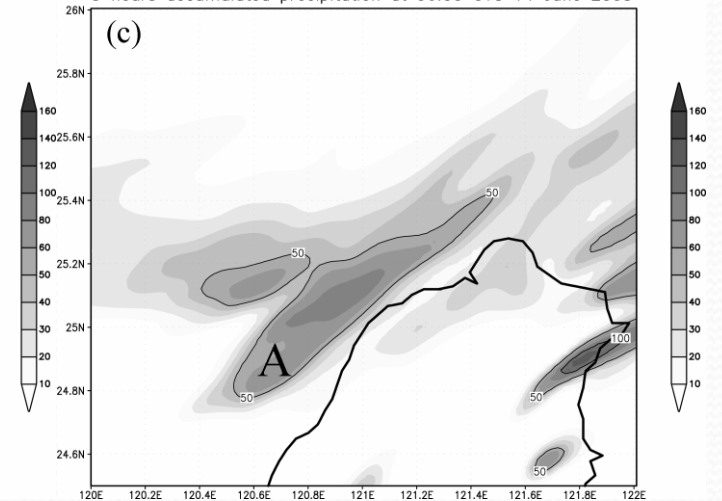
Vr0

RUN2
3 hours accumulated precipitation at 06:00 UTC 14 June 2003



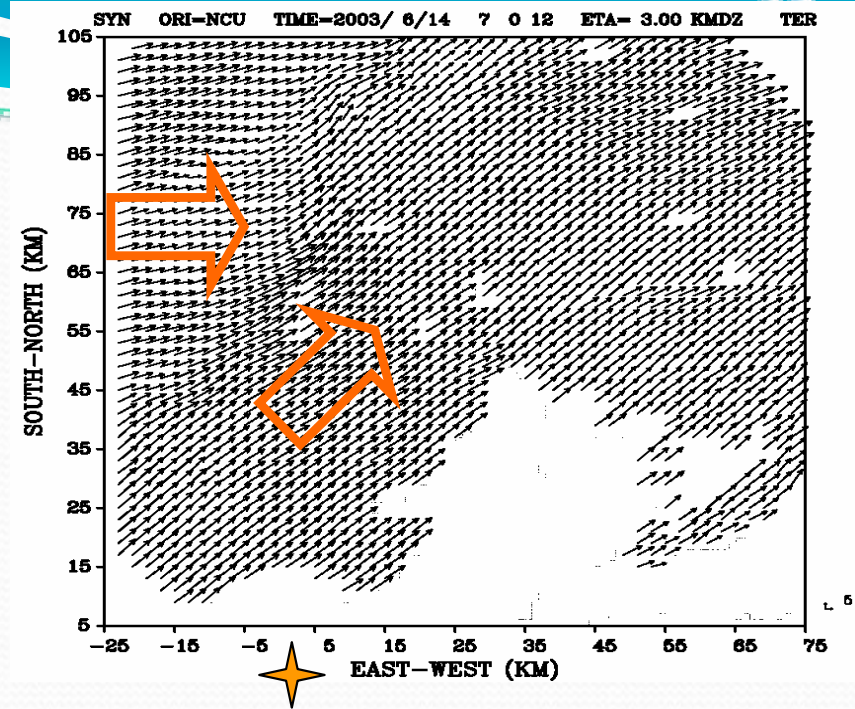
CYC

RUN3
3 hours accumulated precipitation at 06:00 UTC 14 June 2003



700hPa Horizontal wind & Dual-Radar retrieved Wind

The wind shear line of Vro and CYC are more closer the real location which is retrieved from dual-Doppler radar .

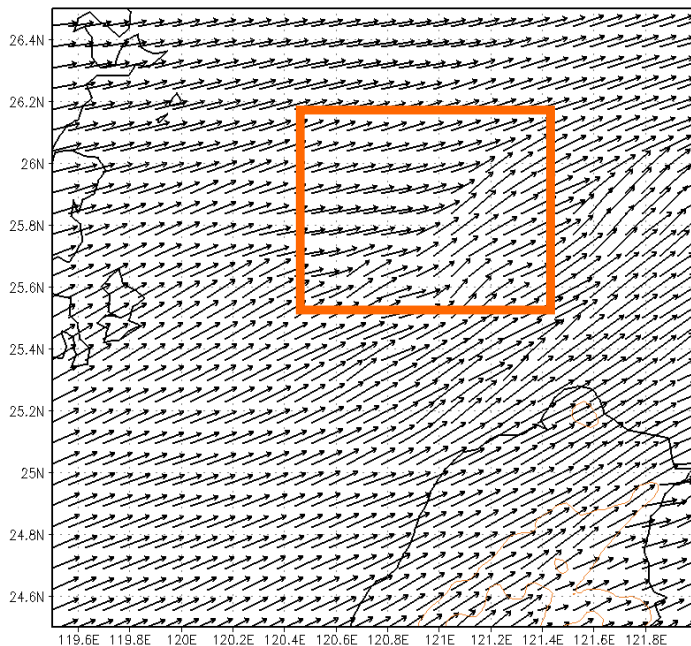


CTL

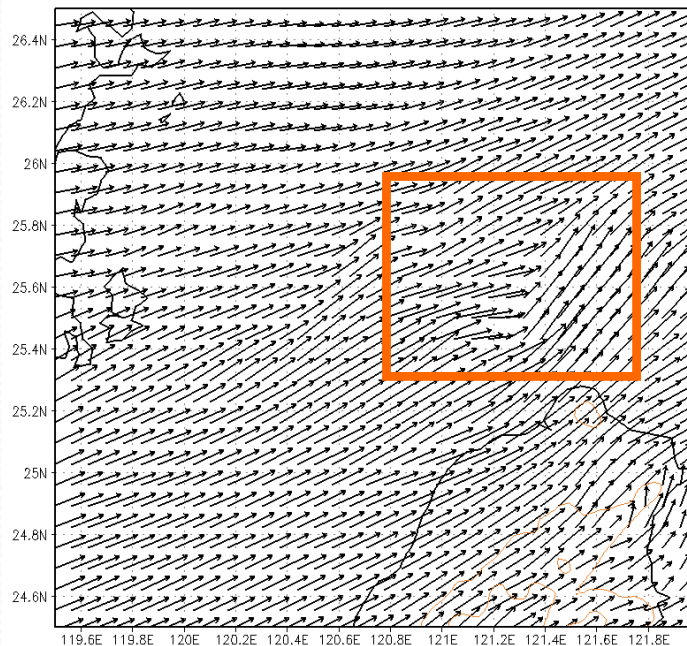
Vr0

CYC

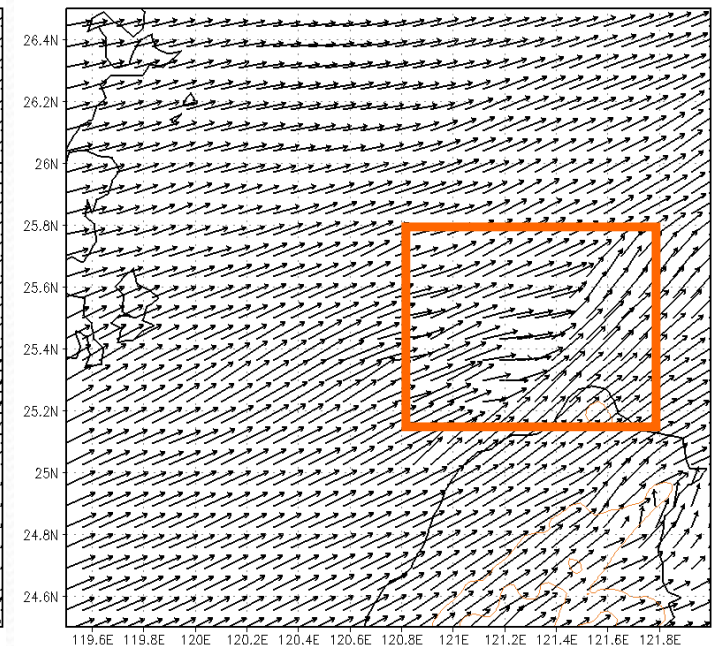
06Z14JUN2003 - Sim. 6hr (non-3DVAR)
700hPa Wind



06Z14JUN2003 - Sim. 6hr (Vr -3DVAR)
700hPa Wind

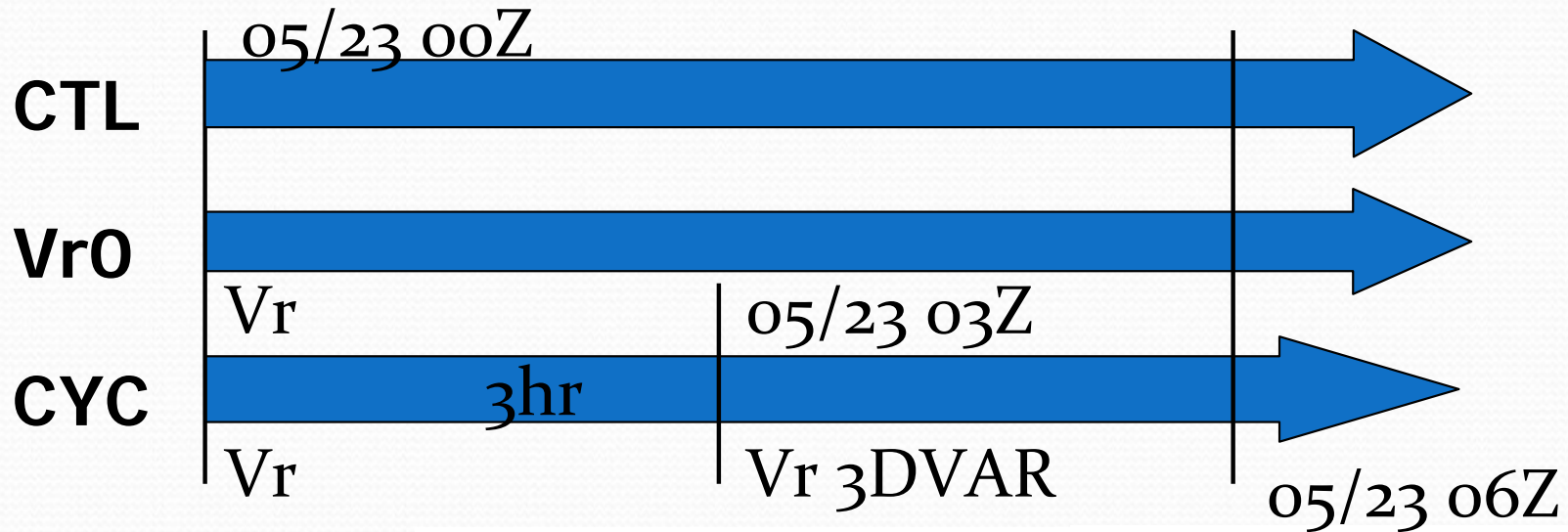


06Z14JUN2003 - Sim. 3hr (Vr -3DVAR)
700hPa Wind



Case 2: 2010/05/23

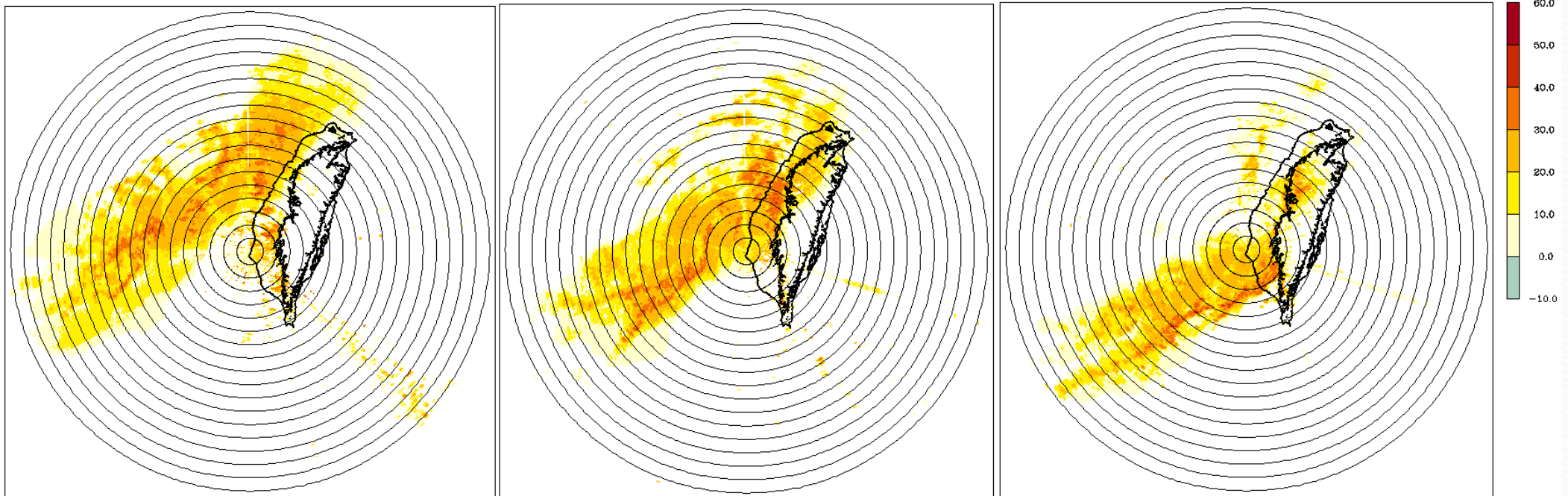
Assimilation and Simulation Processes



RCCG TIME=2010/ 5/23 0 5 37 DZ ANG= 0.50 PPI

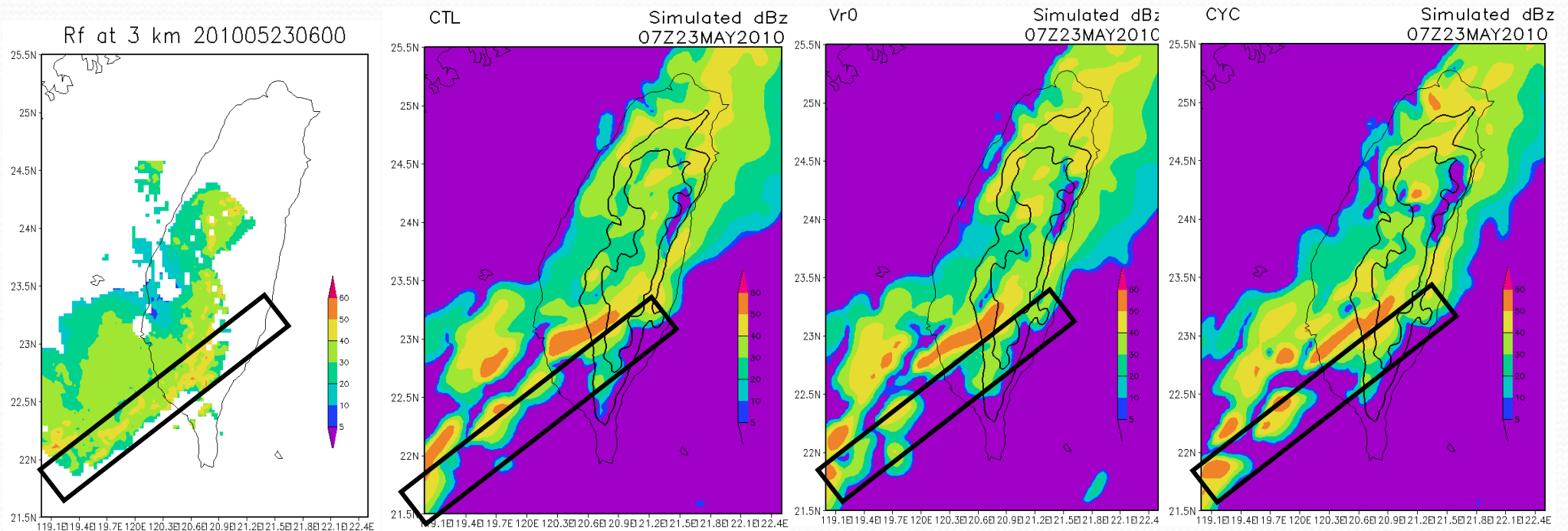
RCCG TIME=2010/ 5/23 2 58 6 DZ ANG= 0.50 PPI

RCCG TIME=2010/ 5/23 5 58 6 DZ ANG= 0.50 PPI



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.



OBS.

CTL

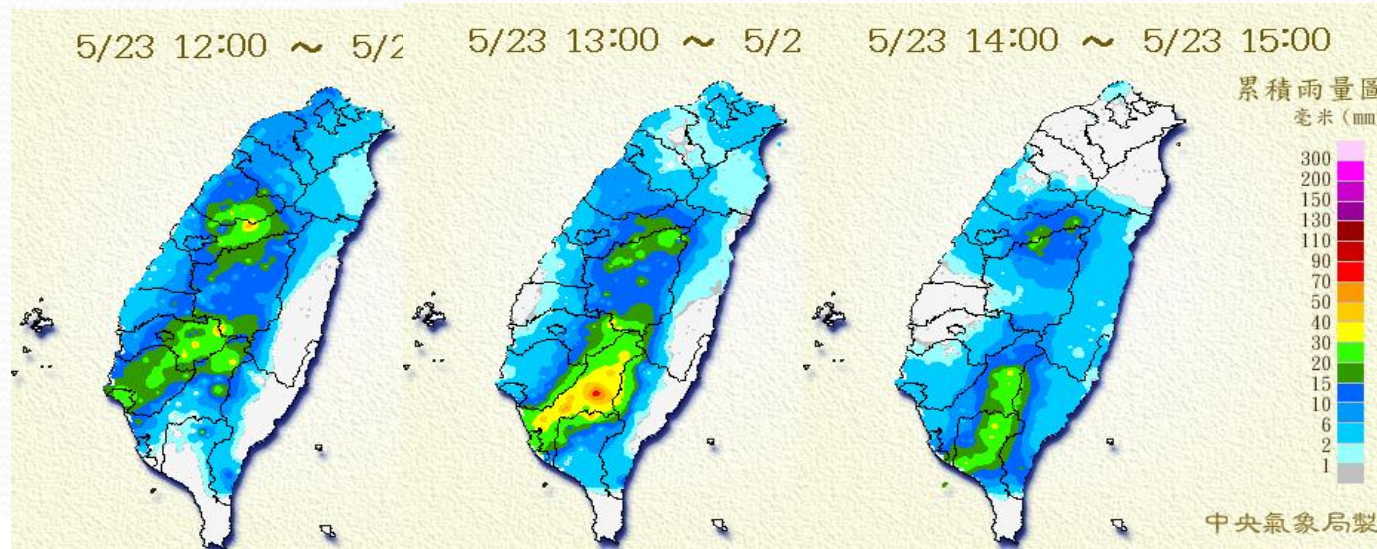
Vr0

CYC

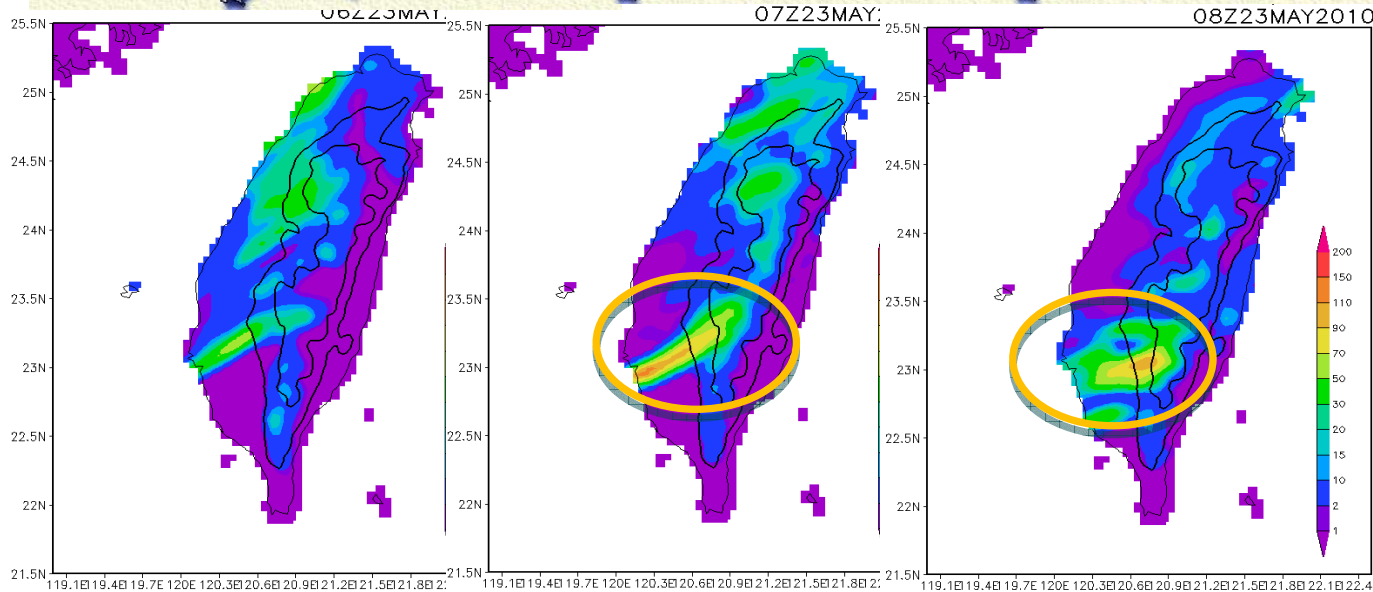
One hour accumulated rainfall

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

OBS.



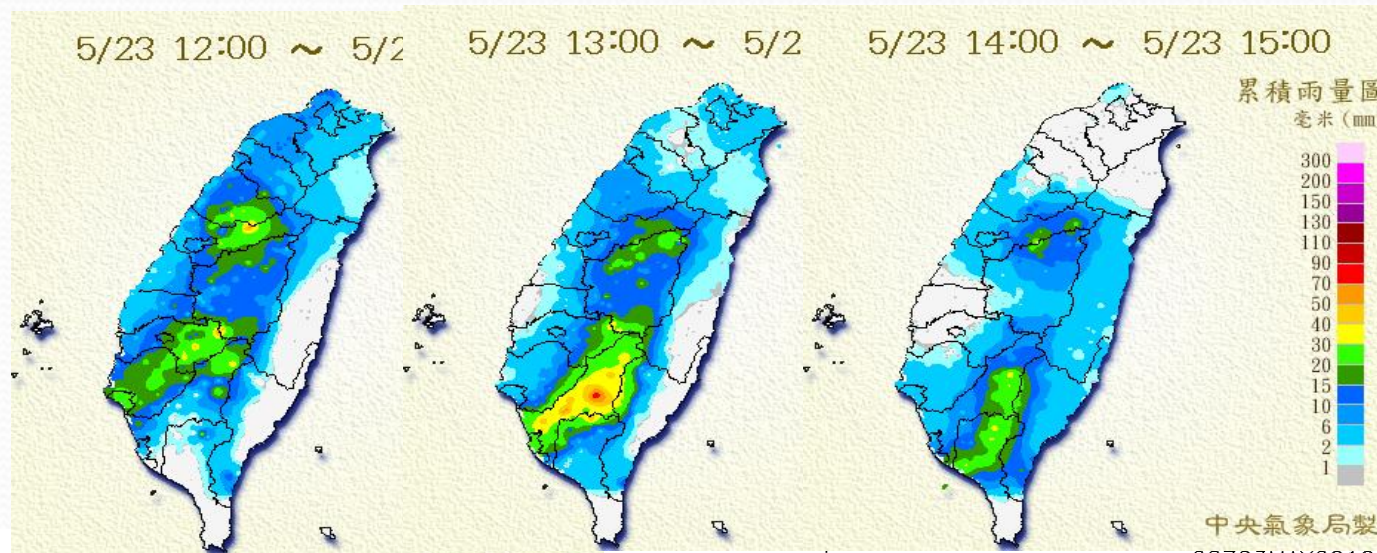
CTL



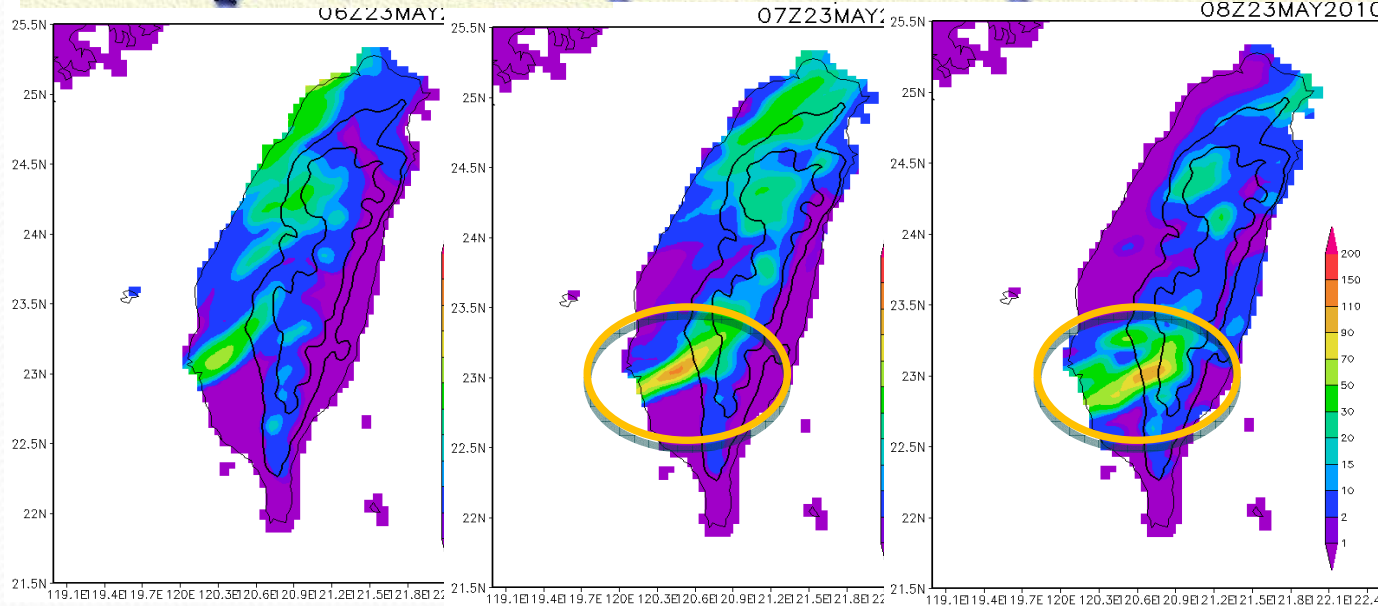
One hour accumulated rainfall

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

OBS.



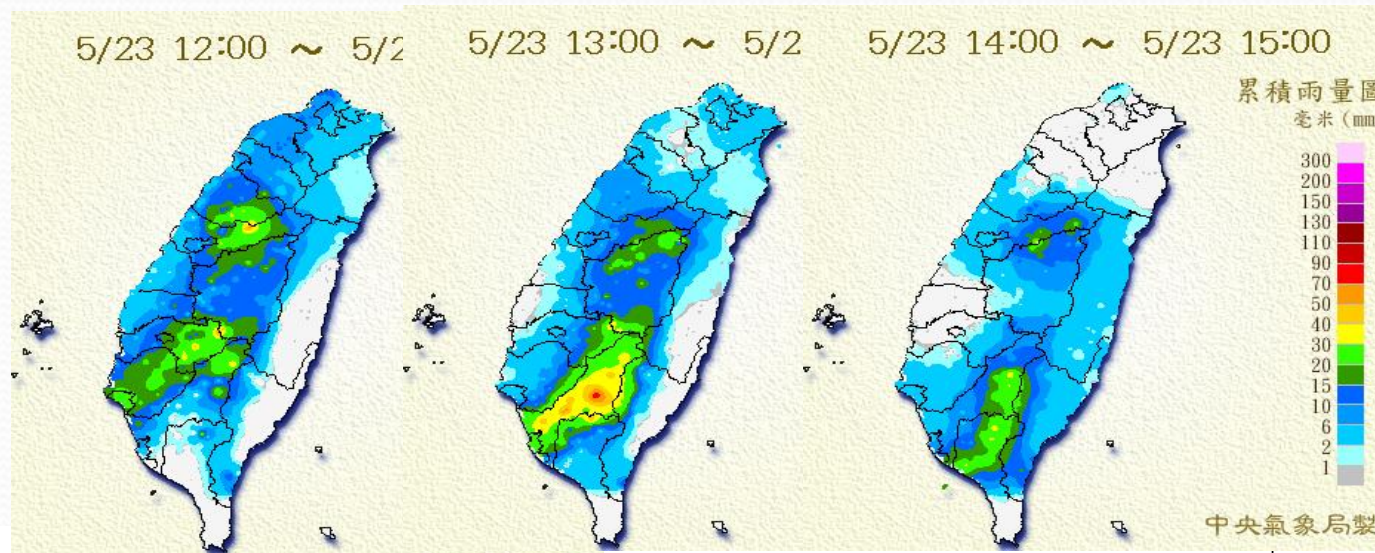
Vr0



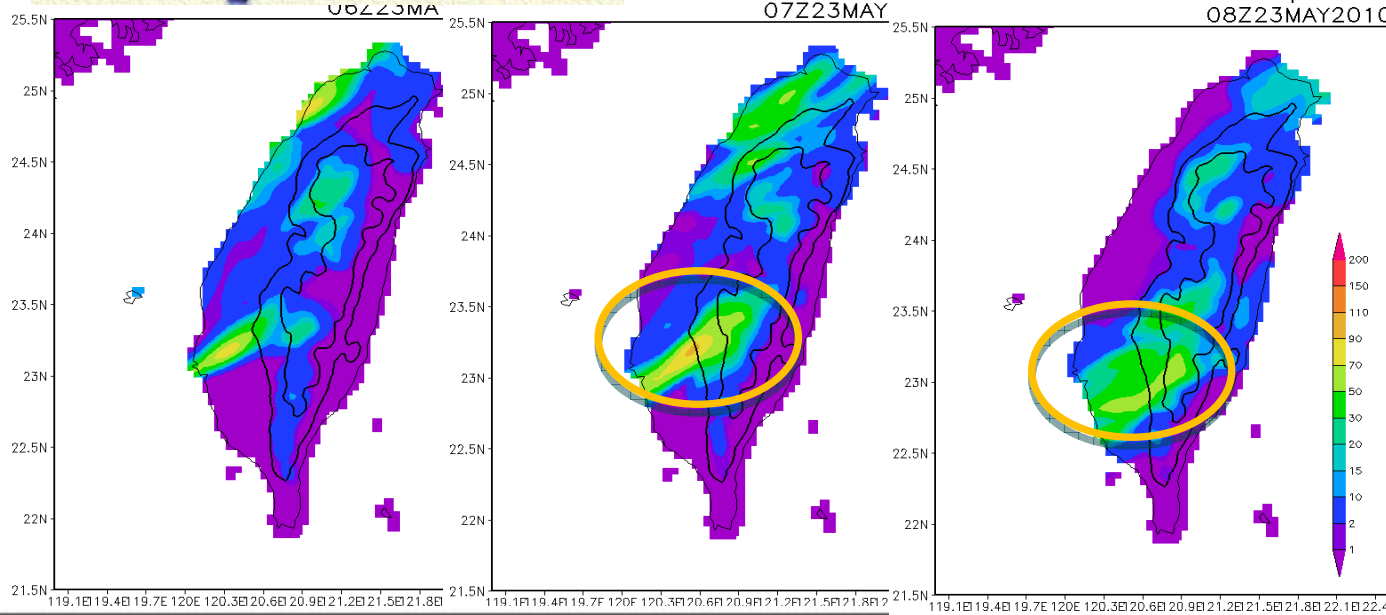
One hour accumulated rainfall

- decrease the rainfall overestimation of coast area at 07 UTC
- improve the rainfall overestimation at 08 UTC

OBS.



CYC



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 refractivity , 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