The preliminary results of a Doppler radar data 4DVAR experiment during 2008 SoWMEX IOP-8

Shao-Fan Chang¹, Sheng-Lun Tai¹, Yu-Chieng Liou¹, and Juanzhen Sun²

¹Institute of Atmospheric Physics, National Central University
²National Center for Atmospheric Research, Boulder, CO, USA

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Introduction

- Radar can provide high resolution radial wind and reflectivity data.
- Assimilate Taiwan radar data into a cloud model (VDRAS) to simulate the mesoscale convection system.
- Understand the potential of radar data assimilation system for quantitative precipitation forecast in Taiwan.
Outline

- 14 June 2008 case during IOP-8
- Experimental design
- Preliminary Results
  - Analysis
  - Forecast
- Summary and future work
The studied case:
JUN/14/2008 UTC 10:00 ~ UTC 14:00

MCS moving eastward

CV from Central Weather Bureau
Experimental design

Model

- **VDRAS** (*Variational Doppler Radar Assimilation System*)
  - Developed by Dr. Sun and Crook, NCAR
  - 4D-Var based radar data assimilation cloud model system
  - Warm-rain process only (microphysics parameterization)

  \[ q_r : \text{rain water} \]
  \[ q_c : \text{cloud water} \]
  \[ q_v : \text{vapor} \]

  - No terrain (Cartesian coordinate)
● **Domain**:  520km * 480km * 15km

● **Grid space**:  
  - Horizontal → 4km * 4km  
  - Vertical → 500m

● **Mesoscale background field**:  
  - Soundings at UTC1200  
  - Surface stations  
  - VAD
Mesoscale background wind in lowest level

Z=250m
• **Radar data**: Chi-Ku (RCCG) and Ken-Ting (RCKT) radars of Central Weather Bureau.

• **Quality Control**: Unfolding (RASTA, Dr. Jen-Hsin Teng, CWB)
  - Eliminate ground clutter

  • Criteria for eliminating ground clutter
    - Reflectivity > 30 dBZ
    - Radial Velocity: +2~-2 m/s
Chi-Ku radar (RCCG) first elevation

Reflectivity

Ground Clutter

Radial wind

After eliminating ground clutter
3 cycles: each assimilate five to six volume scan from 2 radars

- Assimilation window (15 minutes)
- Forecast interval (5 minutes)

1016 1024 1031 (UTC)
1017

Comparison
2 hr forecast
Preliminary Results

Analysis from VDRAS
Lowest level at UTC 1124

Composited radar reflectivity
Analysis from VDRAS in 11th level

Radial wind projected to SPOL radar site at UTC 1124

Radial wind observed by SPOL at UTC 1122
Forecast from 1124 to 1324 UTC

Composited radar reflectivity
One hour accumulated precipitation

Observation

6/14 UTC 1130~1230

Precipitation produced by terrain blocking

Google
Summary

- Use VDRAS to assimilate Taiwan radar data for simulating the mesoscale convection system.

- MCS can be retrieved through assimilating radar data.

- VDRAS couldn’t perform terrain effect for Taiwan case.
Future work: combine the VDRAS with WRF to improve terrain effect

- WRF can take into account the terrain.
- WRF provides the boundary conditions and background field to VDRAS.
- VDRAS assimilates the observations, and the resulting analysis fields can be fed back to WRF for longer forecast.
The end
Thanks for your attention.
Forecast from 1124 to 1324 UTC

Composited radar reflectivity