

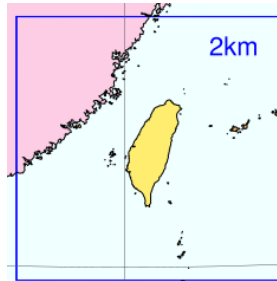
# 中央氣象局防災降雨雷達 資料同化效益之初步評估

蔡雅婷、洪景山、張保亮

20201015

# Motivation

## 區域對流尺度資料同化系統



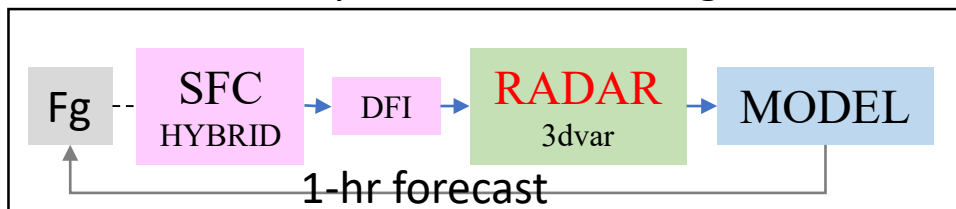
### Configuration

- 2-km resolution 、vertical 52 Levels
- Full cycle , **Hourly Update** , 提供未來13小時預報。

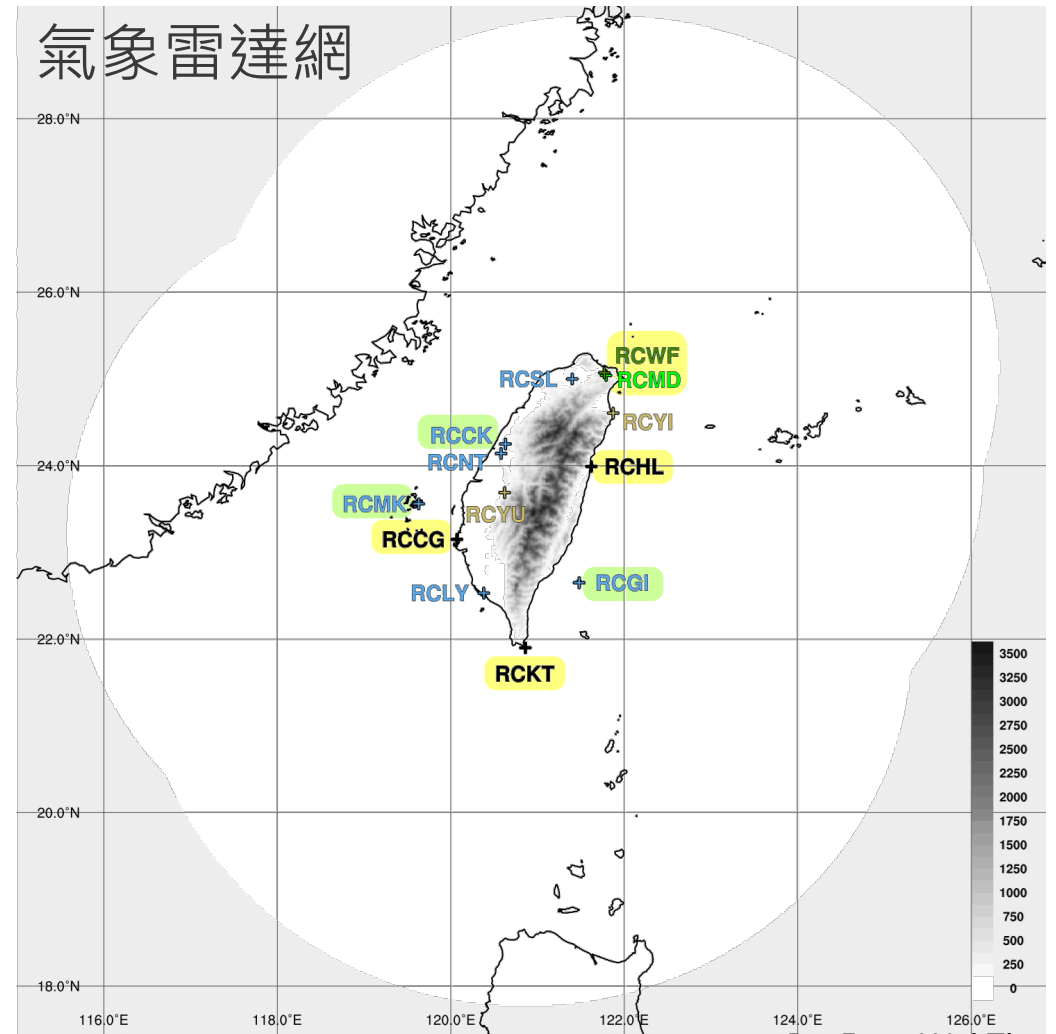


### DA strategy

- Hybrid 3DEnVAR, with ensemble BE from 32-member 2-km LETKF forecast
- Radial wind, correct U, V
- Reflectivity, correct Qr, Qs, Qg

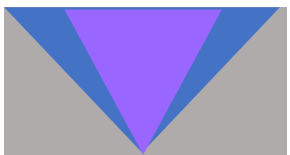
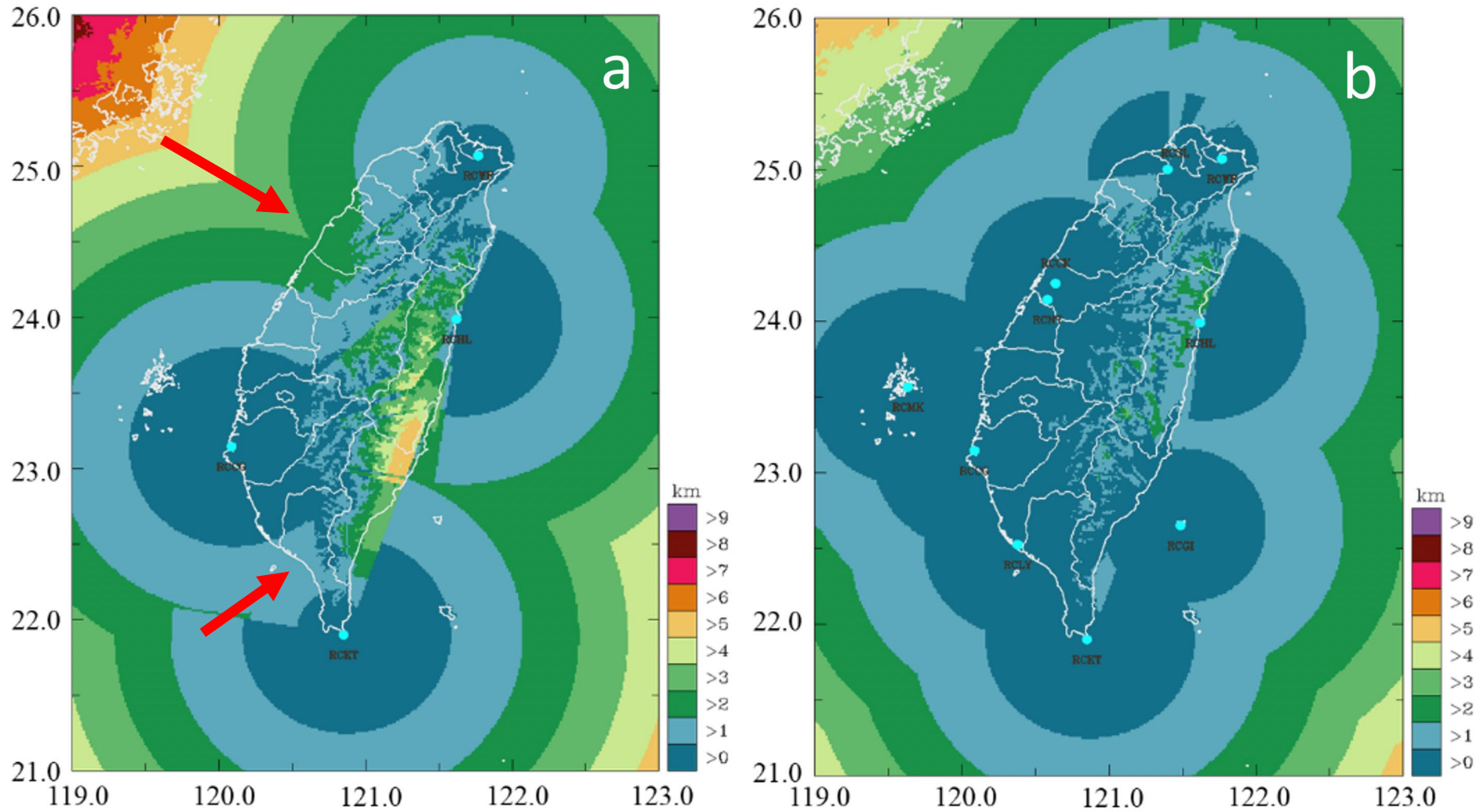


## 氣象雷達網



- By Fang Wei Ting

# 氣象雷達網 - 觀測最低高度

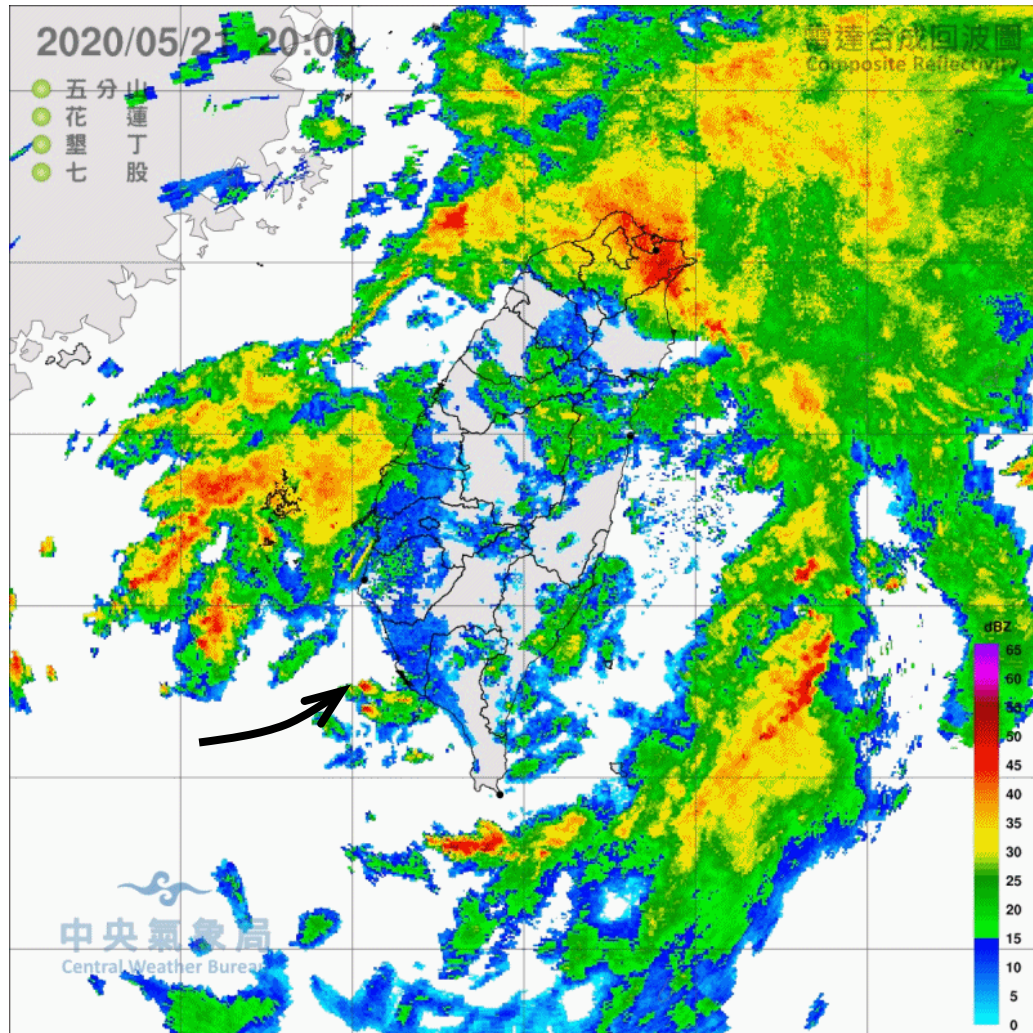


(Chang et al, 2020)

An Operational Multi-Radar Multi-Sensor QPE System in Taiwan. *Bull. Amer. Meteor. Soc.* 1–56.

# Case Overview and Design of Experiments

Case: 20200521 1200 ~ 20200522 1100 UTC



wCband	With RCLY and RCNT
w/oCband	Without RCLY and RCNT

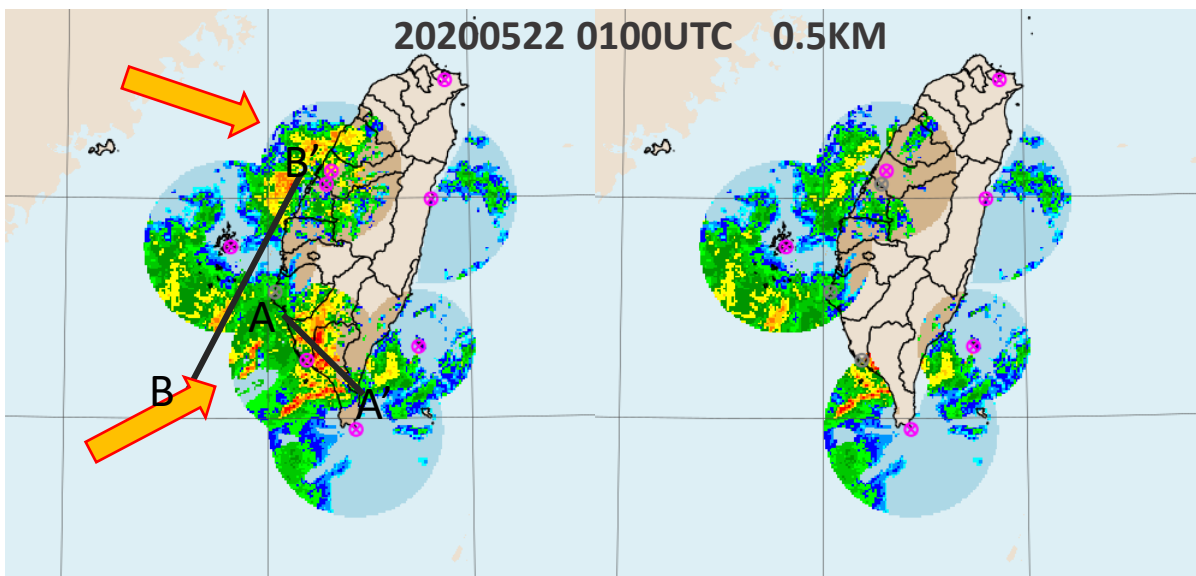
- 1) 單一個案分析
- 2) 梅雨個案分析

# Case study

## 1) 單一個案分析

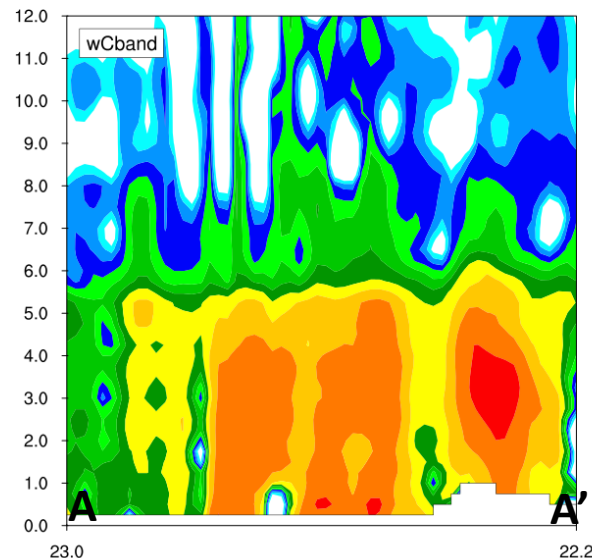
### wCband vs. w/oCband

20200522 0100UTC 0.5KM

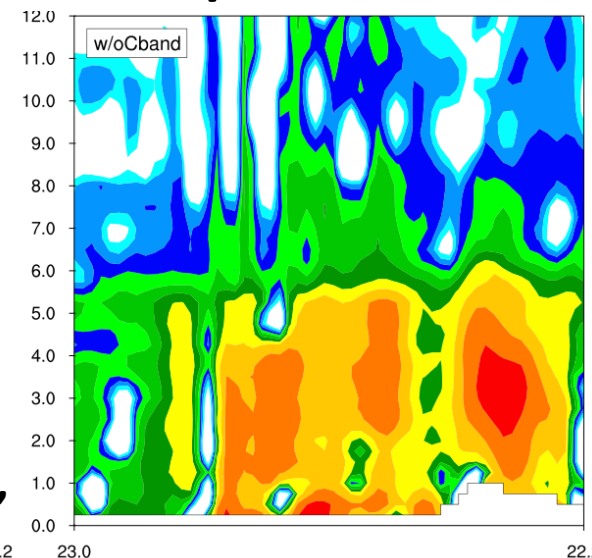


加入降水雷達可填補低層雷達觀測資料不足區域，

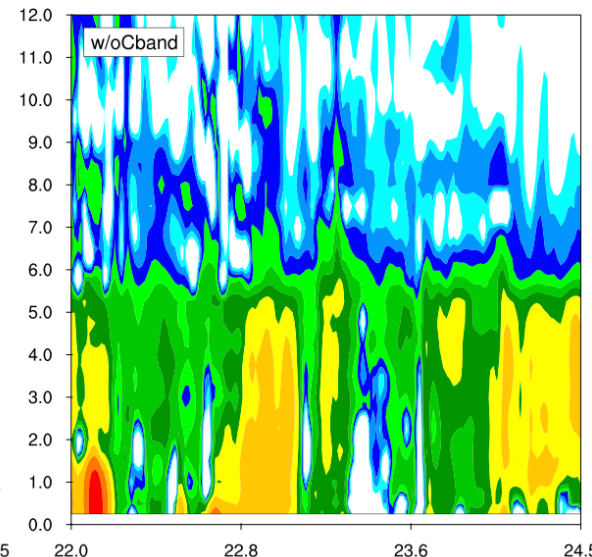
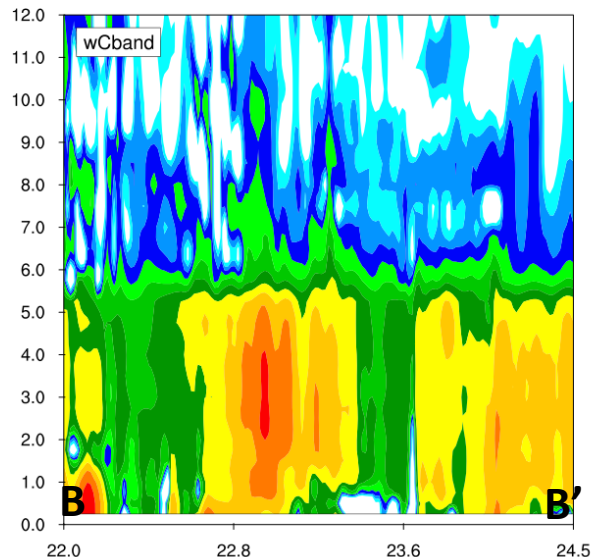
### wCband



### w/oCband

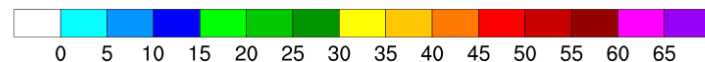


Reflectivity [dBZ]: Initial at 20052201



Latitude

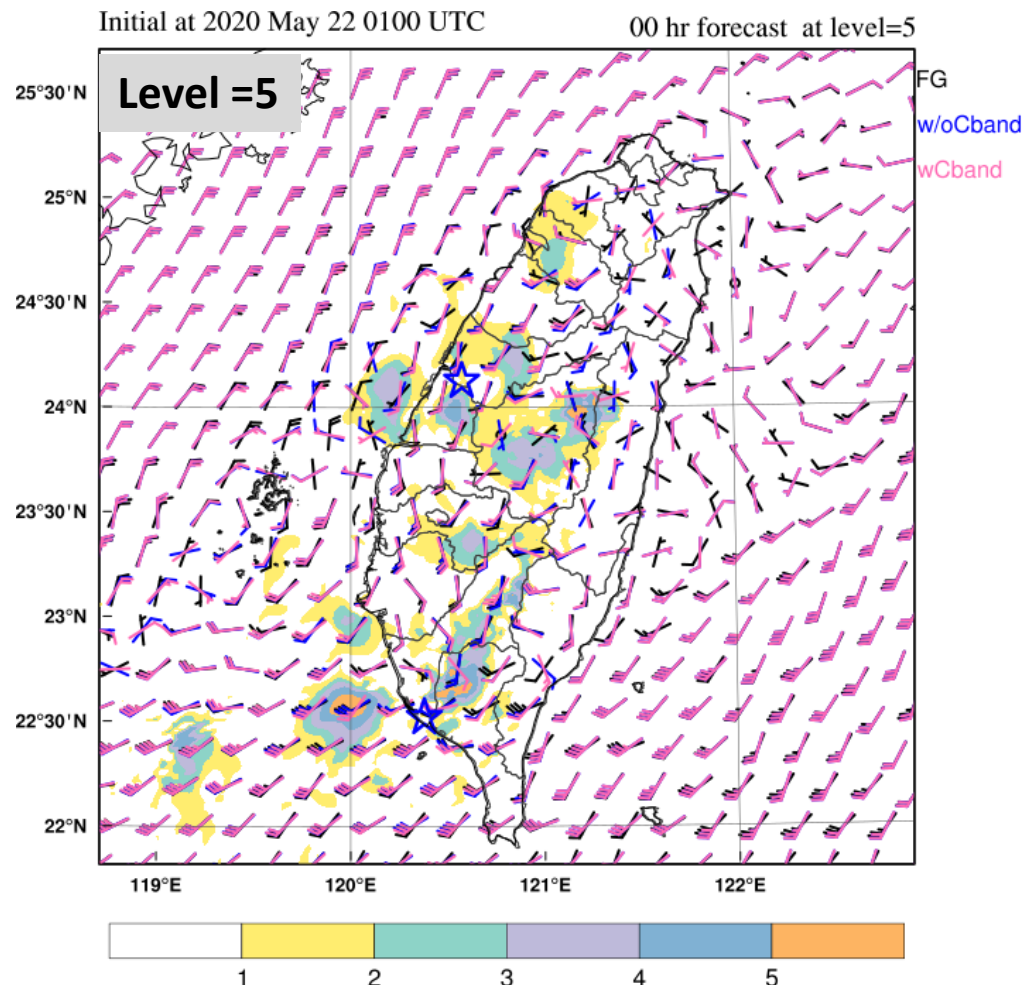
Latitude



# Case study

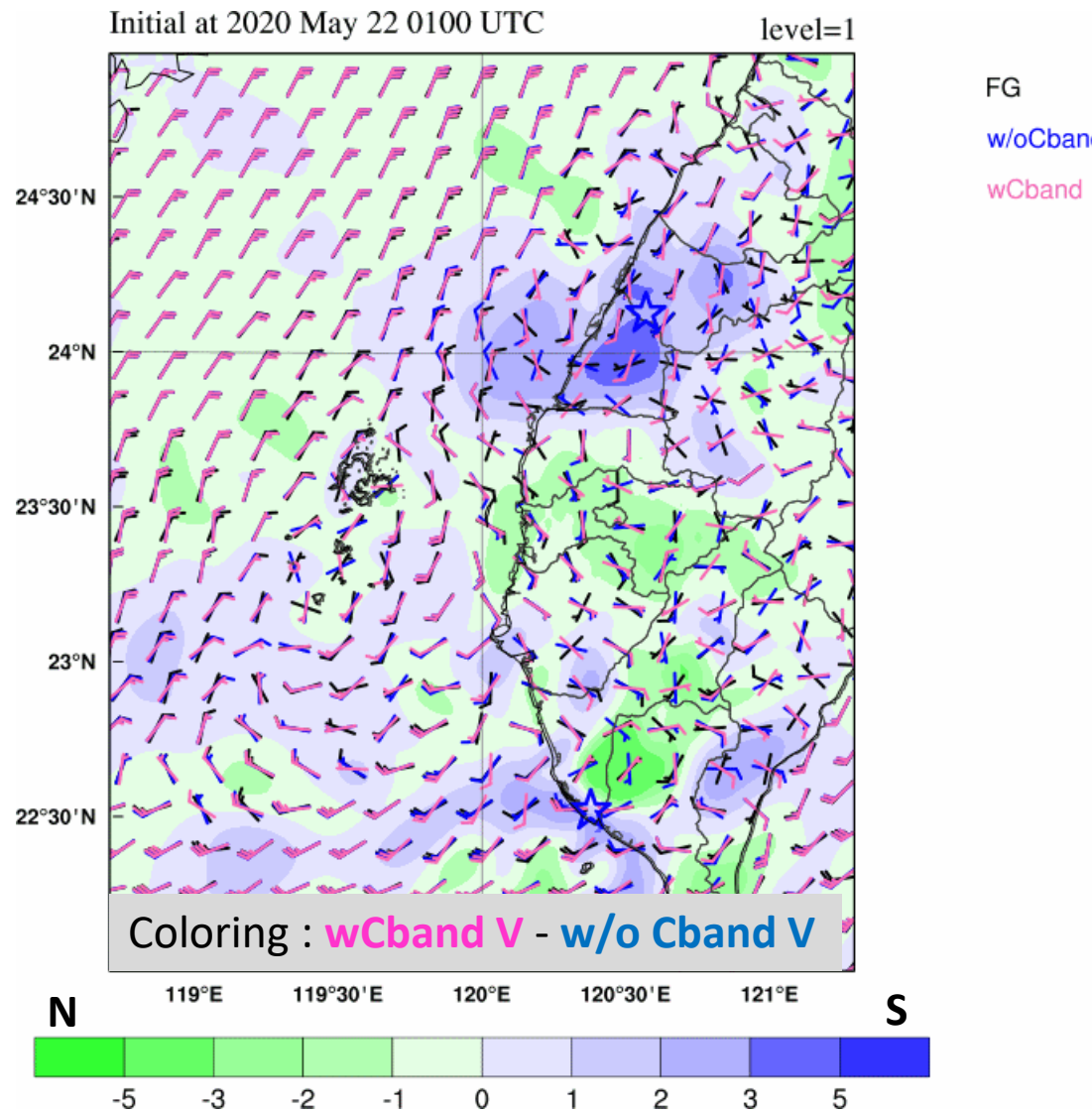
風標: FG w/o Cband wCband

## 1) 單一個案分析



Coloring: 風速增量差值

$$| [(wCband \text{ Ana.} - FG) - (w/oCband \text{ Ana.} - FG)] |$$



Coloring: wCband V - w/o Cband V

藍色表示wCband南向分量越大

# Case study

## 1) 單一個案分析

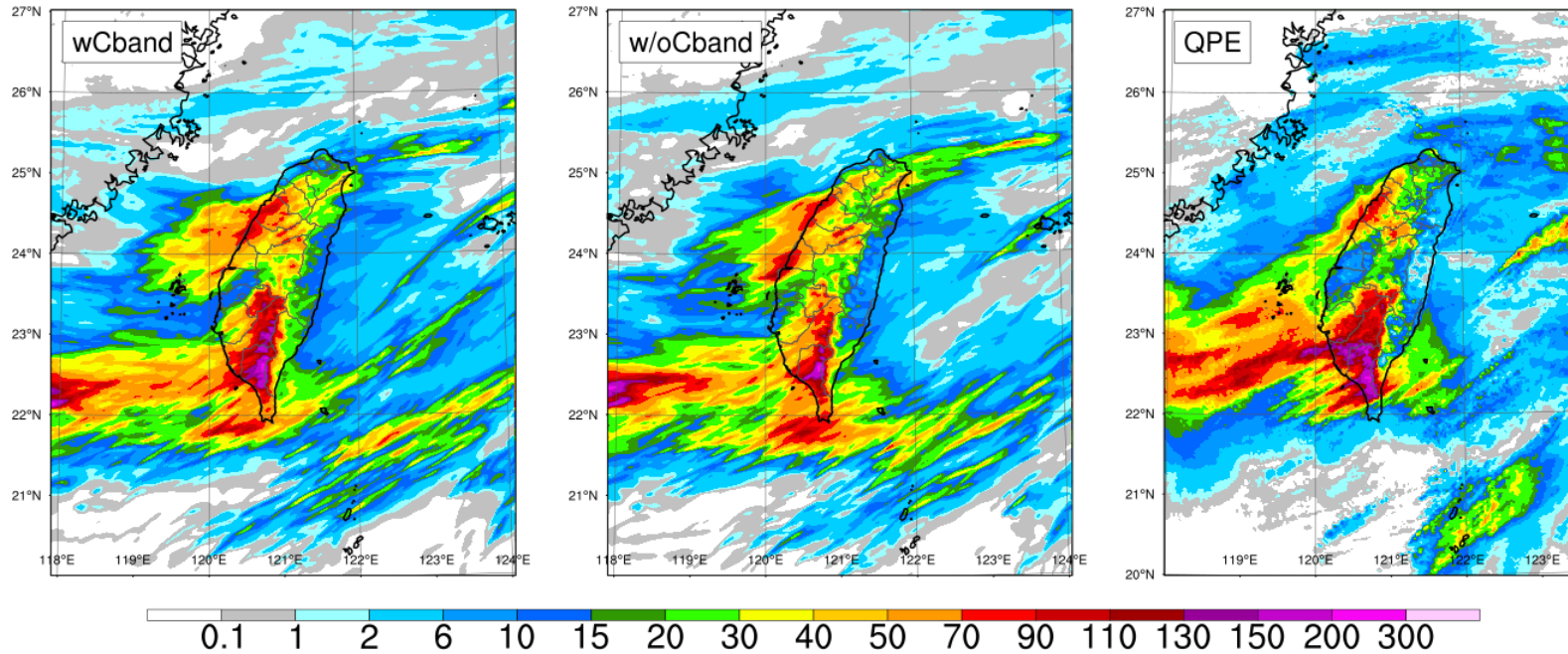
wCband

w/oCband

OBS

6-hr Accu. Rainfall (mm) @ 00 - 06 hr forecast

Initial at 0100 UTC 22 May 2020 / Valid at 2020052201 - 2020052207 UTC



wCband 相對於w/oCband實驗而言:

在強對流區有較強的南向分量，預報累積降雨亦顯示，能改進模式雨量預報結果

# Case study

## 1) 梅雨個案分析

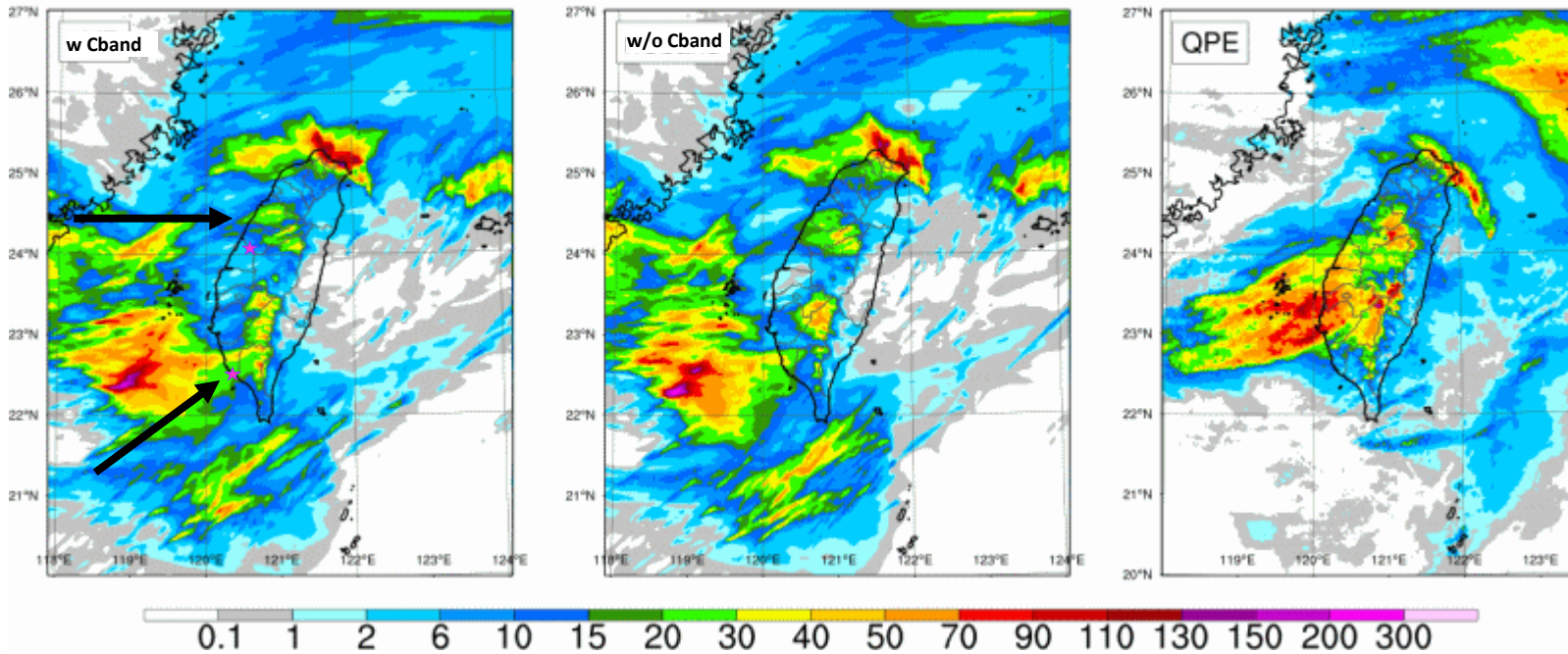
wCband

w/oCband

OBS

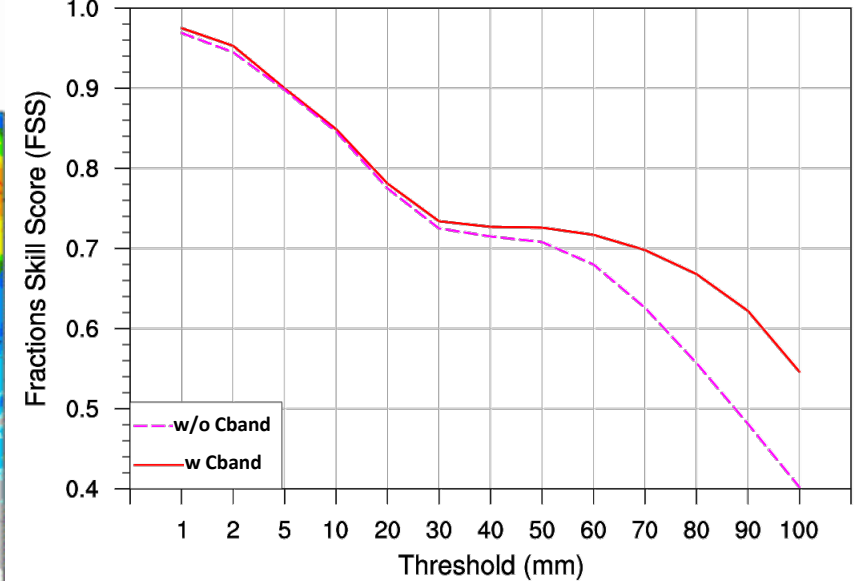
6-hr Accu. Rainfall (mm) @ 00 - 06 hr forecast

Initial at 1200 UTC 21 May 2020 / Valid at 2020052112 - 2020052118 UTC



6 hr Accu. Rainfall (mm)  
Initial from 20052112 to 20052211

00 - 06 hr forecast  
(radius: 8 km)

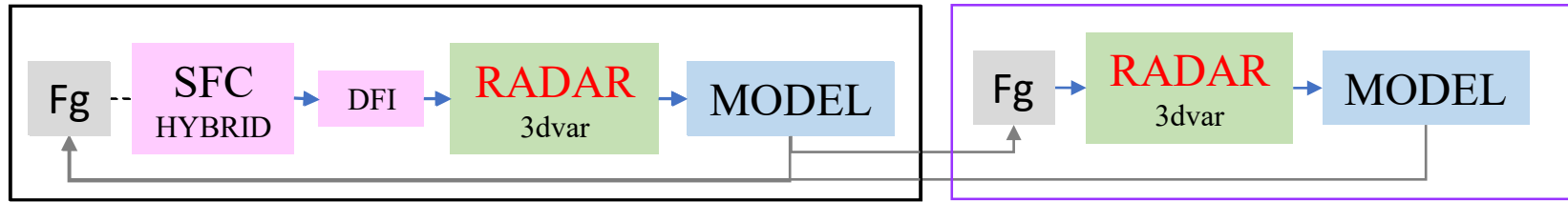


加入降雨雷達，模式可獲得較佳的風場與水氣場資訊，進而改善模式雨量預報

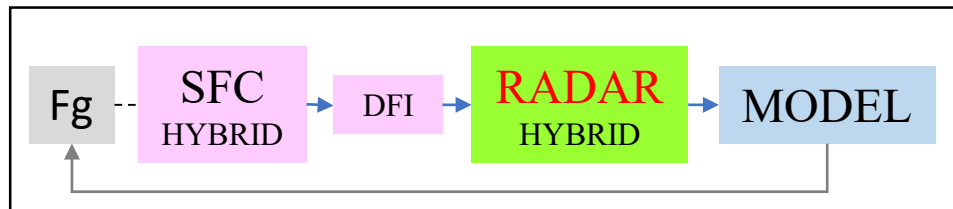


# Challenges and Future work

## 區域對流尺度資料同化系統



1. 提高雷達資料同化頻率



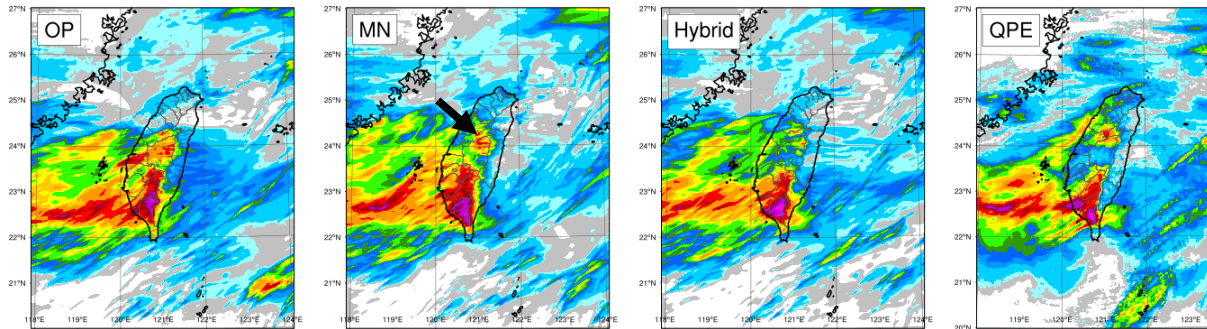
2. 將雷達資料同化策略由3dvar更新為Hybrid 3DEnVar

# Challenges and Furture work

**OP MN Hybrid OBS**

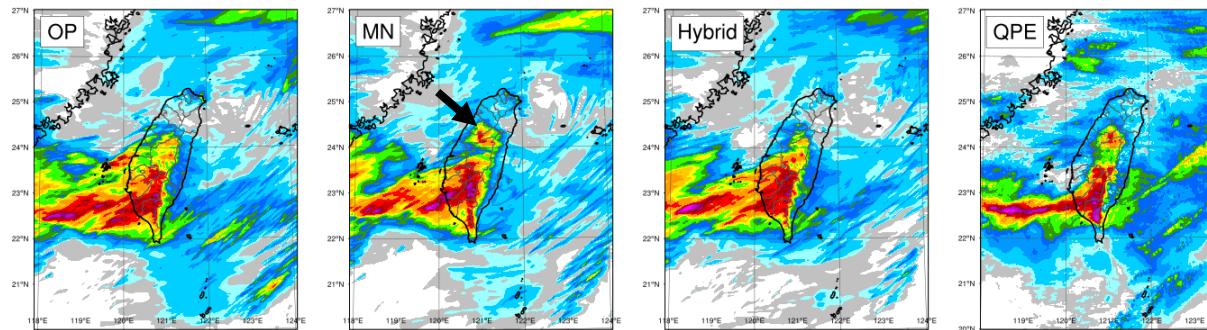
**6-hr Accu. Rainfall (mm) @ 00 - 06 hr forecast**

Initial at 2100 UTC 21 May 2020 / Valid at 2020052121 - 2020052203 UTC



**6-hr Accu. Rainfall (mm) @ 00 - 06 hr forecast**

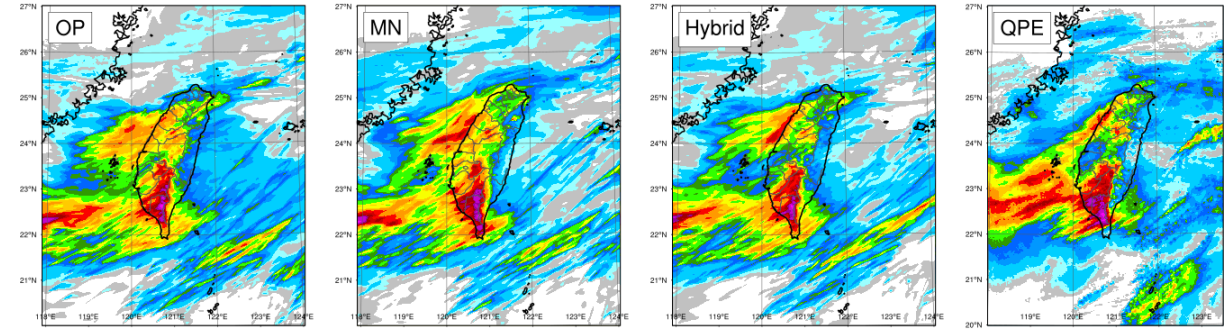
Initial at 1800 UTC 21 May 2020 / Valid at 2020052118 - 2020052200 UTC



**OP MN Hybrid OBS**

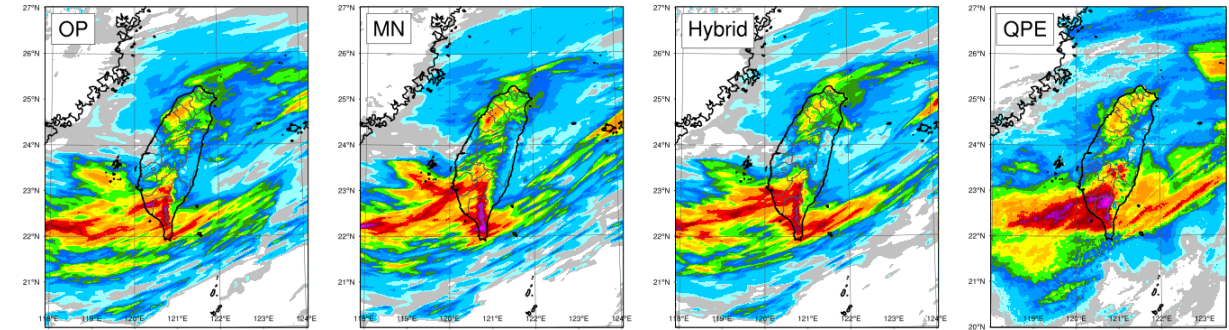
**6-hr Accu. Rainfall (mm) @ 00 - 06 hr forecast**

Initial at 0000 UTC 22 May 2020 / Valid at 2020052200 - 2020052206 UTC

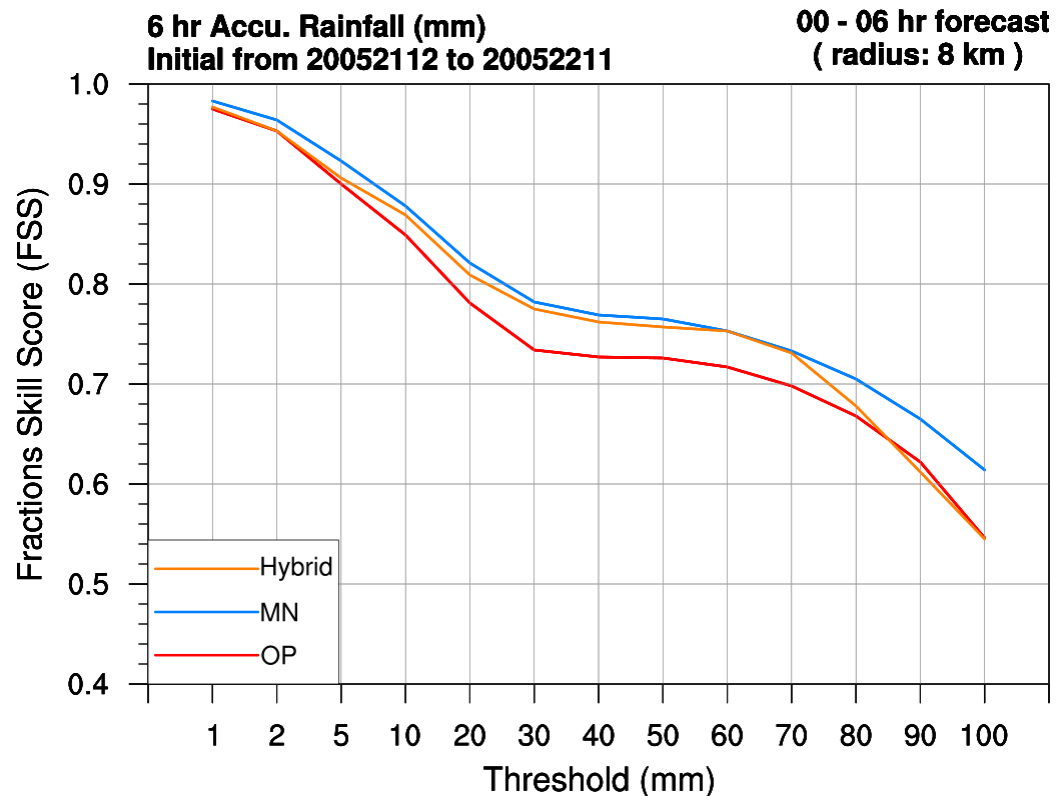


**6-hr Accu. Rainfall (mm) @ 00 - 06 hr forecast**

Initial at 0600 UTC 22 May 2020 / Valid at 2020052206 - 2020052212 UTC



# Challenges and Future work



[OP vs. MN] & [OP vs. Hybrid]

模式皆可改善模式雨量預報

## Future work

- 30分鐘更新策略，也將RADAR DA更新為Hybrid 3DEnVar
- 因應作業需求，調整資料同化策略與加速DA流程，提升電腦計算時間，以提供作業使用

# Summary

- 加入降水雷達可填補低層雷達觀測資料不足區域，模式可獲得較佳的風場與水氣場資訊，進而改善模式雨量預報。
  - 期待未來模組再加入RCSL、RCYI、RCYU 雷達資料，以進一步提升對流尺度模式預報系統降雨預報能力。
- 提高雷達資料同化頻率 與 雷達資料同化方法採用Hybrid 3DEnVar策略，皆可有效提升模式降雨預報能力。
  - 如何有效結合高時空解析度雷達資料與預報模式，仍待更多的評估與測試。