

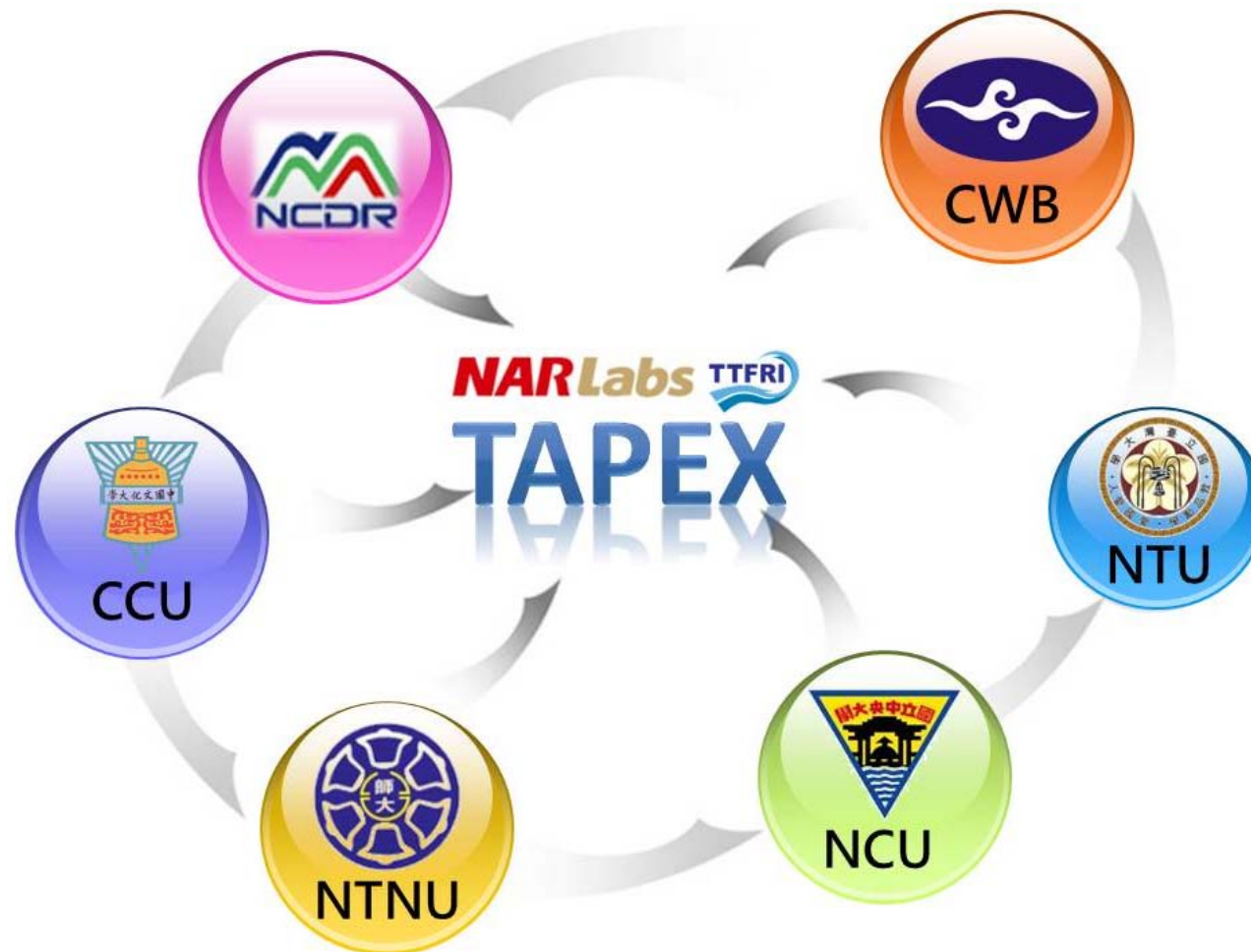
Hurricane WRF模式 2013年於西北太平洋之預報表現評估

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Der – Song Chen² Jian – Wen Bao³ Cheng – Shang Lee¹*

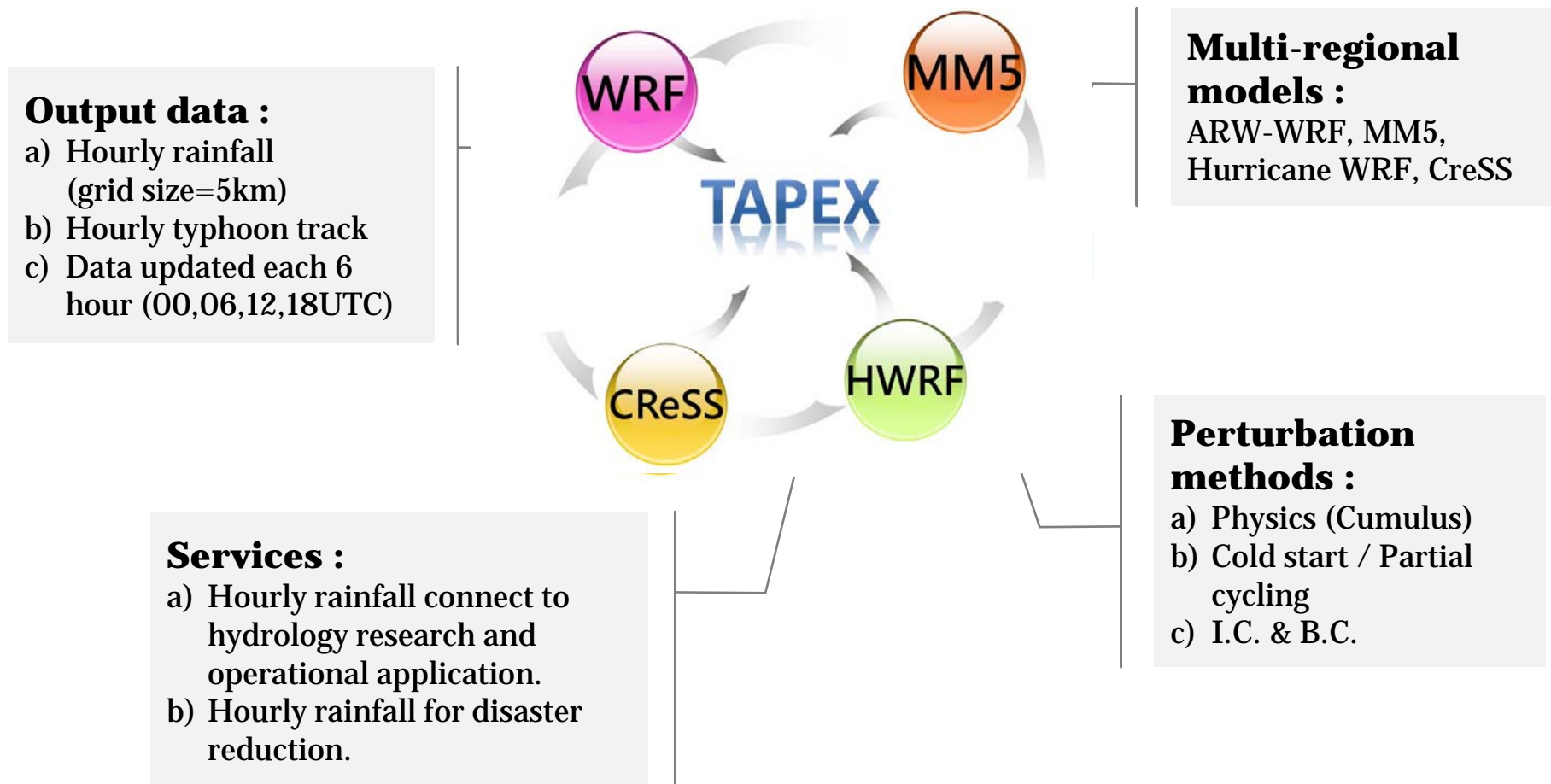
*Taiwan Typhoon and Flood Research Institute¹
Central Weather Bureau²
NOAA Earth System Research Laboratory³*

Introduction of TAPEX

TAiwan cooperative **P**recipitation **E**nsemble forecast **e**Xperiment



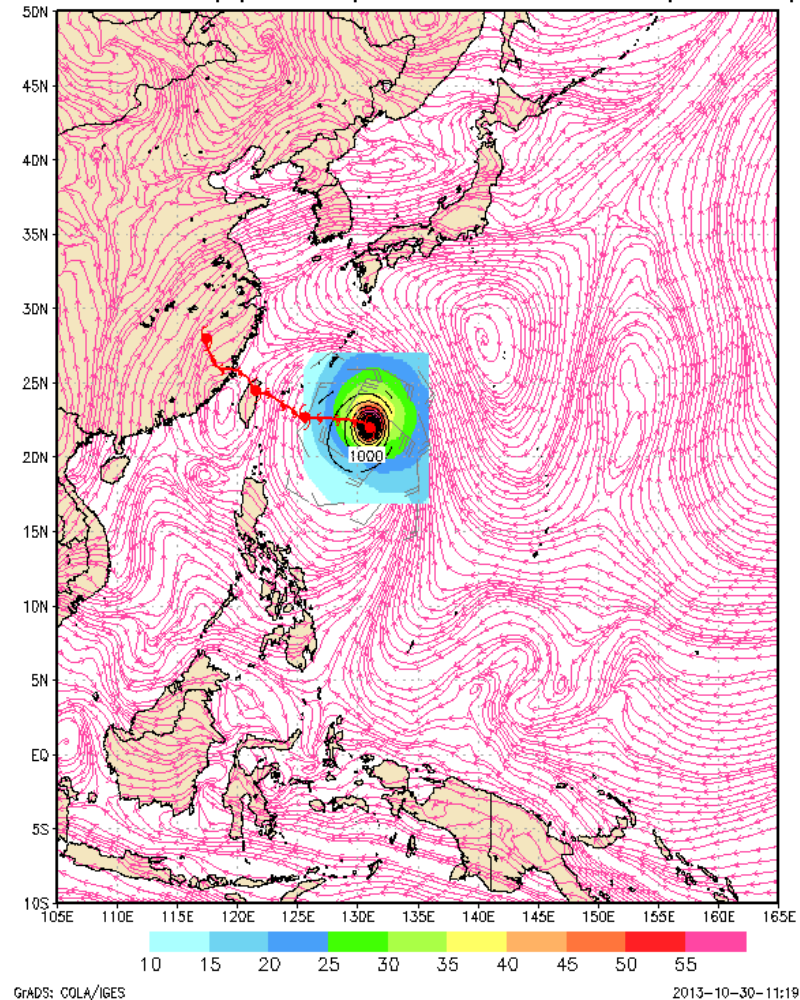
Specialties in TAPEX?



Hurricane WRF

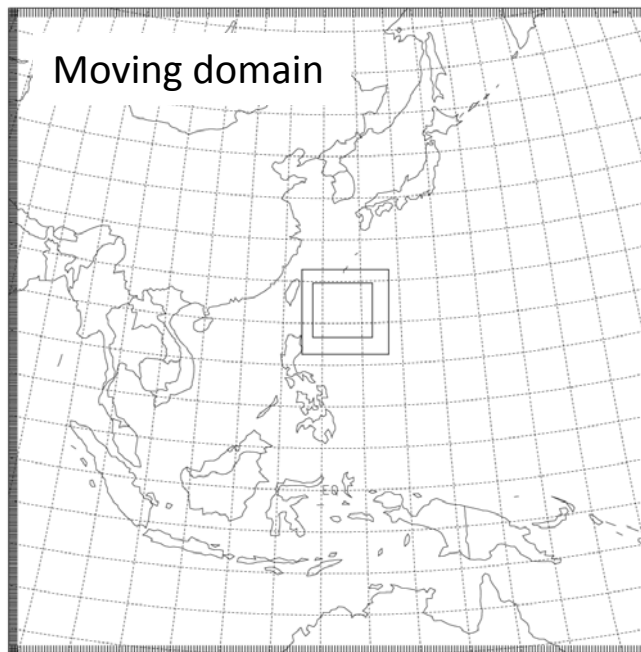
- The Weather Research and Forecast (WRF) system for hurricane prediction (HWRF) is **an operational model** implemented at the National Weather Service (**NWS**)/National Centers for Environmental Prediction (**NCEP**) to provide numerical guidance to the National Hurricane Center for the forecasting of tropical cyclones' track, intensity, and structure.
- **TTFRI and CWB** collaborated with **ESRL/NOAA** and had successfully implemented the Hurricane WRF(HWRF) model in Taiwan since 2012. Operational version from **EMC/NCEP**.
- TTFRI had added 2 HWRF members into Taiwan Cooperative Precipitation Ensemble Forecast Experiment (TAPEX) **from 2012 to 2013** .

Strm, windsp(shaded) at 850hPa & SLP(contour)

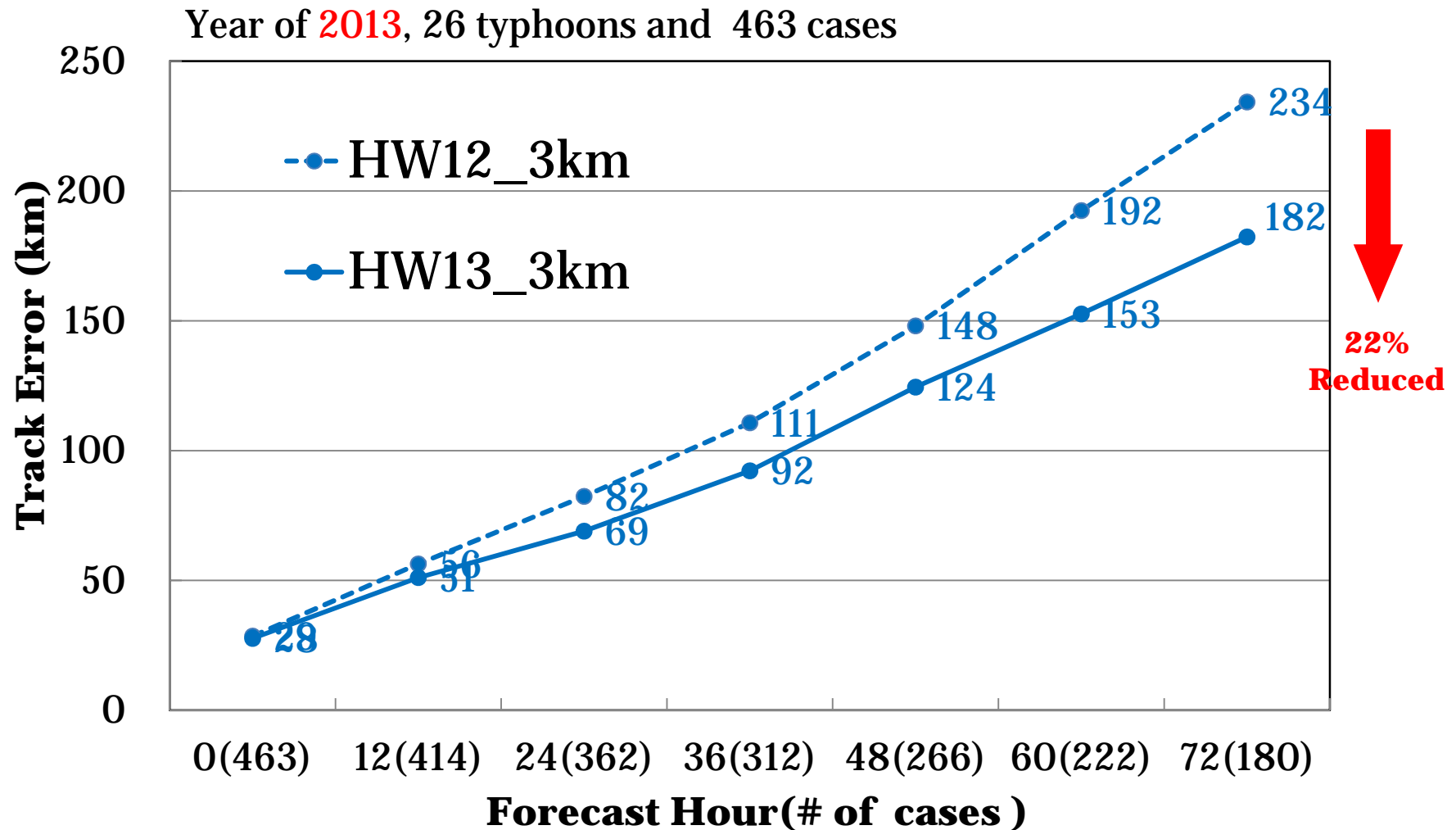


Configuration of HWRF

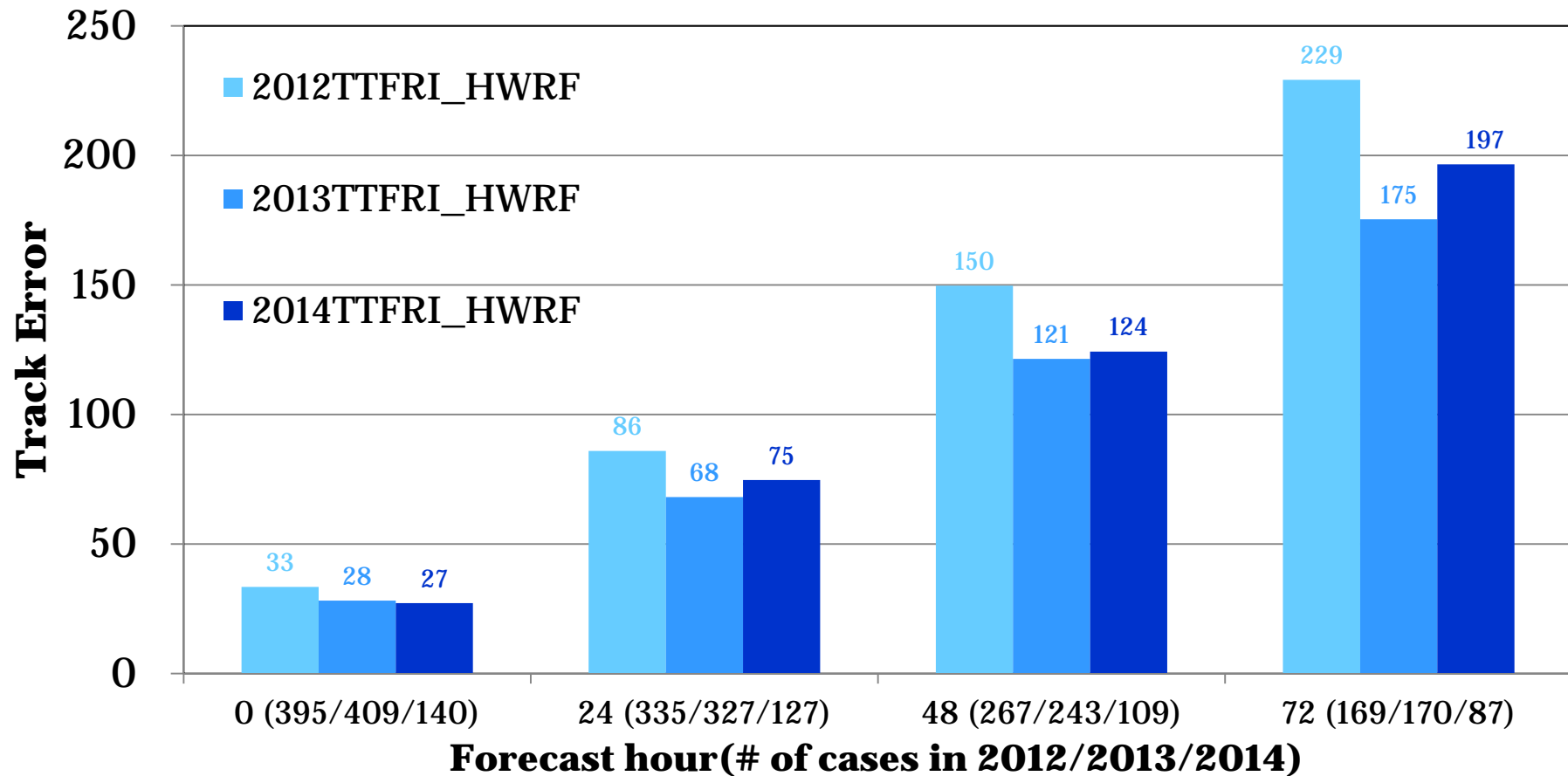
Experiment	cold/warm	analysis	bogus	Cu.	M.P.	PBL	Note
HWRF	cold start	NODA	HWRF bogus	SAS	Ferrier	NCEP GFS	43levels; P_top 50hPa; 2 way; 27/9/3km ; moving ; no ocean couple & no GSI; IC&BC from NCEP T574 atmospheric spectral data and include NCEP 0.5deg data.
HWRF_T	cold start	NODA	no bogus	SAS	Ferrier	NCEP GFS	43levels; P_top 50hPa; 1 way; 45/15/5km ; static ; no ocean couple & no GSI; IC&BC from NCEP 0.5deg data.



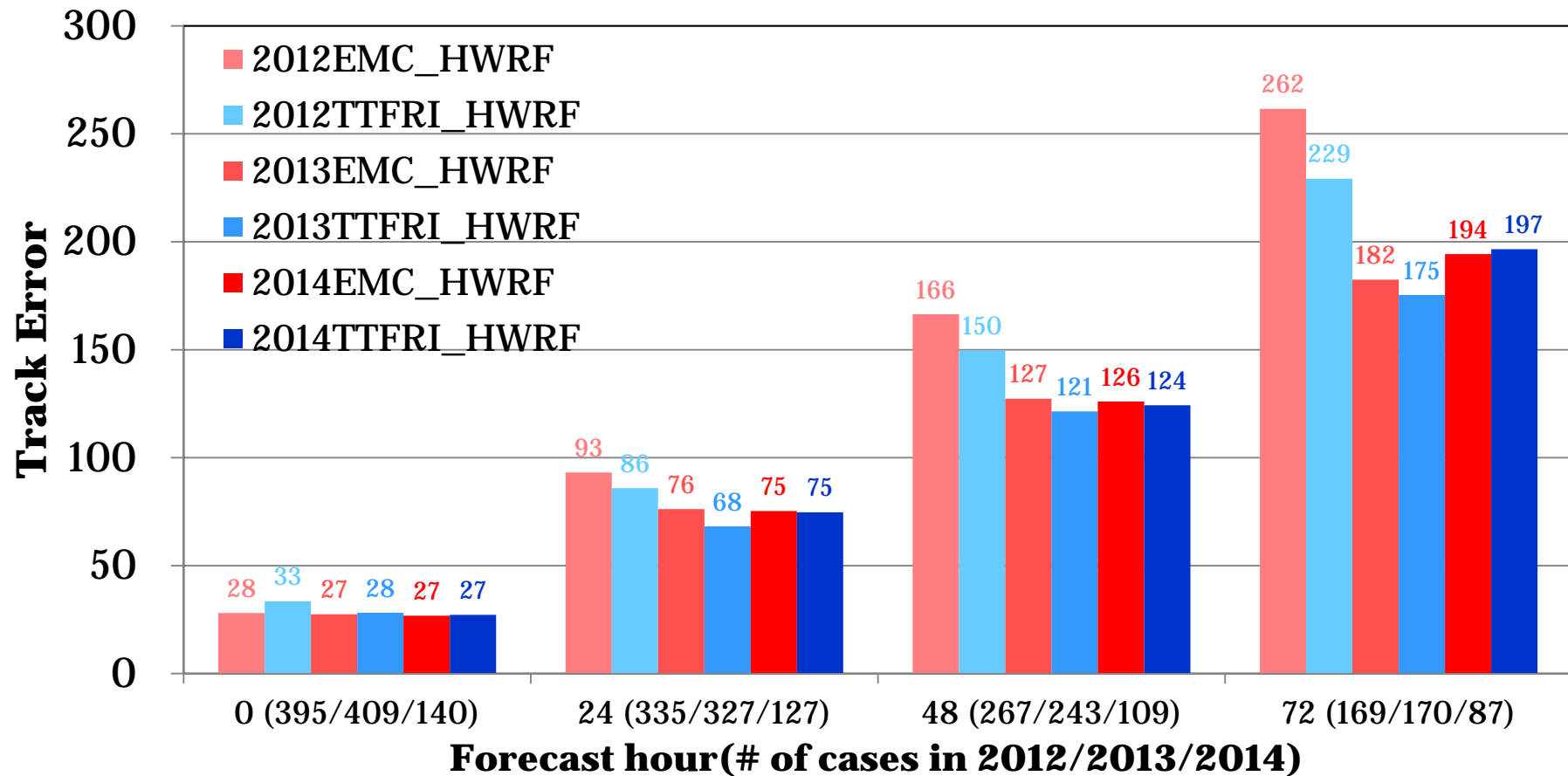
Comparison of track performance between HW2012 and HW2013 over Northwestern Pacific Ocean in 2013



TTFRI HWRF 2012-2014



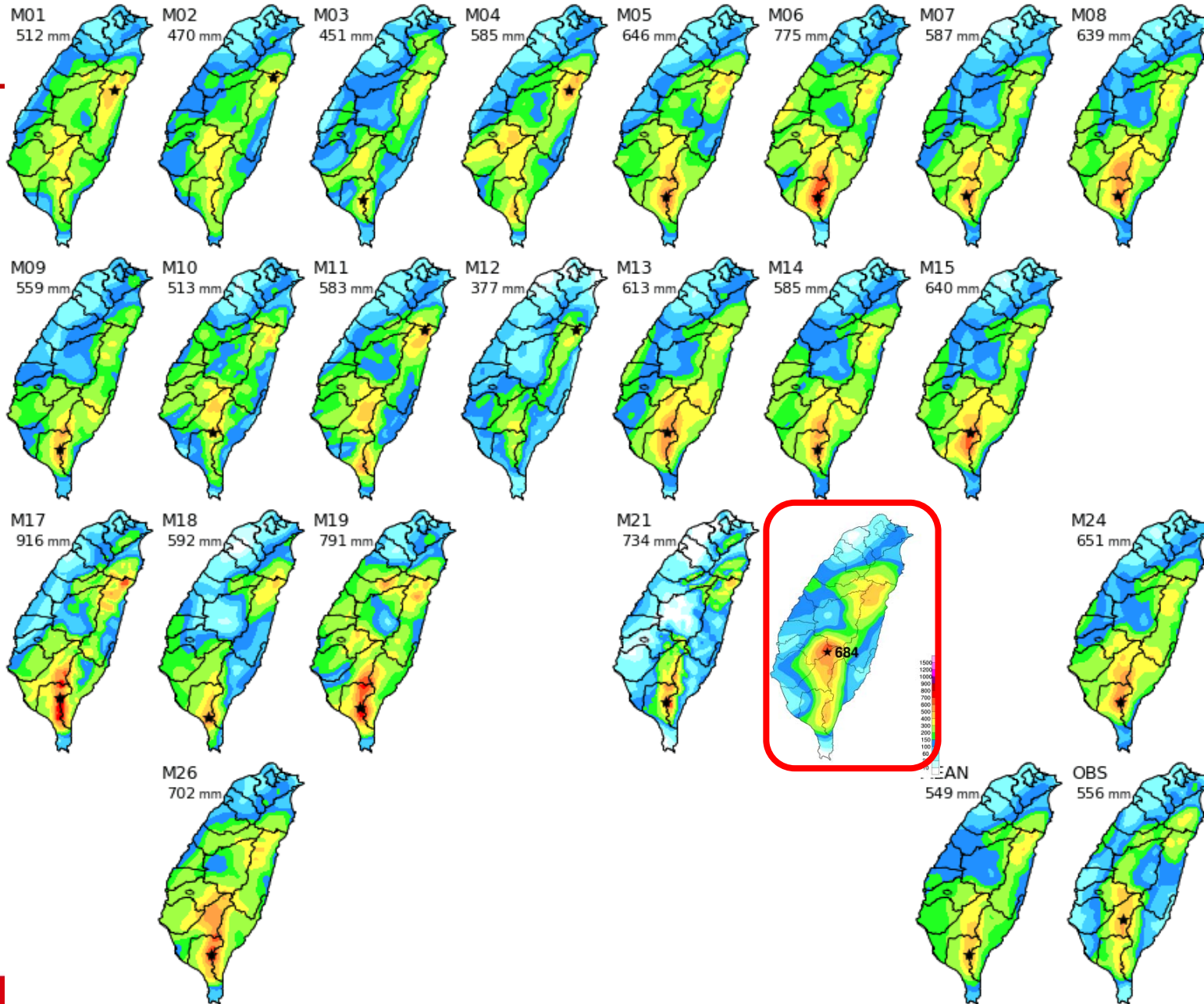
EMC v.s. TTFRI HWRF 2012-2014



Rainfall of HWRF moving nested
in MATMO(2014)
preliminary

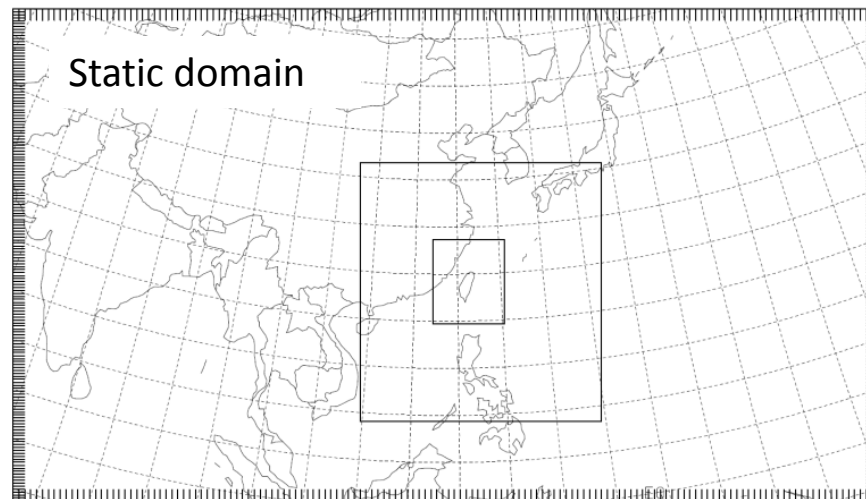


Valid at 2014072218-2014072318 Z Accumulated Precipitation



Configuration of HWRF

Experiment	cold/warm	analysis	bogus	Cu.	M.P.	PBL	Note
HWRF	cold start	NODA	HWRF bogus	SAS	Ferrier	NCEP GFS	43levels; P_top 50hPa; 2 way; 27/9/3km ; moving ; no ocean couple & no GSI; IC&BC from NCEP T574 atmospheric spectral data and include NCEP 0.5deg data.
HWRF_T	cold start	NODA	no bogus	SAS	Ferrier	NCEP GFS	43levels; P_top 50hPa; 1 way; 45/15/5km ; static ; no ocean couple & no GSI; IC&BC from NCEP 0.5deg data.

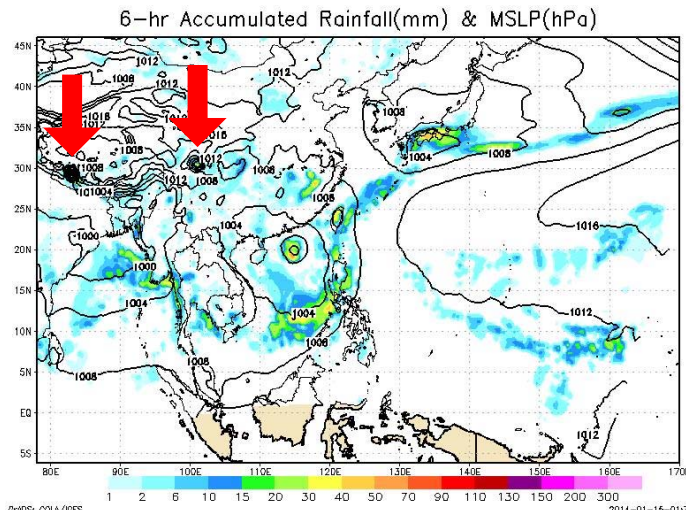


Trouble

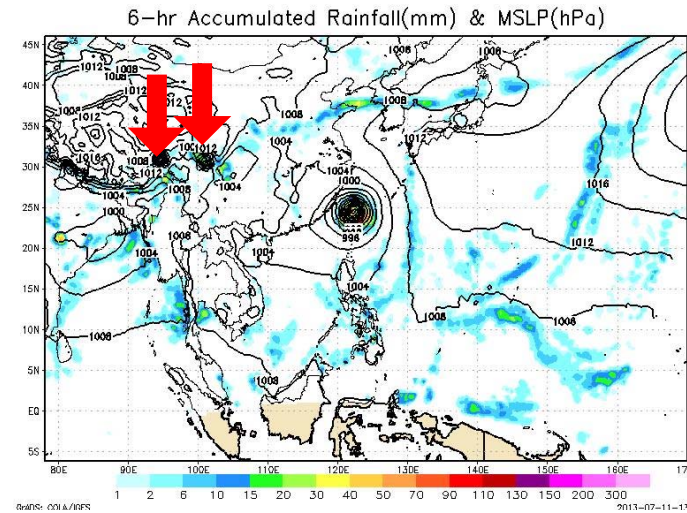
MSLP of HWRF_T(45/15/5km) has Bull's eye

Reduce terrain resolution >> adjust ptsgm level from 200hPa to 420hPa(HWRF)

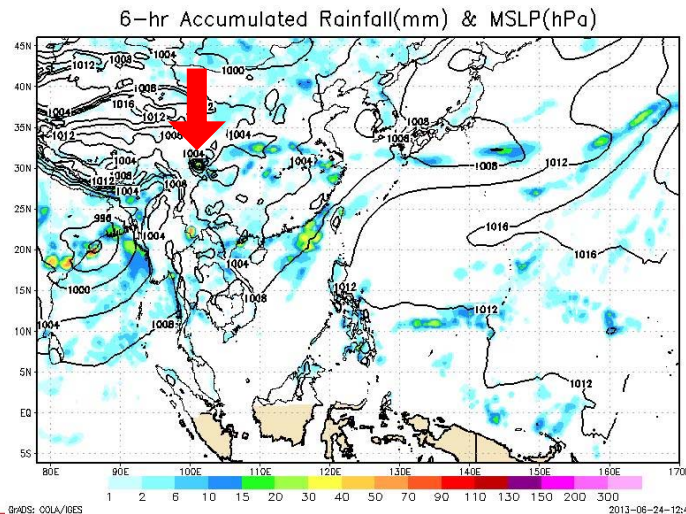
06/20 18Z
+18fhr



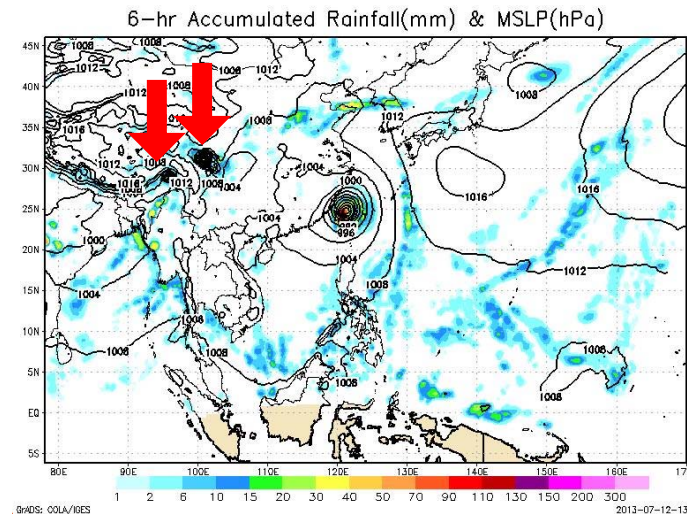
07/11 00Z
+42fhr



06/24 00Z
+12fhr

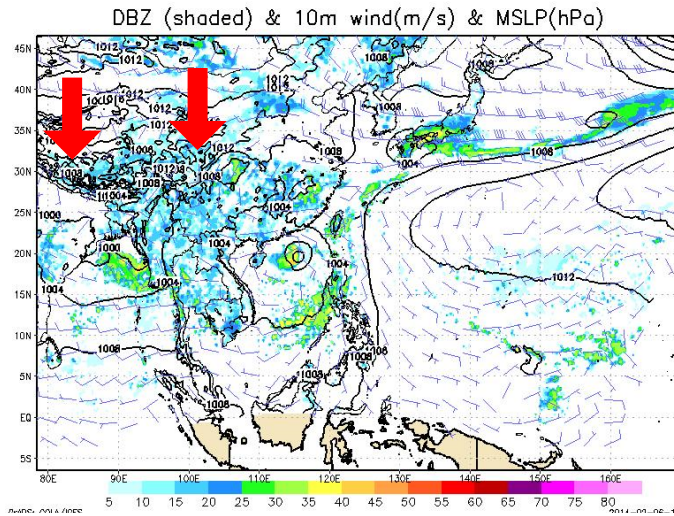


07/12 00Z
+24fhr

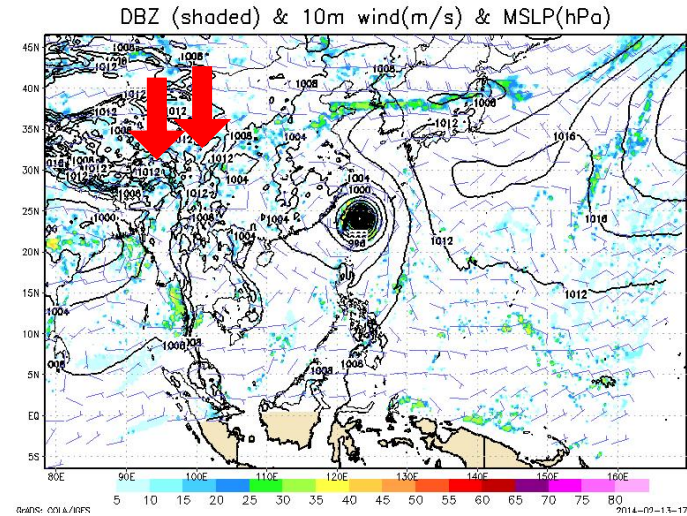


Bull's eye of MSLP had significantly reduced when increasing the resolution(27/9/3km)

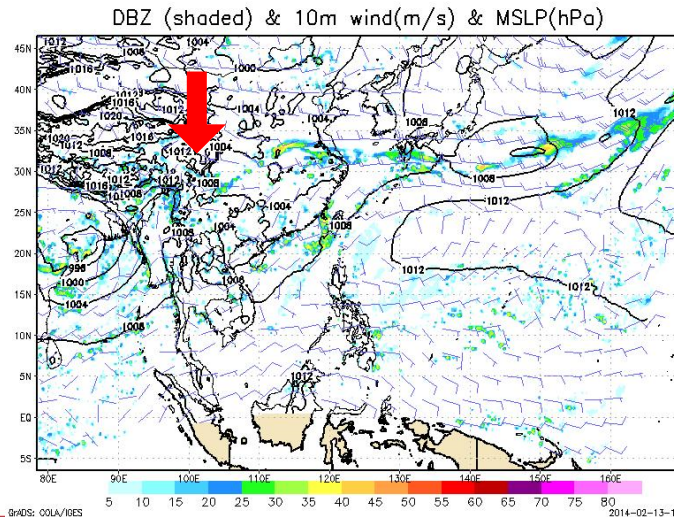
06/20 18Z
+18hr



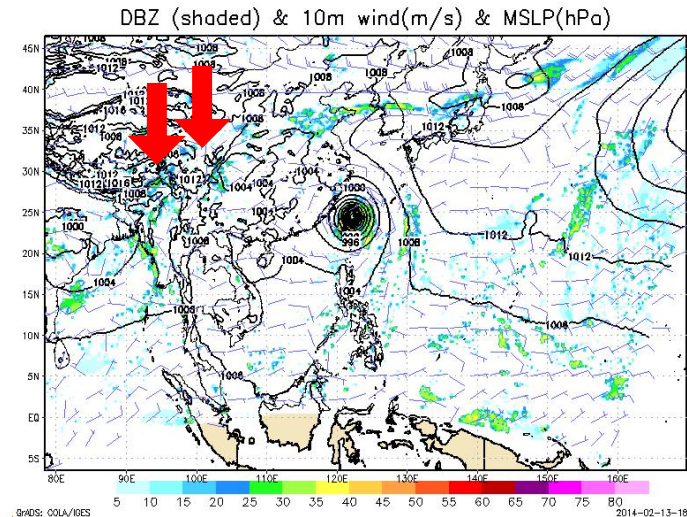
07/11 00Z
+42hr



06/24 00Z
+12hr



07/12 00Z
+24hr



Cases study for HWRF_T(27/9/3km)

- **Experiments**

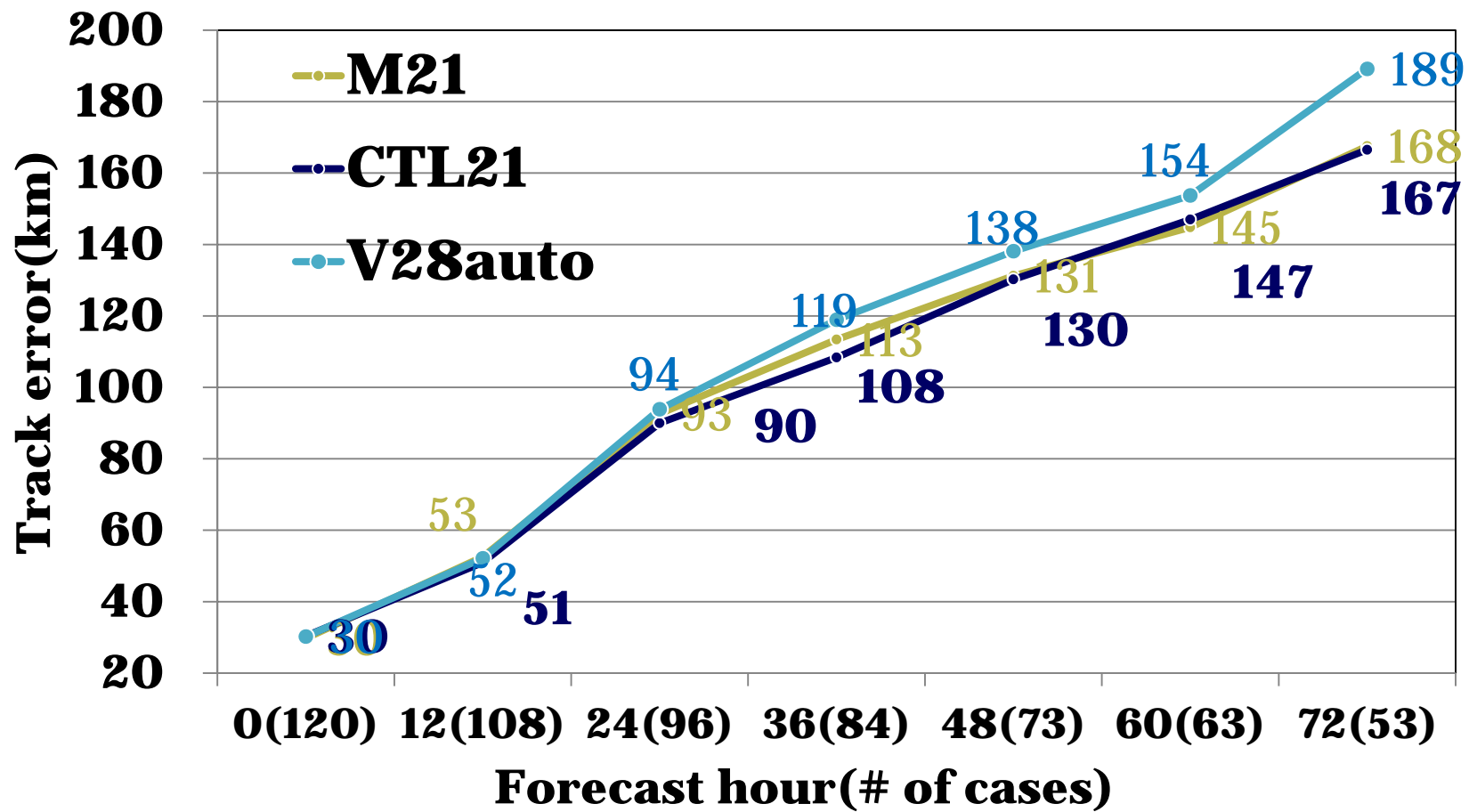
- M21 : 45/15/05 km, e_vert=43
- CTL21 : 27/09/03 km, e_vert=43
- V28auto : 27/09/03 km, e_vert=28

- **Cases with warning issued by CWB,2013**

- Soulik 07W : TRK:070800-1318Z,RAN:1200-1212Z
- Cimaron 08W : TRK:071700-1812Z,RAN:1800-1812Z
- Trami 12W : TRK:081800-2206Z,RAN:2100-2112Z
- Kong-rey 14W : TRK:082606-3012Z,RAN:2806-2818Z
- Usagi 17W : TRK:091618-2300Z,RAN:2018Z-2106Z
- Fitow 22W : TRK:093012-0700Z,RAN:0506-0518Z

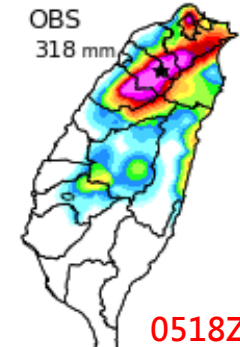
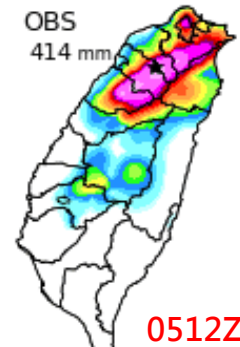
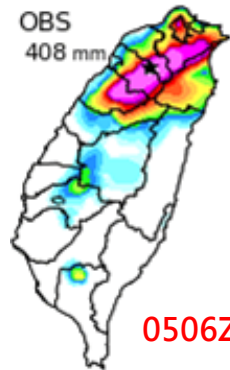
Track error of 6 warning TCs

120 cases had been finished

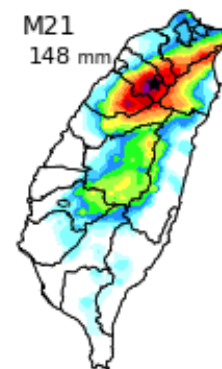
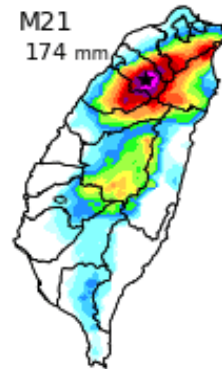
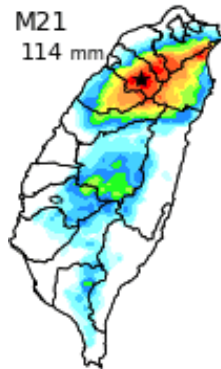


24-hour accumulated rainfall for Typhoon FITOW(2013)

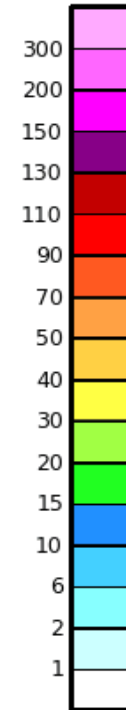
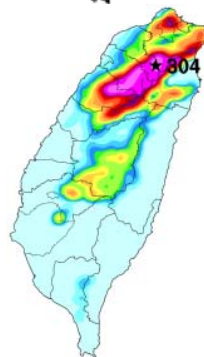
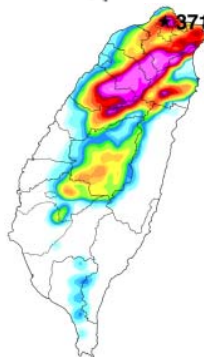
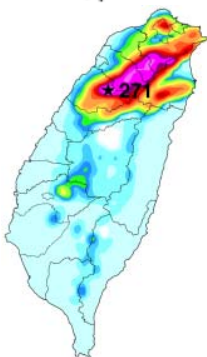
OBS



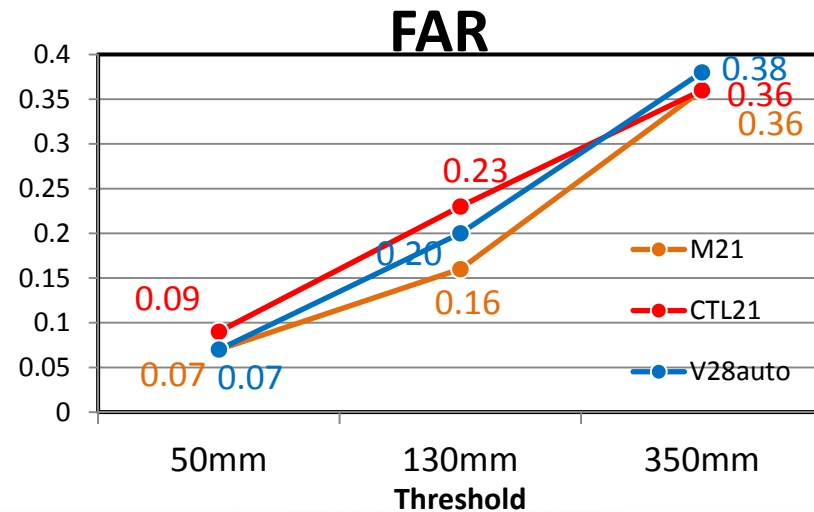
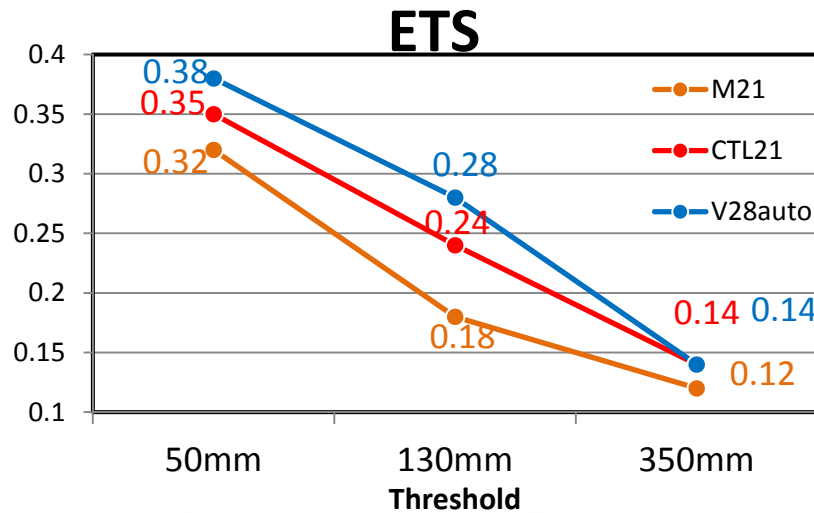
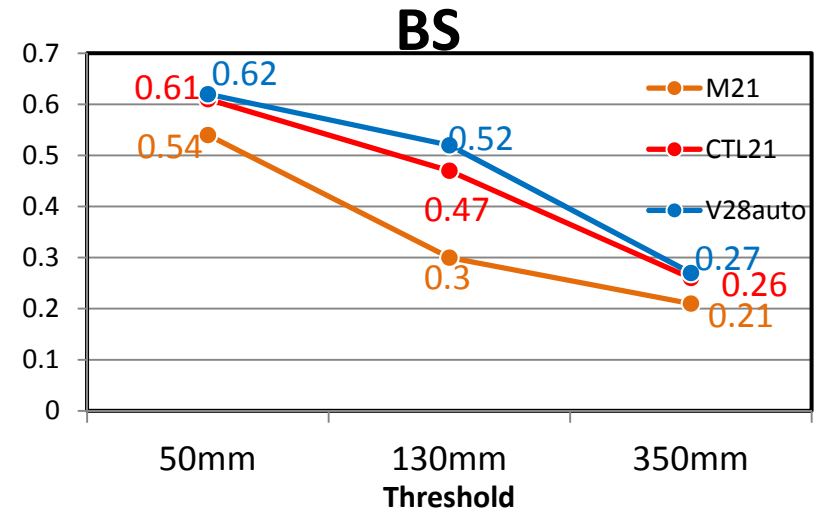
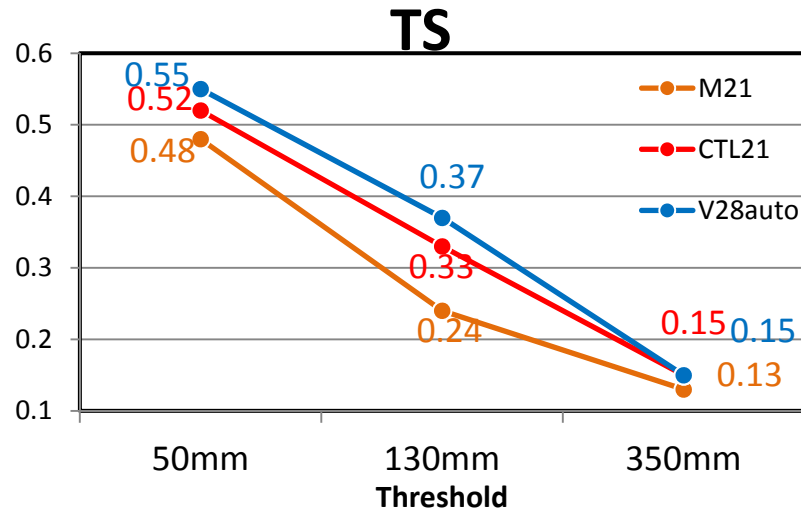
5km



3km



Precipitation skill score (6 TCs, 18 cases)



Summary and Future work

- HWRF(moving domain)
 - 2013年新版HWRF透過(1)更新巢狀網格颱風中心演算法；(2)修正巢狀網格內插方法；(3)擴大第三層預報範圍與調整物理參數法使用頻率，能顯著提升颱風路徑預報之能力。
 - 未來將評估moving domain在台灣之降雨預報技術得分。
- HWRF_T(static domain)
 - 三層固定巢狀網格之實驗由45/15/5公里提升為27/9/3公里，可有效移除青藏高原附近之海面氣壓牛眼現象。模式預報降水，3公里解析度能有效改進24小時累積降雨預報低估現象。
 - 水平解析度之差異對於預報路徑誤差表現較不敏感，但垂直層數較少，隨預報時間增加，路徑預報能力略差。
 - 探討同樣是3公里解析度，但垂直層數較少的實驗設計24小時降雨預報得分略佳？
 - 西南風之沿海降雨預報能力？