高解析度模式於東亞地區預報影響之分析

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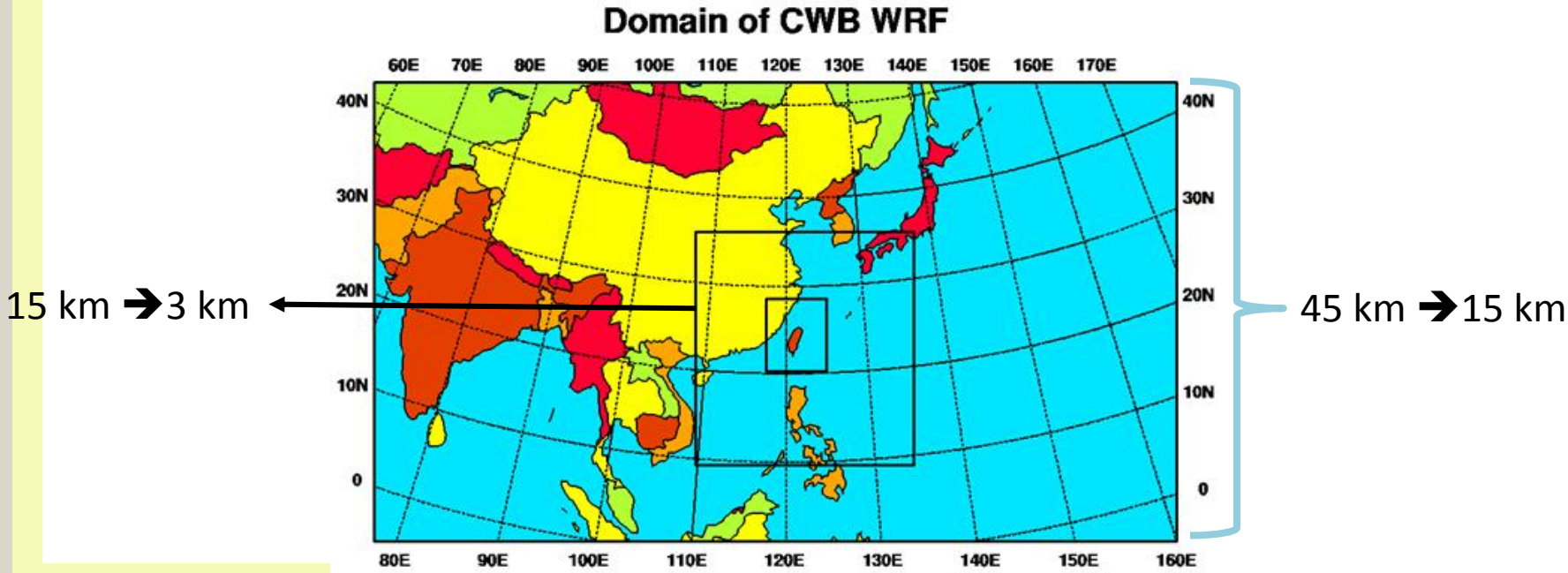
大 綱

1. 動機
2. 模式垂直解析度測試實驗
3. 水平解析度(15公里)測試實驗
4. 整合水平與垂直解析度之測試實驗
5. 結論與未來工作

動機

- 因應中小尺度劇烈天氣之預報需求，預計將現行作業45/15/5 km模式解析度提升為15/3 km。



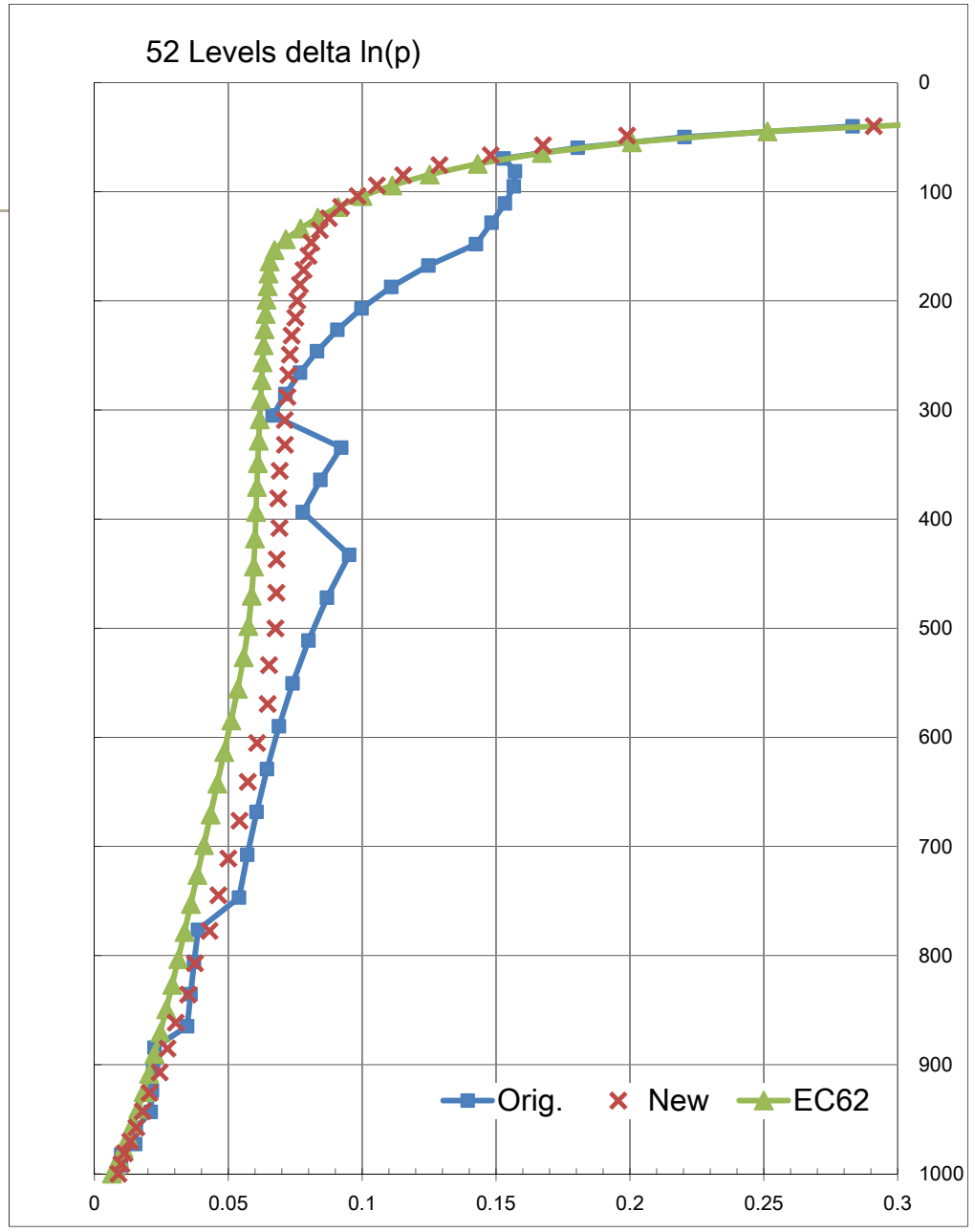
模式垂直解析度測試實驗

52層垂直分層

- 參考EC全球模式垂直分層設計。
- 模式層頂：

  30百帕➔10百帕
- 垂直層數：

  45層➔52層
- 多數區域都有較現行作業模式高的解析度。



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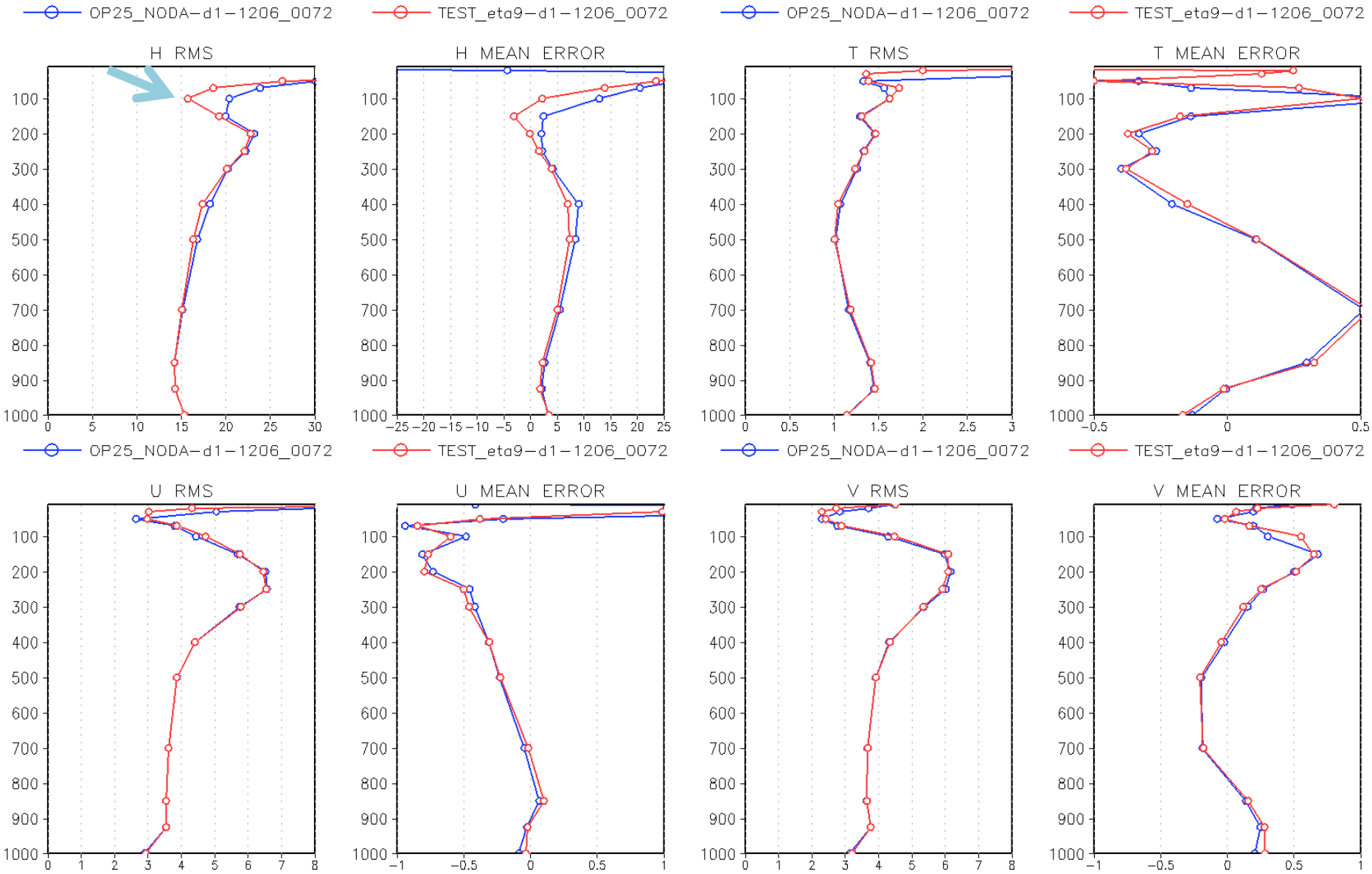
OP25_NODA-d1-1206_0072
TEST_eta9-d1-1206_0072
H RMS
H MEAN ERROR
T RMS
T MEAN ERROR
U RMS
U MEAN ERROR
V RMS
V MEAN ERROR

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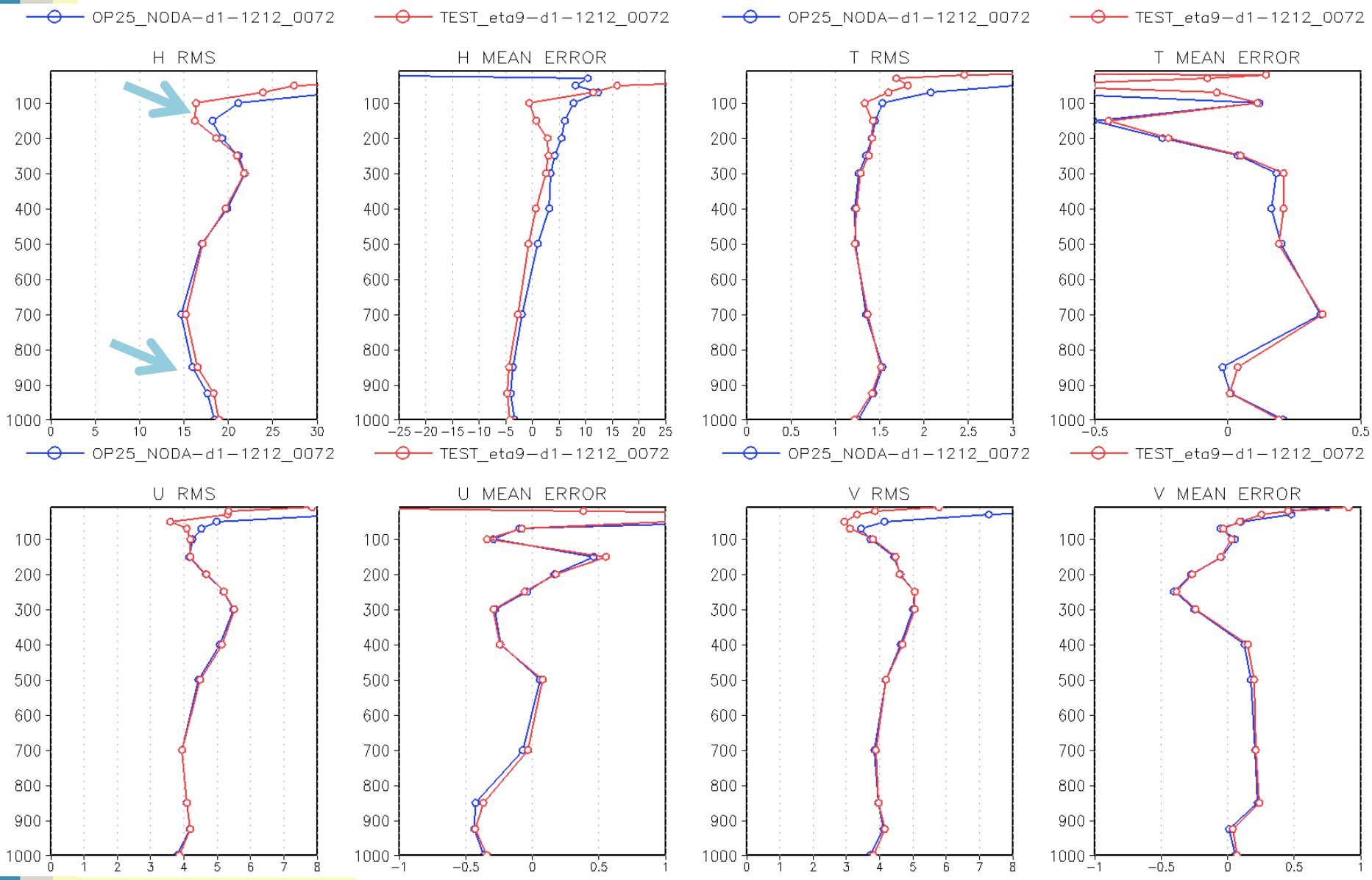
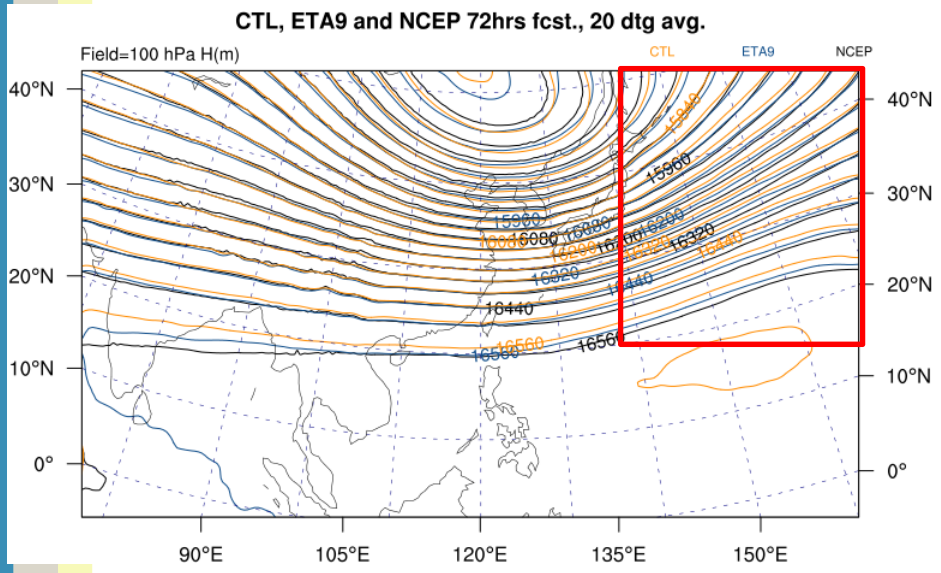
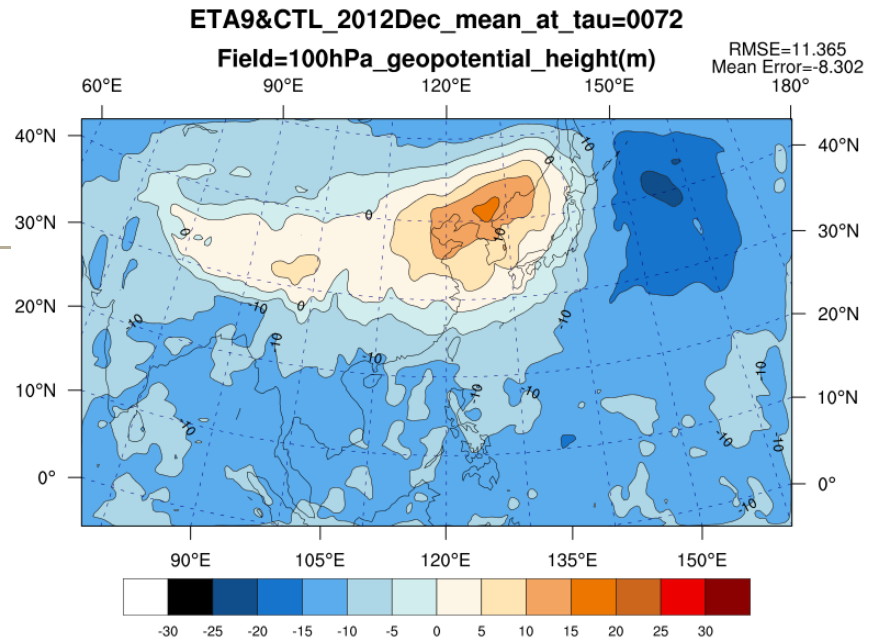
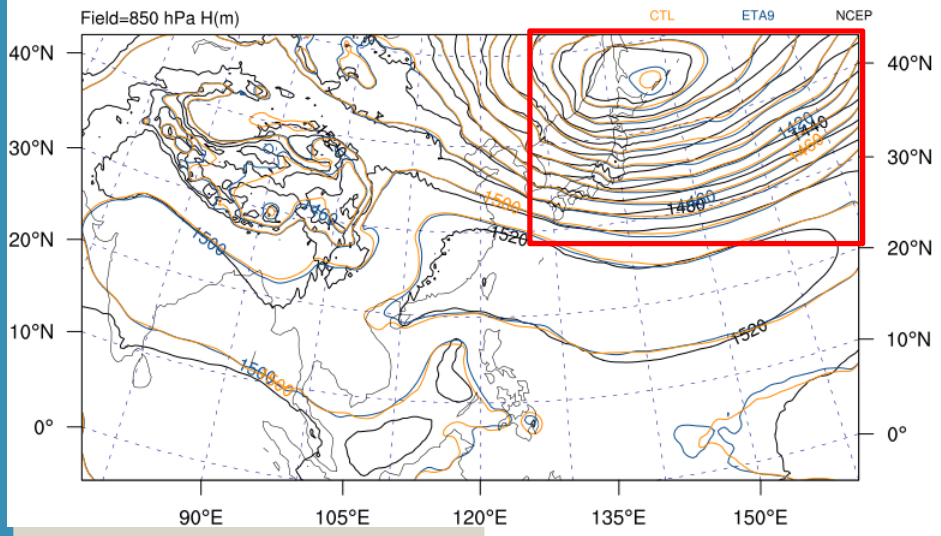
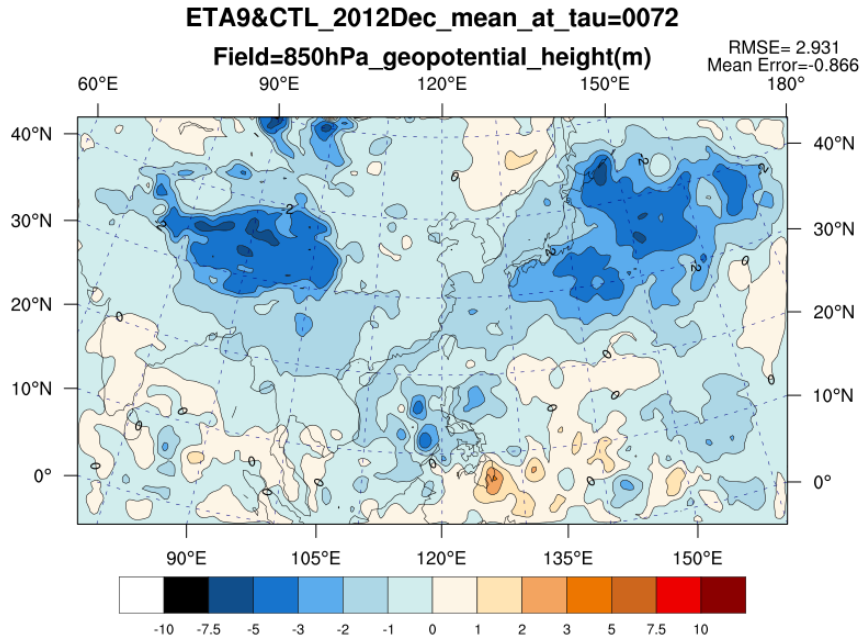

OP25_NODA-d1-1212_0072
TEST_eta9-d1-1212_0072
H RMS
H MEAN ERROR
T RMS
T MEAN ERROR
U RMS
U MEAN ERROR
V RMS
V MEAN ERROR

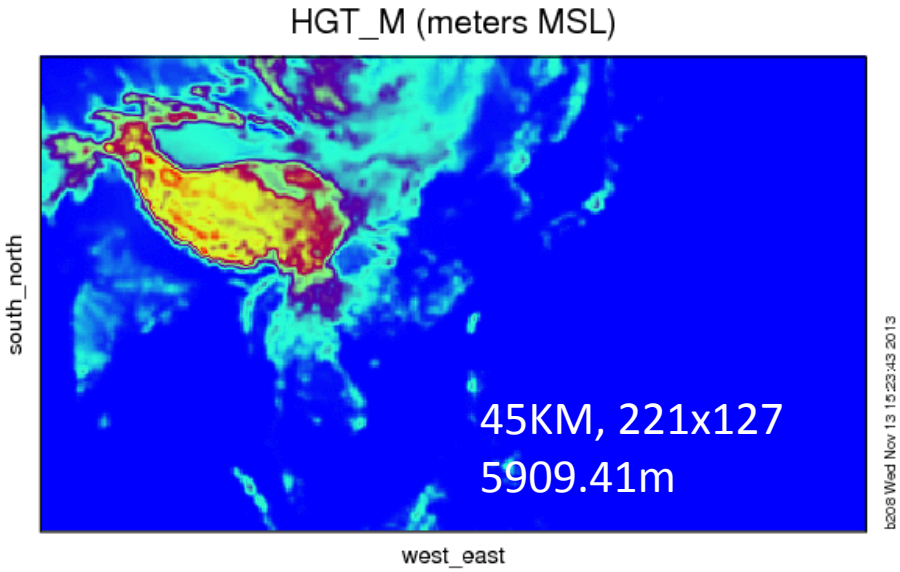

CTL, ETA9 and NCEP 72hrs fcst., 20 dtg avg.
Field=100 hPa H(m)
CTL
ETA9
NCEP
40°N
30°N
20°N
10°N
0°
90°E
105°E
120°E
135°E
150°E


ETA9&CTL_2012Dec_mean_at_tau=0072
Field=100hPa_geopotential_height(m)
RMSE=11.365
Mean Error=-8.302
60°E
90°E
120°E
150°E
180°
40°N
30°N
20°N
10°N
0°
90°E
105°E
120°E
135°E
150°E
-30 -25 -20 -15 -10 -5 0 5 10 15 20 25 30

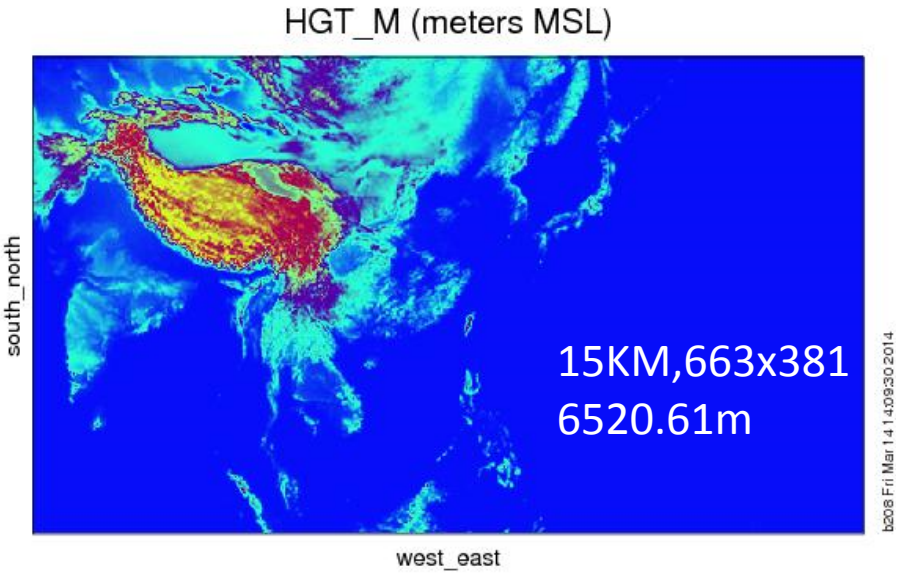

CTL, ETA9 and NCEP 72hrs fcst., 20 dtg avg.
Field=850 hPa H(m)
CTL
ETA9
NCEP
40°N
30°N
20°N
10°N
0°
90°E
105°E
120°E
135°E
150°E


ETA9&CTL_2012Dec_mean_at_tau=0072
Field=850hPa_geopotential_height(m)
RMSE= 2.931
Mean Error=-0.866
60°E
90°E
120°E
150°E
180°
40°N
30°N
20°N
10°N
0°
90°E
105°E
120°E
135°E
150°E
-10 -7.5 -5 -3 -2 -1 0 1 2 3 5 7.5 10

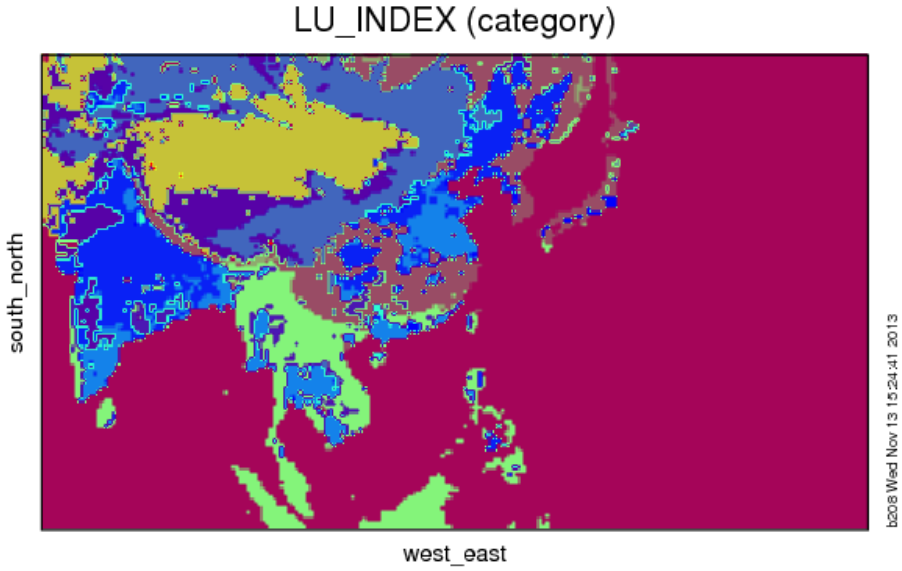
水平解析度(15公里)測試實驗



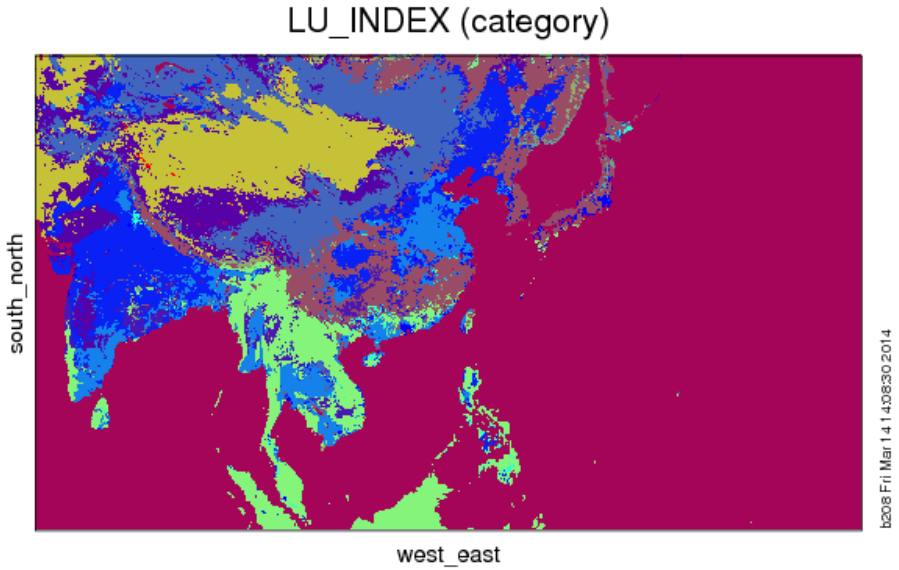
Range of HGT_M: 0 to 5909.41 meters MSL
Range of west_east: 0 to 220
Range of south_north: 0 to 126

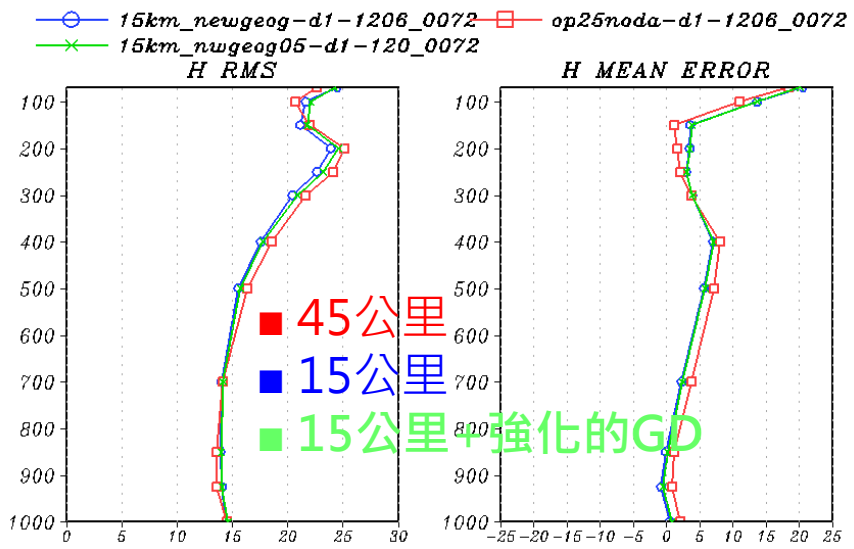


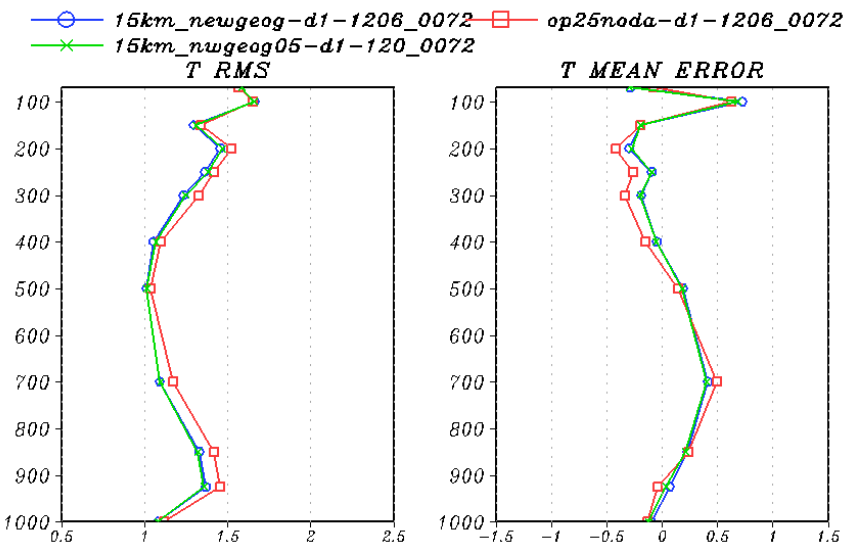
Range of HGT_M: -174.368 to 6520.61 meters MSL
Range of west_east: 0 to 662
Range of south_north: 0 to 380



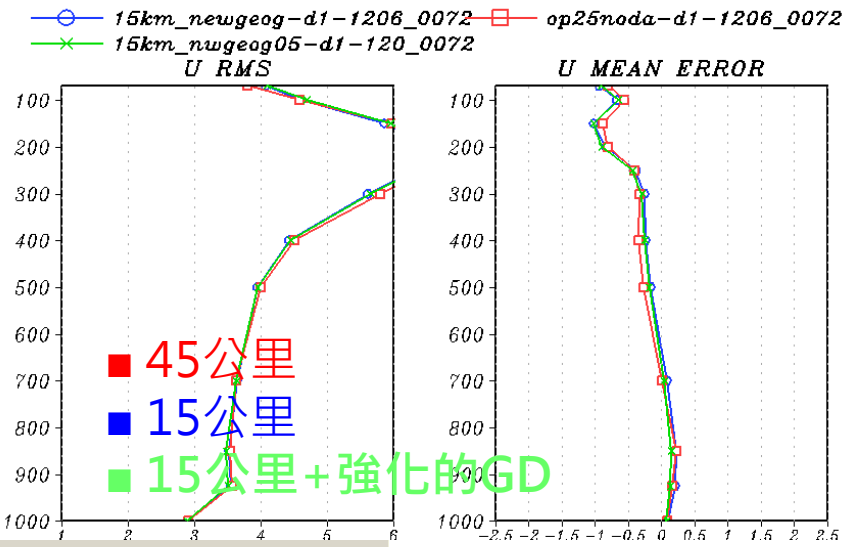
Range of LU_INDEX: 1 to 24 category

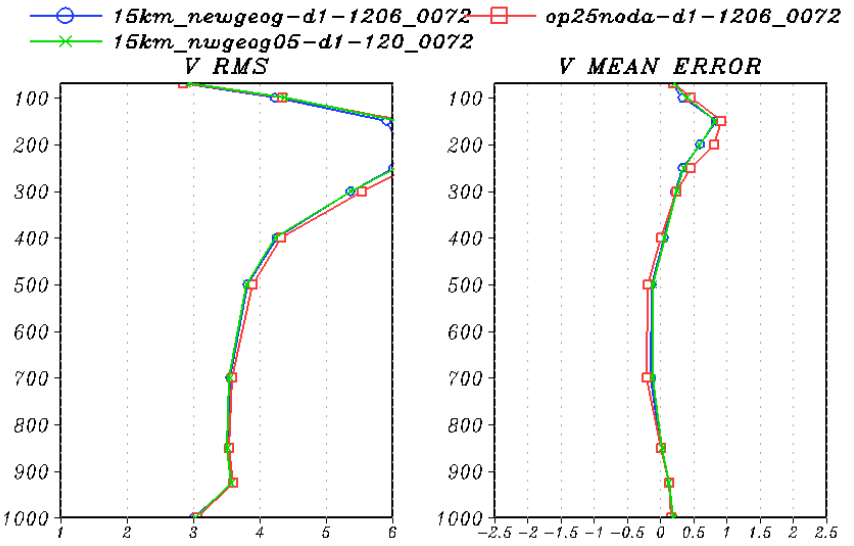


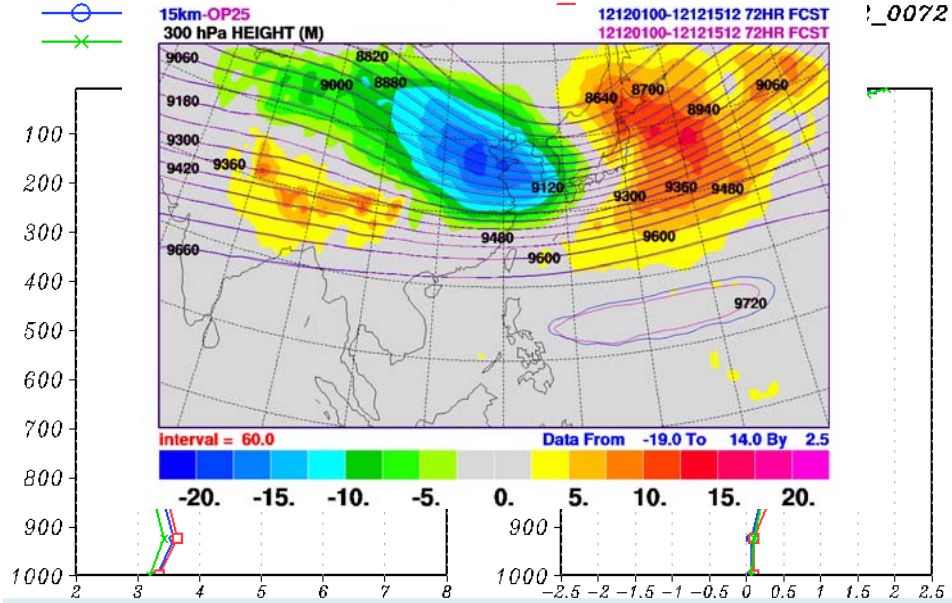


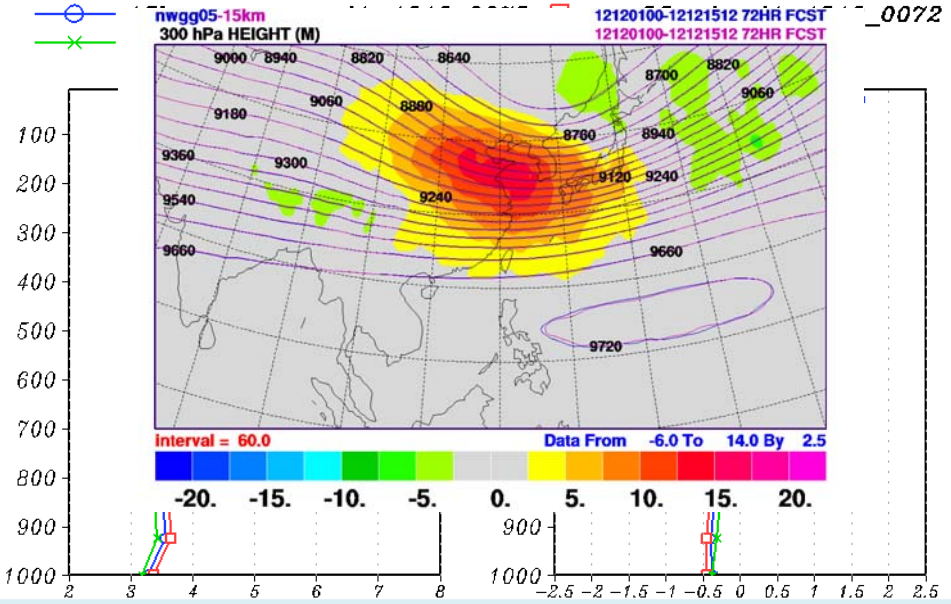


2012年6月之15天校驗(紅: 45km_noda,藍: 15km_noda,綠: 15km_geog05)

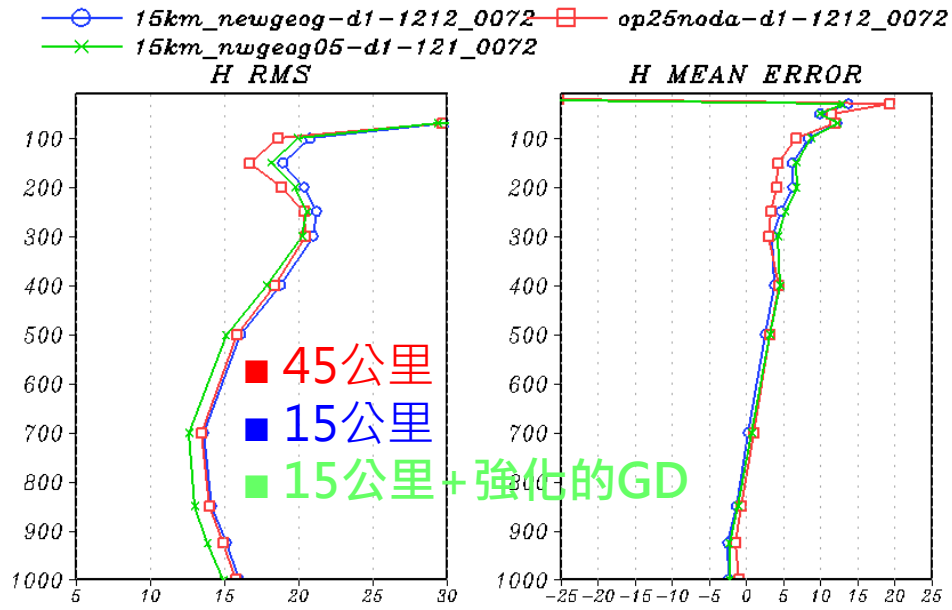


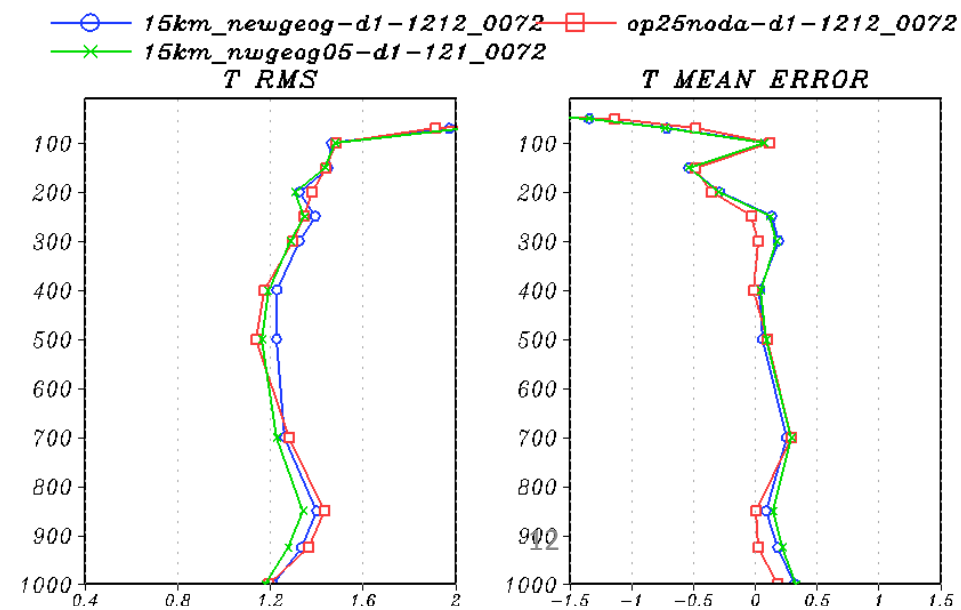






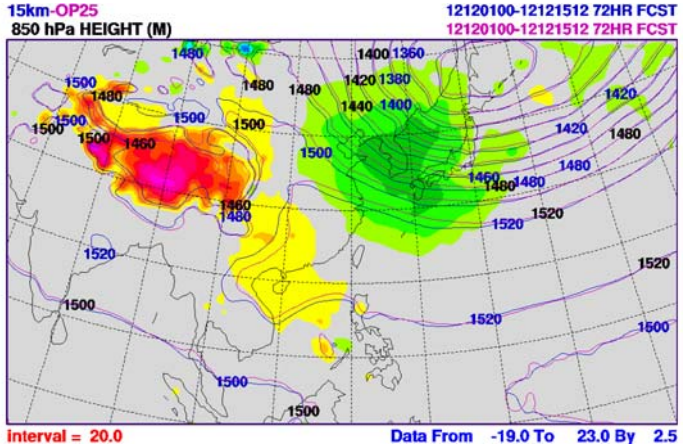
2012年12月之15天校驗(紅: 45km_noda,藍: 15km_noda,綠: 15km_geog05)

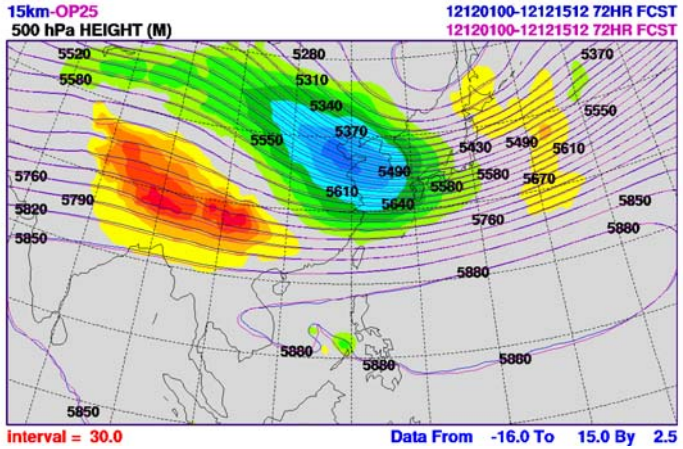


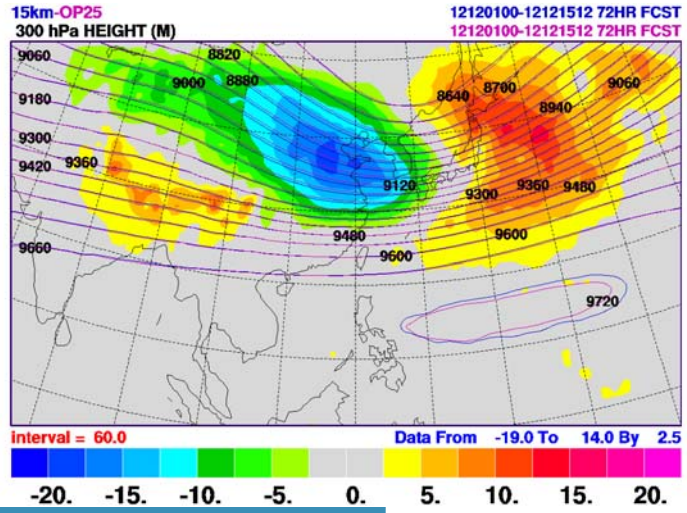


增加水平解析度後模式的平均變化以及放大GWDO後的變化

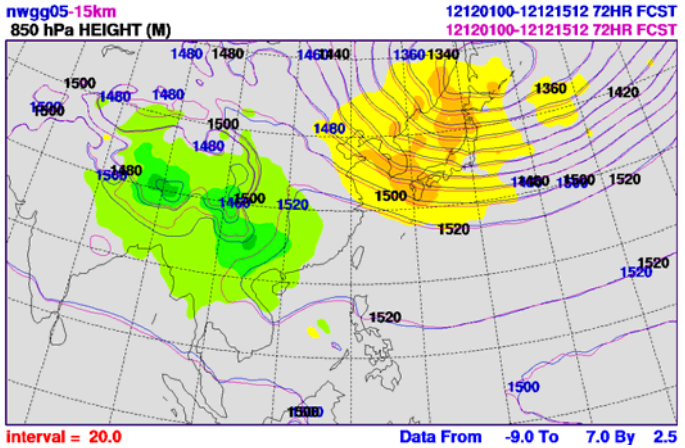
15km .vs. 45km

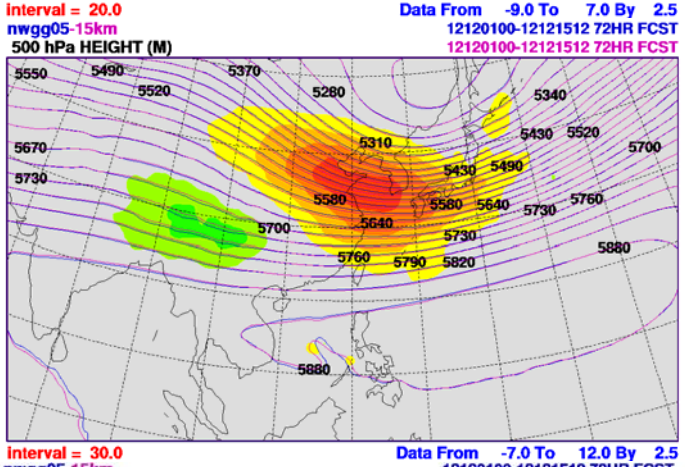

15km-OP25
12120100-12121512 72HR FCST
850 hPa HEIGHT (M)
12120100-12121512 72HR FCST
interval = 20.0
Data From -19.0 To 23.0 By 2.5

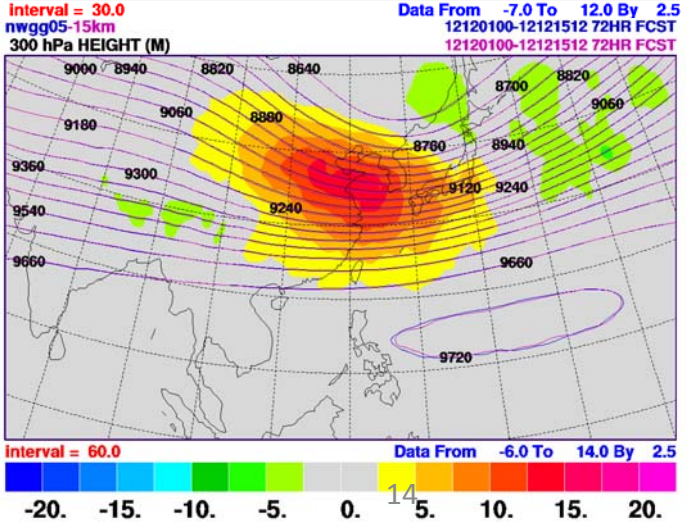

15km-OP25
12120100-12121512 72HR FCST
500 hPa HEIGHT (M)
12120100-12121512 72HR FCST
interval = 30.0
Data From -16.0 To 15.0 By 2.5

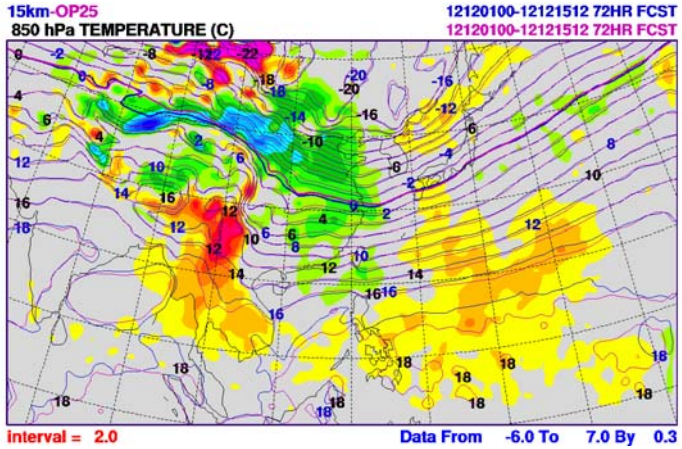

15km-OP25
12120100-12121512 72HR FCST
300 hPa HEIGHT (M)
12120100-12121512 72HR FCST
interval = 60.0
Data From -19.0 To 14.0 By 2.5
-20. -15. -10. -5. 0. 5. 10. 15. 20.

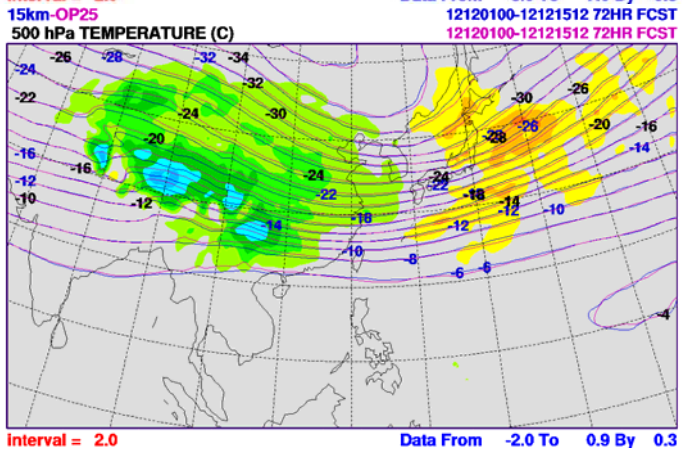
H

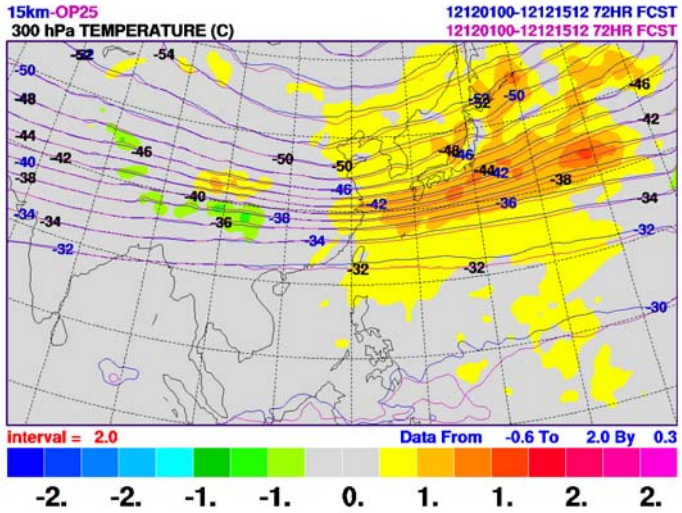

nwgg05-15km
12120100-12121512 72HR FCST
850 hPa HEIGHT (M)
12120100-12121512 72HR FCST
interval = 20.0
Data From -9.0 To 7.0 By 2.5


nwgg05-15km
12120100-12121512 72HR FCST
500 hPa HEIGHT (M)
12120100-12121512 72HR FCST
interval = 30.0
Data From -7.0 To 12.0 By 2.5

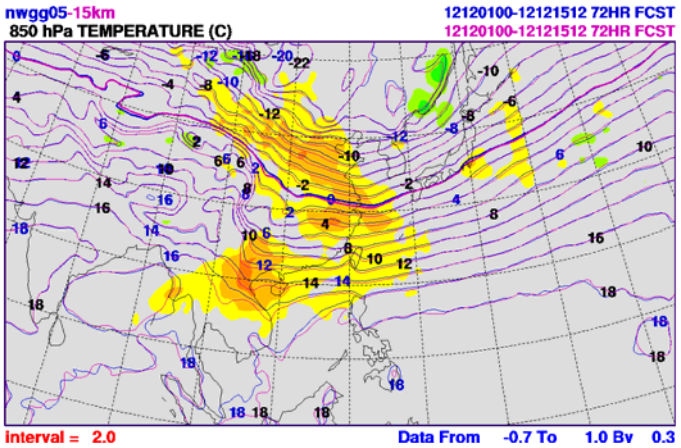

nwgg05-15km
12120100-12121512 72HR FCST
300 hPa HEIGHT (M)
12120100-12121512 72HR FCST
interval = 60.0
Data From -6.0 To 14.0 By 2.5
-20. -15. -10. -5. 0. 5. 10. 15. 20.

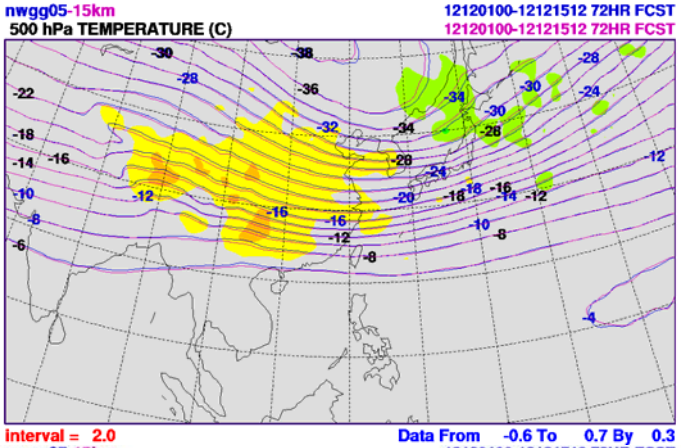

15km-OP25
12120100-12121512 72HR FCST
850 hPa TEMPERATURE (C)
12120100-12121512 72HR FCST
interval = 2.0
Data From -6.0 To 7.0 By 0.3

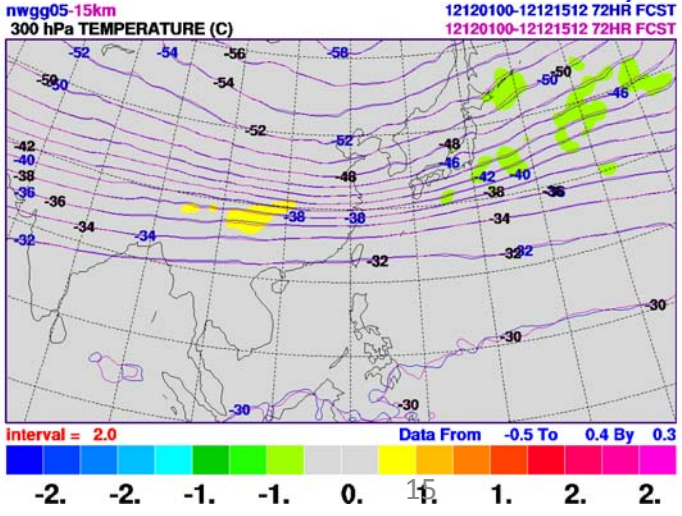

15km-OP25
12120100-12121512 72HR FCST
500 hPa TEMPERATURE (C)
12120100-12121512 72HR FCST
interval = 2.0
Data From -2.0 To 0.9 By 0.3


15km-OP25
12120100-12121512 72HR FCST
300 hPa TEMPERATURE (C)
12120100-12121512 72HR FCST
interval = 2.0
Data From -0.6 To 2.0 By 0.3
-2. -2. -1. -1. 0. 1. 1. 2. 2.

T


nwgg05-15km
12120100-12121512 72HR FCST
850 hPa TEMPERATURE (C)
12120100-12121512 72HR FCST
interval = 2.0
Data From -0.7 To 1.0 By 0.3

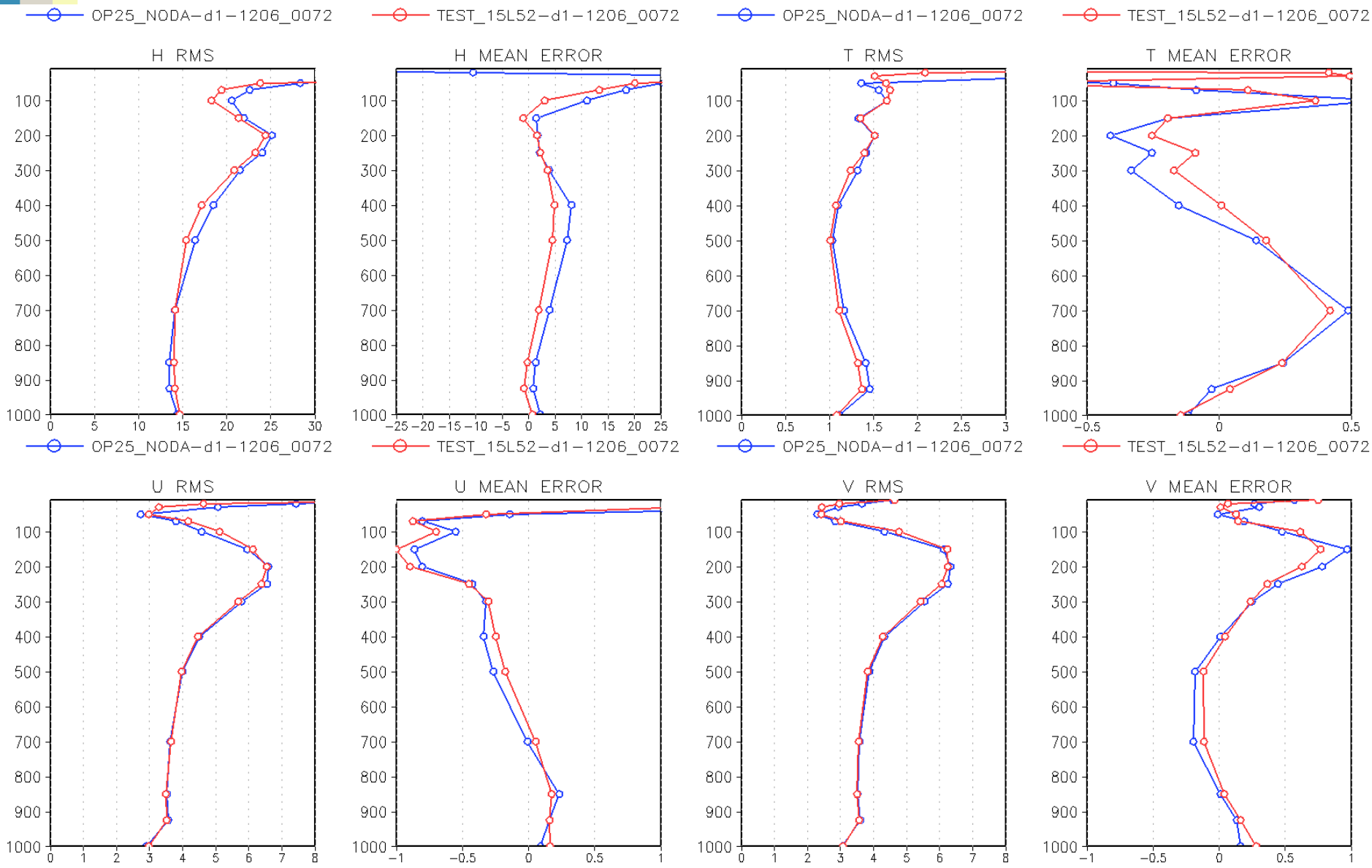

nwgg05-15km
12120100-12121512 72HR FCST
500 hPa TEMPERATURE (C)
12120100-12121512 72HR FCST
interval = 2.0
Data From -0.6 To 0.7 By 0.3


nwgg05-15km
12120100-12121512 72HR FCST
300 hPa TEMPERATURE (C)
12120100-12121512 72HR FCST
interval = 2.0
Data From -0.5 To 0.4 By 0.3
-2. -2. -1. -1. 0. 1. 1. 2. 2.

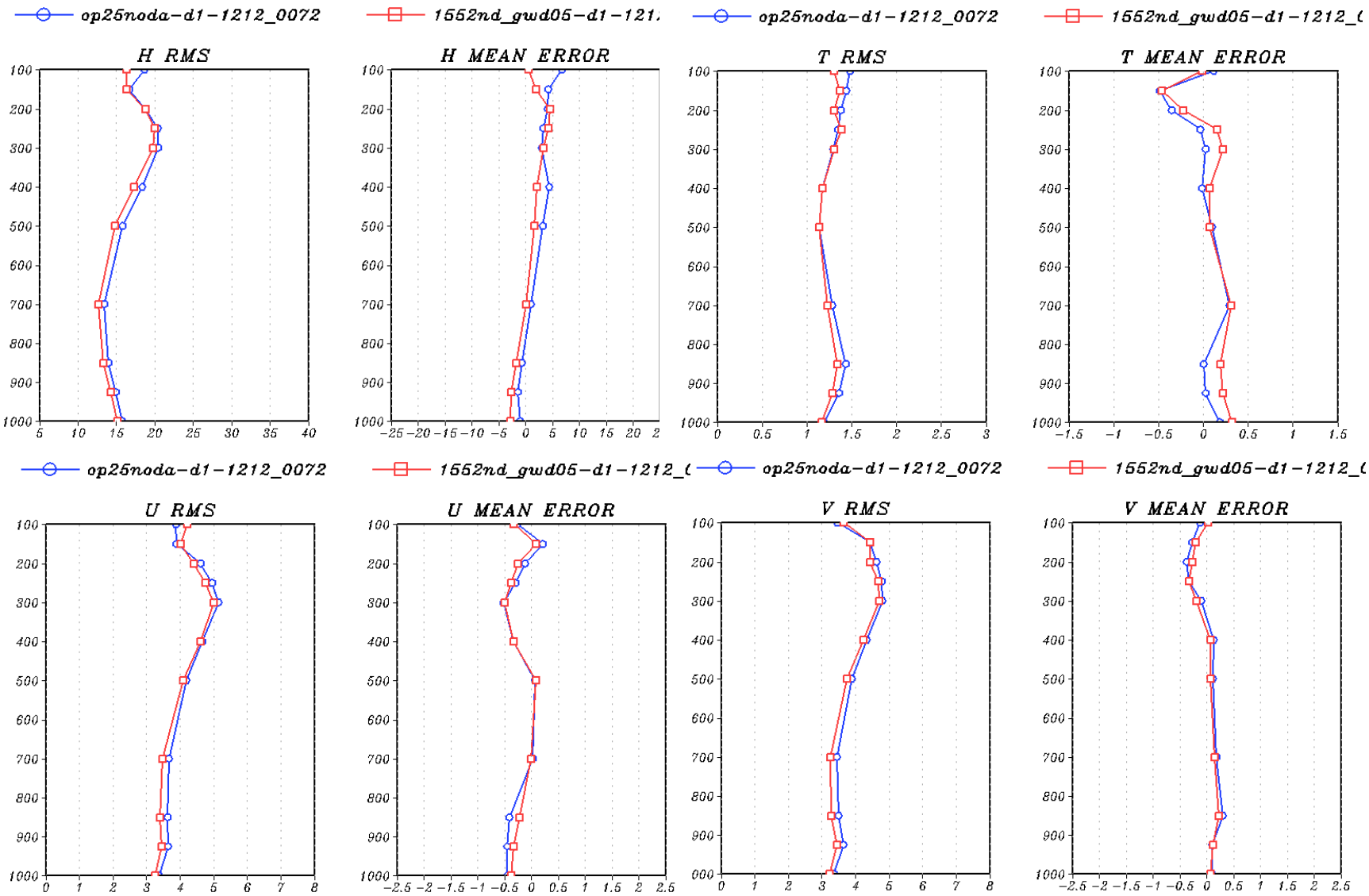
2012 6月 & 12月 NoDA

整合水平與垂直解析度之測試實驗

2012/06/04/00~2012/06/15/12



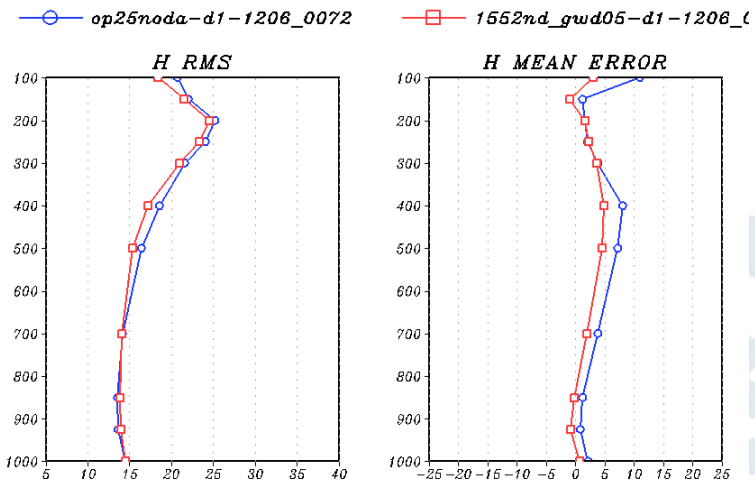
2012/12/04/00~2012/12/15/12

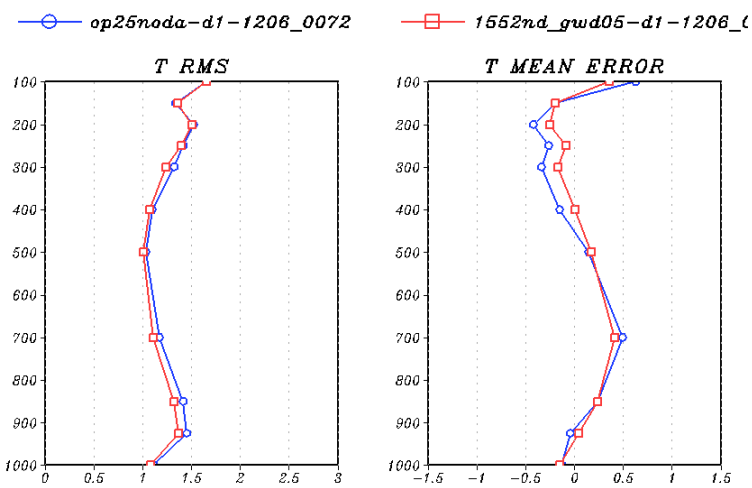


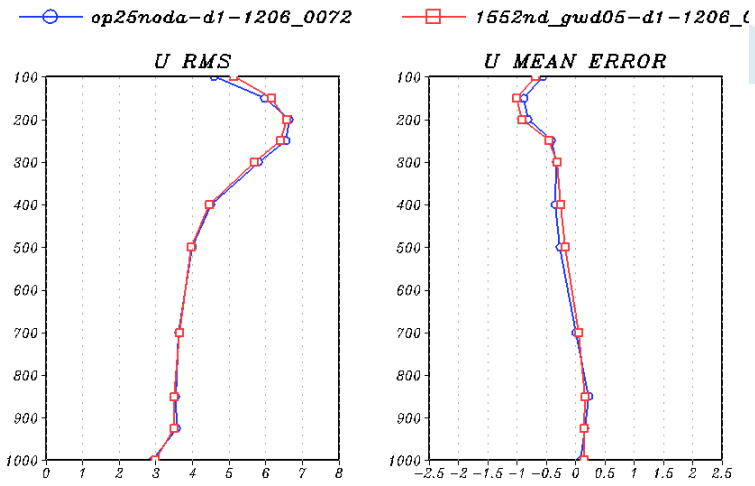
整合測試整理

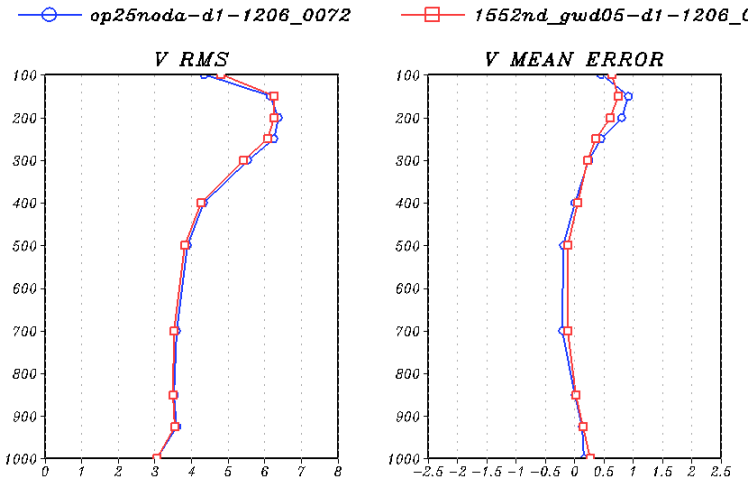
水平解析度15公里 垂直52層
(2012年12月 / D02)

2012/06/04/00~2012/06/15/12

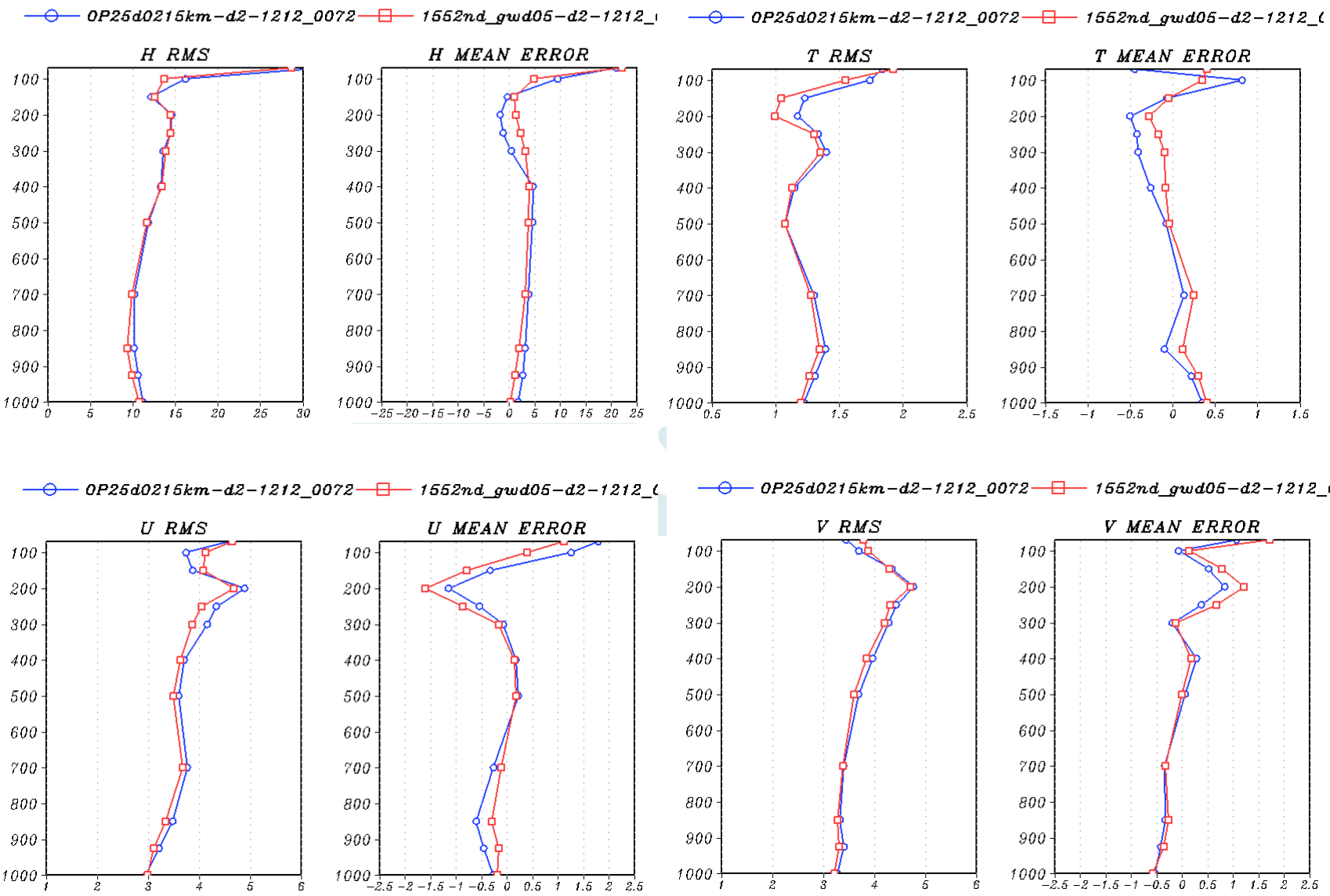








2012/12/04/00~2012/12/18/12



結 論

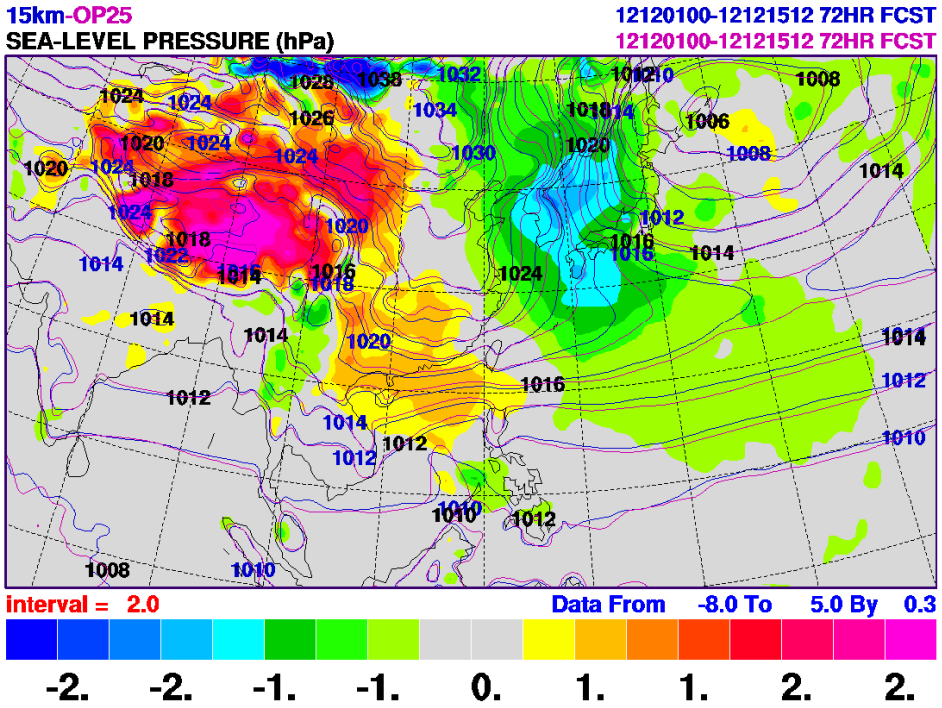
- 根據整合測試結果，高解析度(15 km、52層)模式的預報相較於45km有較好的表現。
- 垂直解析度的改變，影響主要集中於高度場高層，其他場無明顯差異。
- 水平解析度的增加(45km->15km)，冬季時在東亞區域上的預報結果是東亞主槽加深，陸地變冷，海洋變暖。
- 經由重力位拖曳參數的調整，可適度抑制高解析度模式在此區對東亞主槽過深的預報，改進12月之預報結果，但對於6月的預報結果則無明顯的幫助。

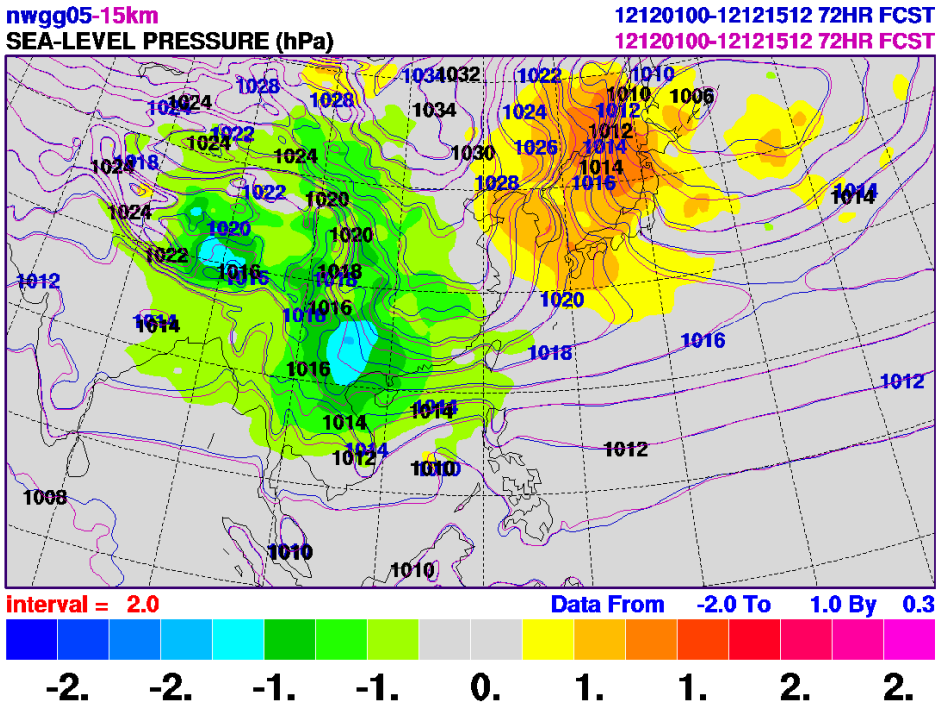
未來工作

- 15/3公里高解析度模式準平行作業
- 15公里資料同化相關測試
- 台灣地區3公里解析度預報特性分析(物理參數法的測試與調整)

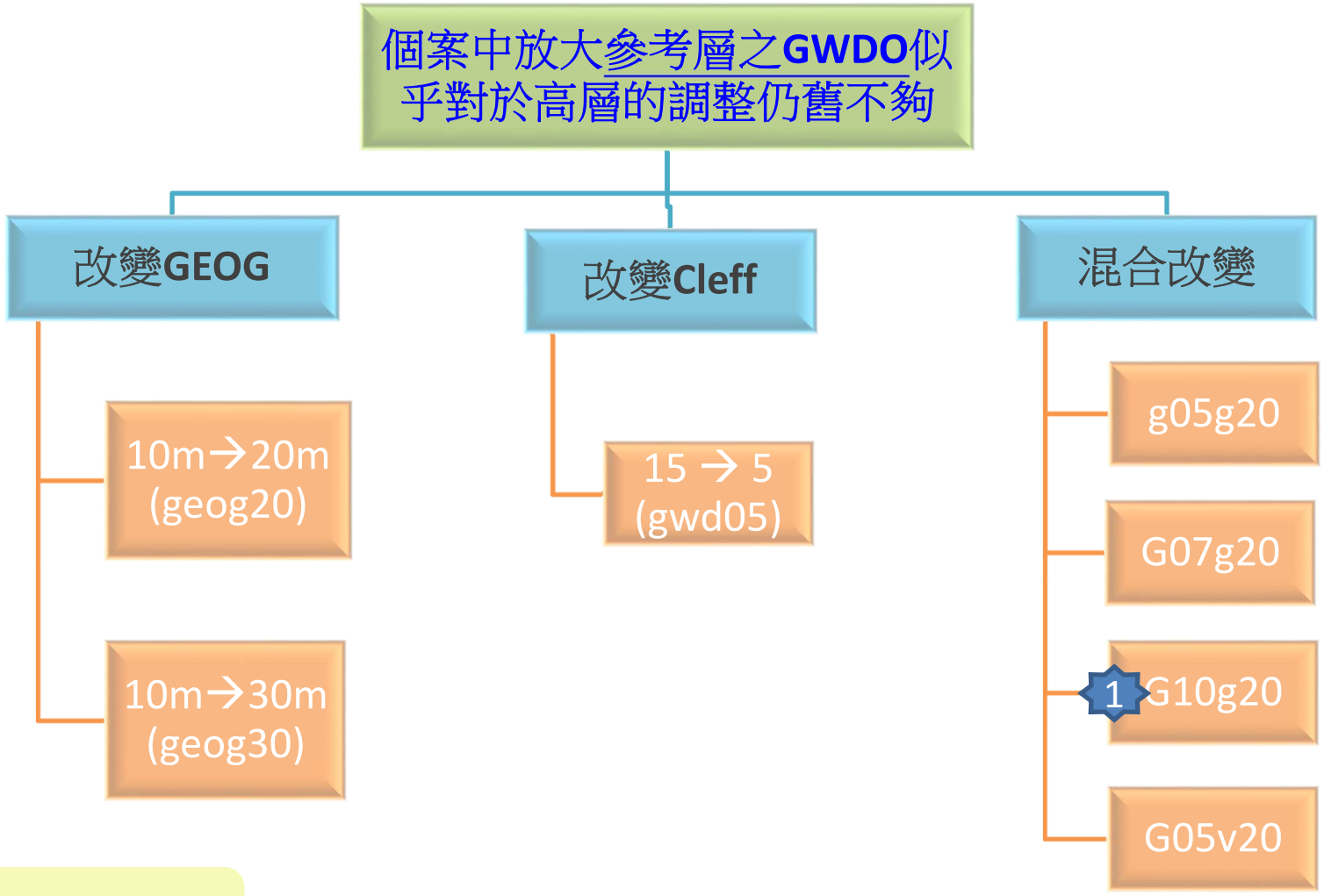
報告完畢

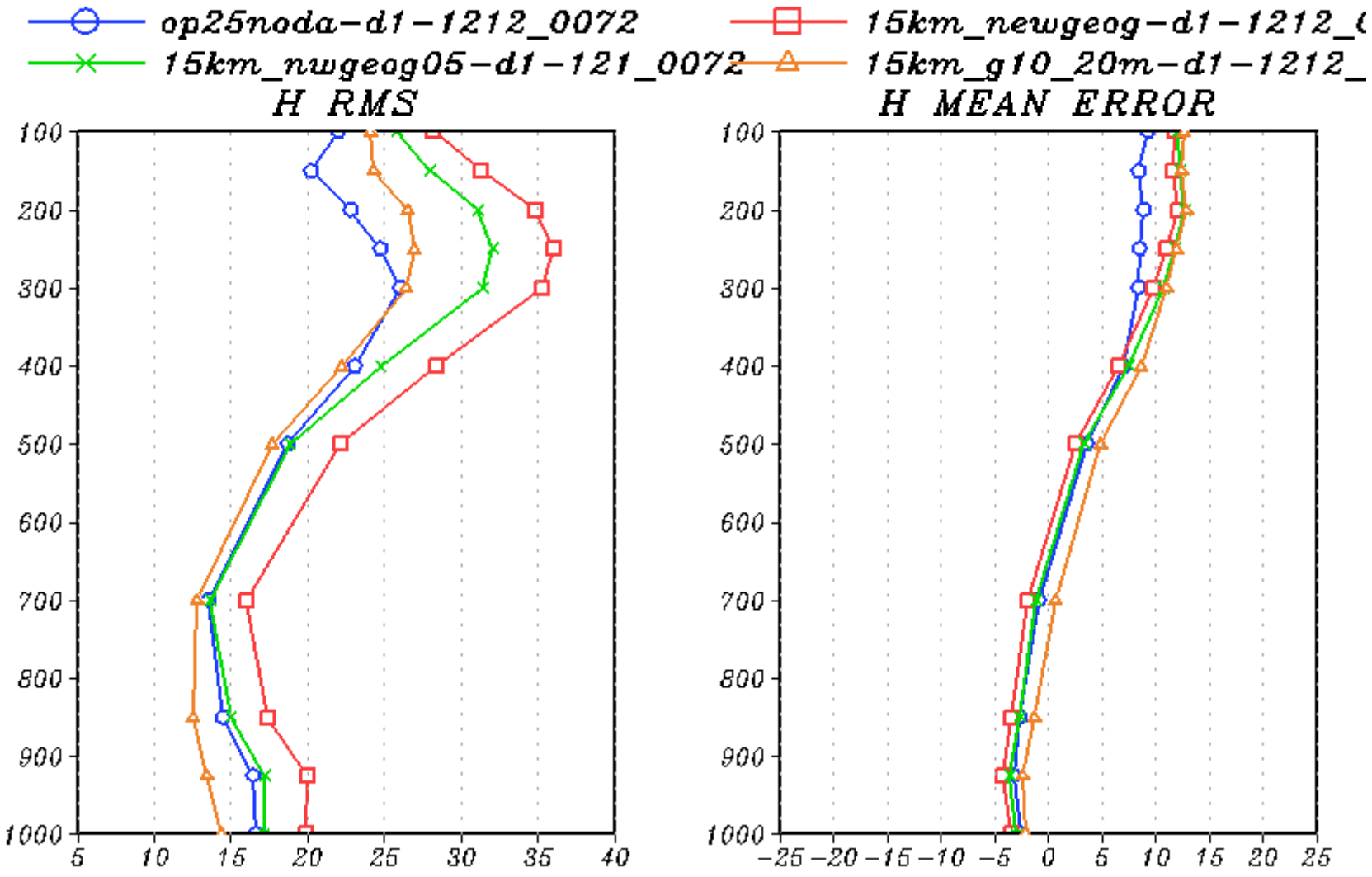
謝謝指教


15km-OP25
12120100-12121512 72HR FCST
SEA-LEVEL PRESSURE (hPa)
12120100-12121512 72HR FCST
interval = 2.0
Data From -8.0 To 5.0 By 0.3
-2. -2. -1. -1. 0. 1. 1. 2. 2.


nwgg05-15km
12120100-12121512 72HR FCST
SEA-LEVEL PRESSURE (hPa)
12120100-12121512 72HR FCST
interval = 2.0
Data From -2.0 To 1.0 By 0.3
-2. -2. -1. -1. 0. 1. 1. 2. 2.

個 案 實 驗


個案中放大參考層之GWDO似乎對於高層的調整仍舊不夠
改變GEOG
改變Cleff
混合改變
10m→20m (geog20)
10m→30m (geog30)
15 → 5 (gwd05)
g05g20
G07g20
1
G10g20
G05v20


op25noda-d1-1212_0072
15km_newgeog-d1-1212_(
15km_nwgeog05-d1-121_0072
15km_g10_20m-d1-1212_
H RMS
H MEAN ERROR
100
200
300
400
500
600
700
800
900
1000
5
10
15
20
25
30
35
40
-25
-20
-15
-10
-5
0
5
10
15
20
25

- 2012/12/04/00~2012/12/08/12 測試結果

	H				T				U				V			
	850	500	300	200	850	500	300	200	850	500	300	200	850	500	300	200
OP25	17.57	17.84	22.20	18.94	1.581	1.261	1.277	1.476	4.290	4.580	5.763	4.934	4.210	4.361	5.277	4.741
15_ori	18.21	18.64	24.06	22.45	1.565	1.395	1.373	1.435	4.200	4.583	5.913	4.998	4.126	4.294	5.333	4.996
Gwd05	16.26	16.74	22.43	21.01	1.457	1.291	1.306	1.438	3.975	4.385	5.679	4.844	3.895	4.149	5.227	4.784
Geog20	17.06	17.57	23.12	20.98	1.509	1.248	1.285	1.513	4.068	4.493	5.727	4.811	3.980	4.185	5.244	4.702
Geog30	17.64	18.00	23.21	20.95	1.586	1.262	1.278	1.494	4.143	4.582	5.704	4.729	4.040	4.190	5.121	4.646
G05g20	17.93	18.36	23.84	21.76	1.645	1.287	1.309	1.488	4.207	4.671	5.784	4.808	4.100	4.241	5.106	4.622
G07g20	17.68	18.06	23.69	21.36	1.594	1.273	1.292	1.500	4.211	4.645	5.765	4.762	4.091	4.248	5.161	4.617
G10g20	17.05	17.69	23.28	21.12	1.534	1.258	1.269	1.485	4.038	4.508	5.588	4.715	3.979	4.205	5.089	4.595
G05v20	16.72	17.08	22.51	20.84	1.478	1.280	1.283	1.444	4.030	4.415	5.689	4.862	3.926	4.166	5.144	4.736

- 2012/06/04/00~2012/06/15/12 測試結果

	H				T				U				V			
	850	500	300	200	850	500	300	200	850	500	300	200	850	500	300	200
OP25	13.58	16.41	21.59	25.19	1.418	1.037	1.325	1.526	3.552	4.006	5.809	6.647	3.541	3.892	5.537	6.384
15_ori	13.96	15.56	20.46	23.91	1.331	1.014	1.237	1.458	3.531	3.956	5.616	6.537	3.550	3.827	5.371	6.106
Gwd05	14.02	15.70	20.86	24.57	1.321	1.013	1.248	1.471	3.489	3.966	5.647	6.607	3.514	3.806	5.370	6.231
G05v20	14.00	15.87	21.24	25.12	1.331	1.018	1.258	1.489	3.472	3.974	5.706	6.635	3.492	3.820	5.431	6.269

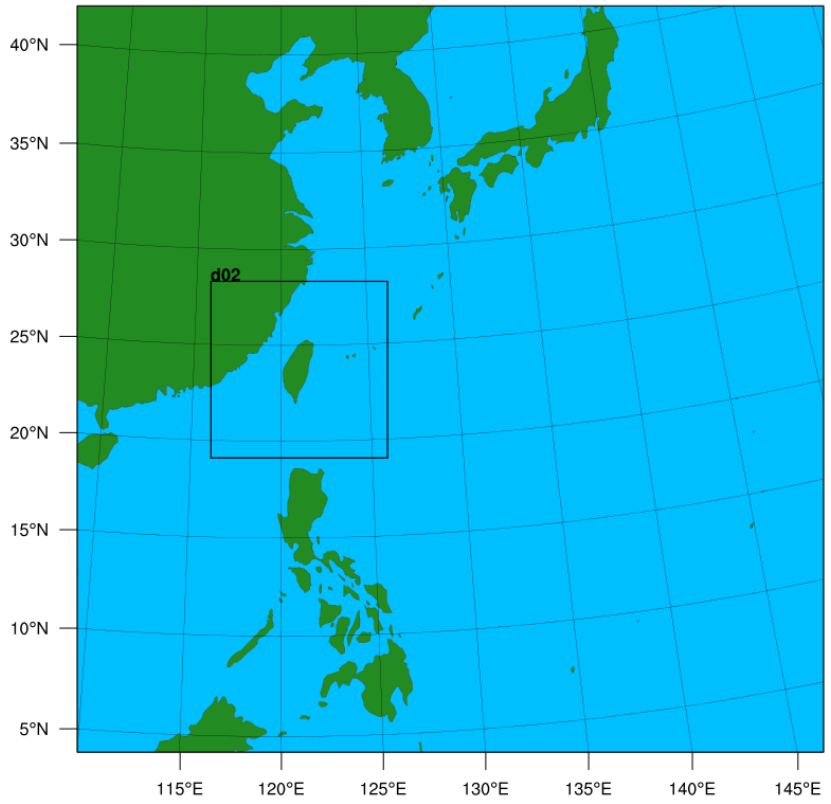
GWD05

垂直52層

準平行15-3建置情形

SemiOP

- 以勤芳出國前所設定好的15-3進行準平行測試。
  - D1: 280*280
  - D2: 331*331
- 流程與OP25相同，不做資料同化。
- 72小時預報，整體流程定可在4小時(約3小時9分鐘)內完成，使用192顆核心進行WRF的預報，費時約9900秒。



SemiOP

- 安內研發用資源充足，應可不必與作業搶資源，但須確保工作的優先度，以備不時之需。
- 每6小時輸出，72小時預報總共需要11.7G(包含DMS key以及原始檔)
- 目前可進行D1的綜觀校驗。(轉cold_wrfinput的key為校驗對象)
- 預報產品的呈現? (Hong’s WEB或者其他地方)