

WRF模式積分範圍對模式預報的影響

氣象資訊中心

魏士偉、洪景山

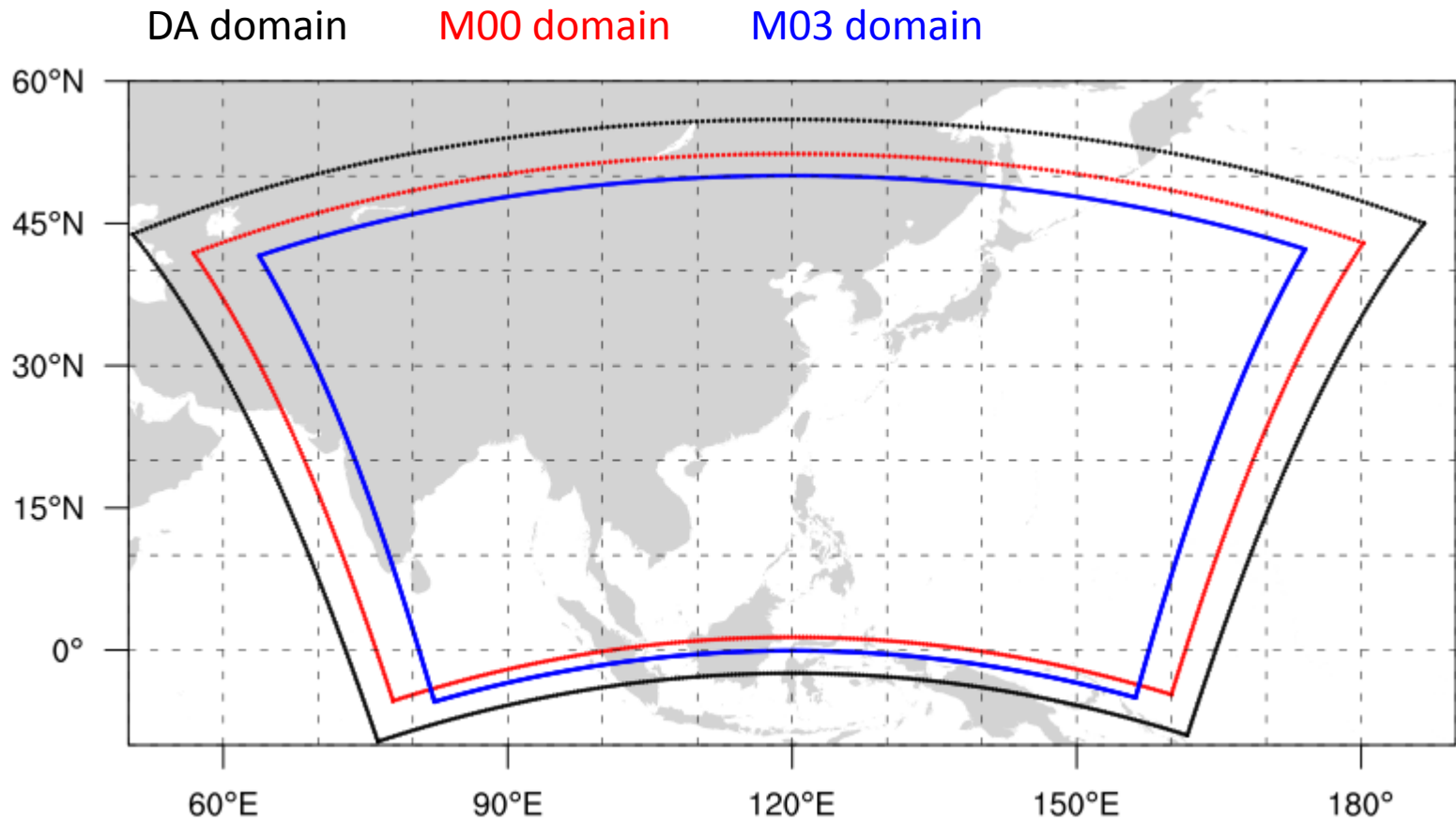
2015.09.17

天氣分析與預報研討會

大綱

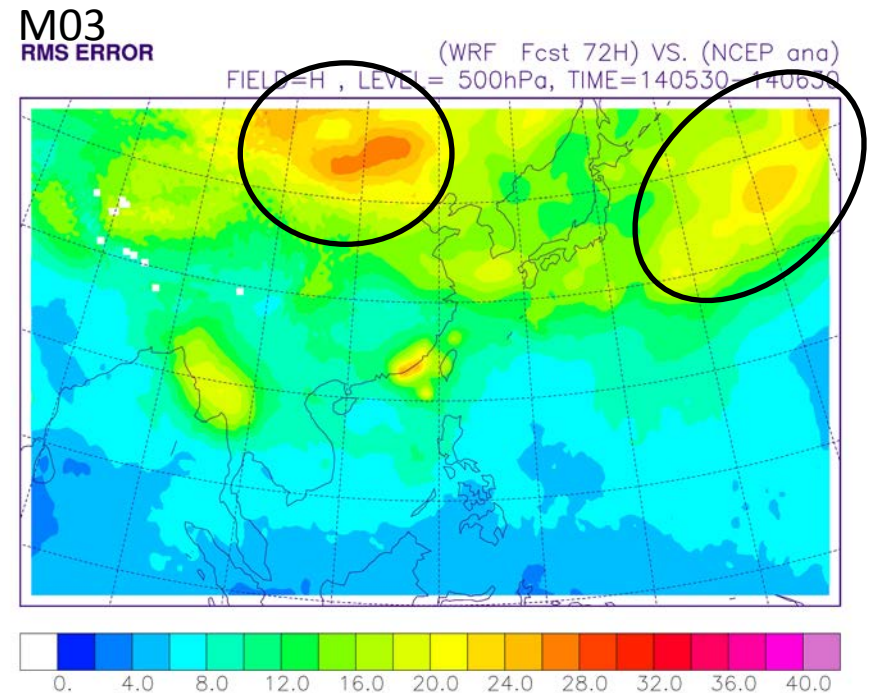
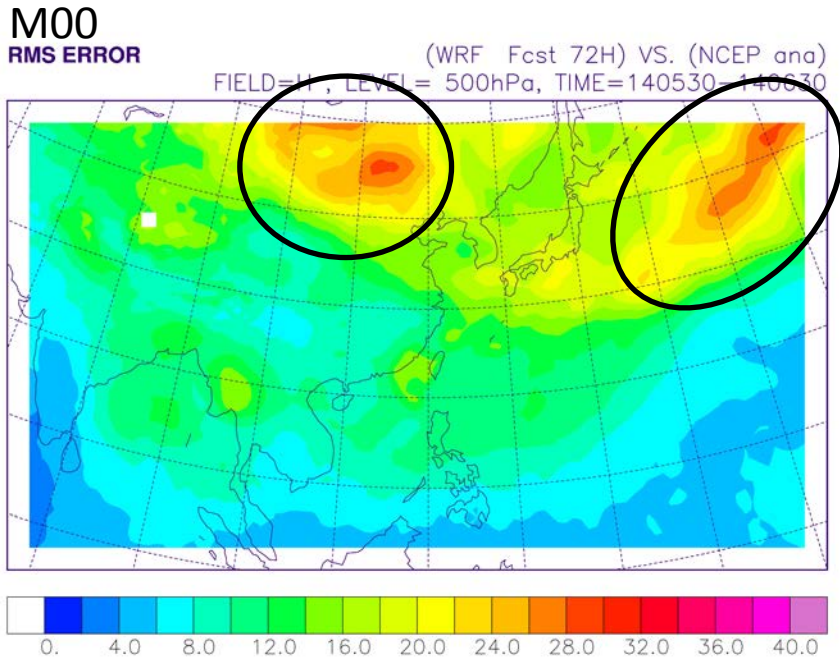
- 前言
 - 背景與動機介紹
- 實驗設計
- 結果討論與分析
 - 預報邊界條件
 - 分析邊界條件
 - NCEP GFS及WRF預報誤差緯向平均
- 結論

CWB 作業積分範圍

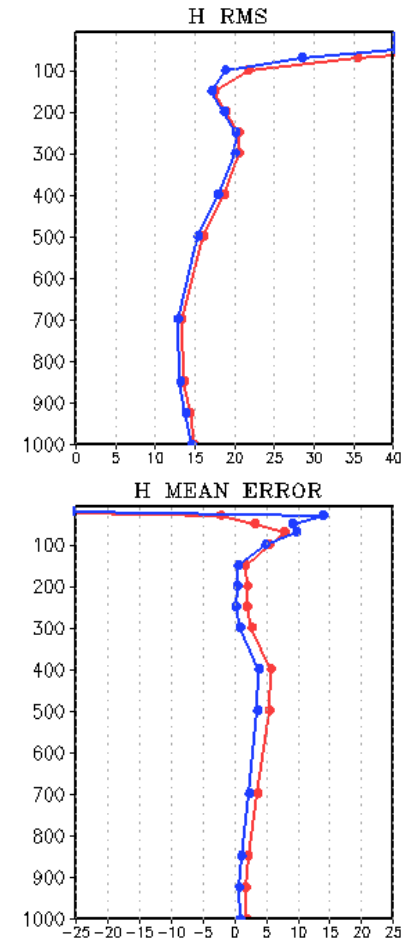
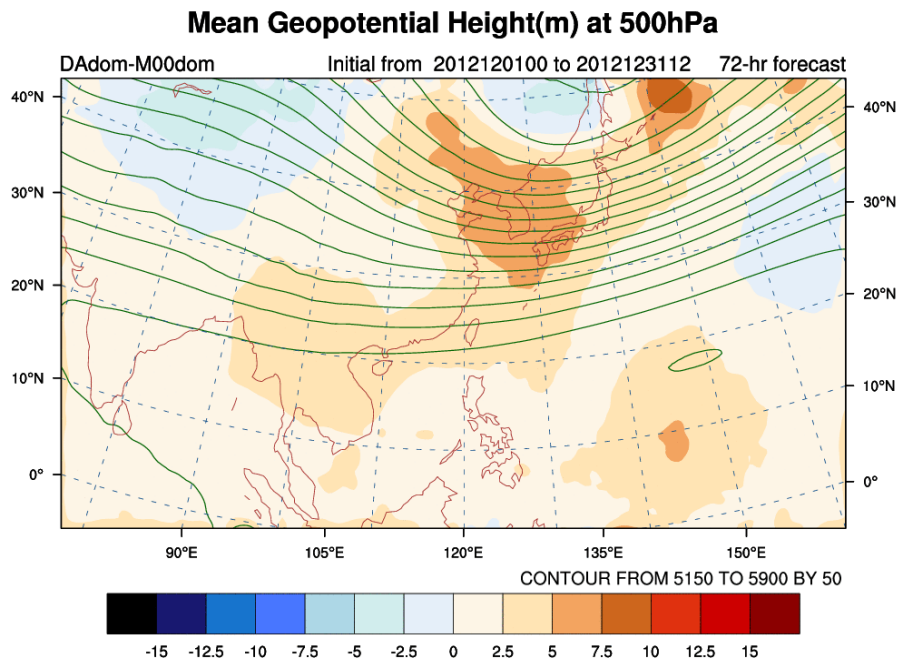


動機

- M00與M03在北方邊界附近的預報誤差有明顯的差異。



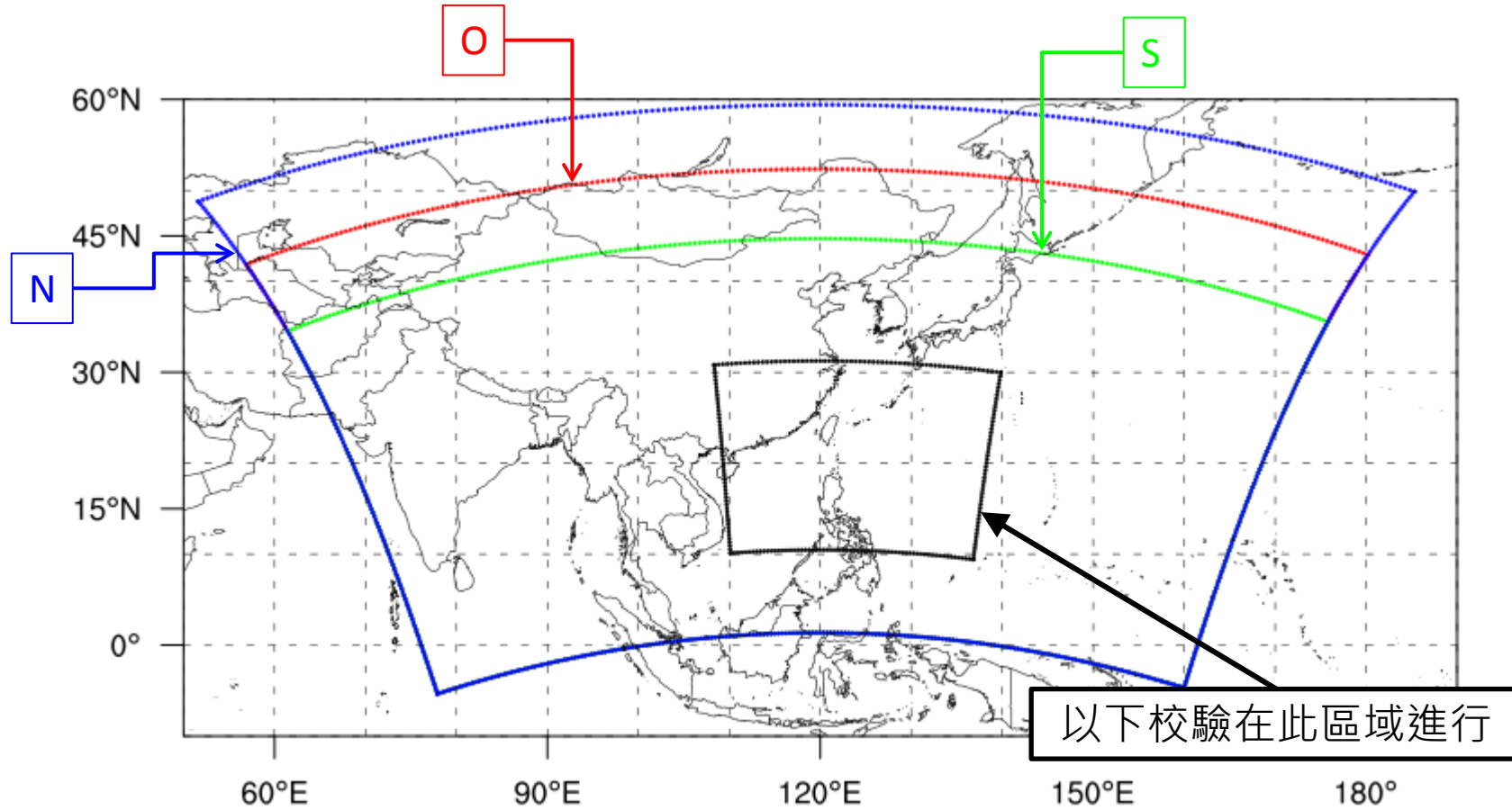
- DA的72小時預報誤差也較M00大。



From 江琇瑛

實驗設計

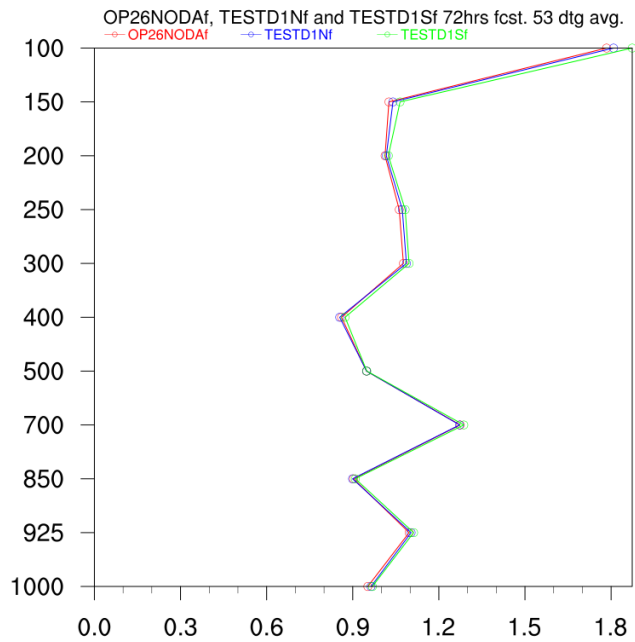
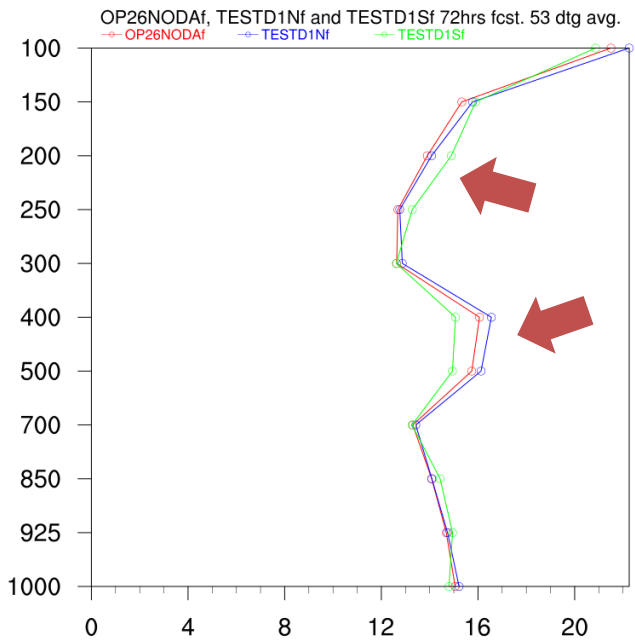
- 為了瞭解WRF模式北側邊界對於模式預報的影響，因此設計不同北側邊界的三組實驗進行測試與分析。



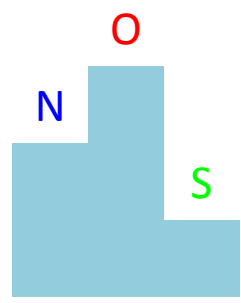
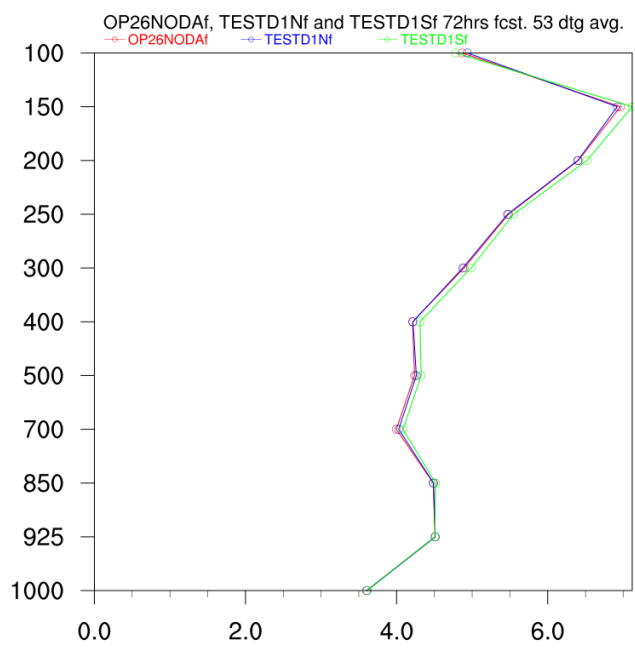
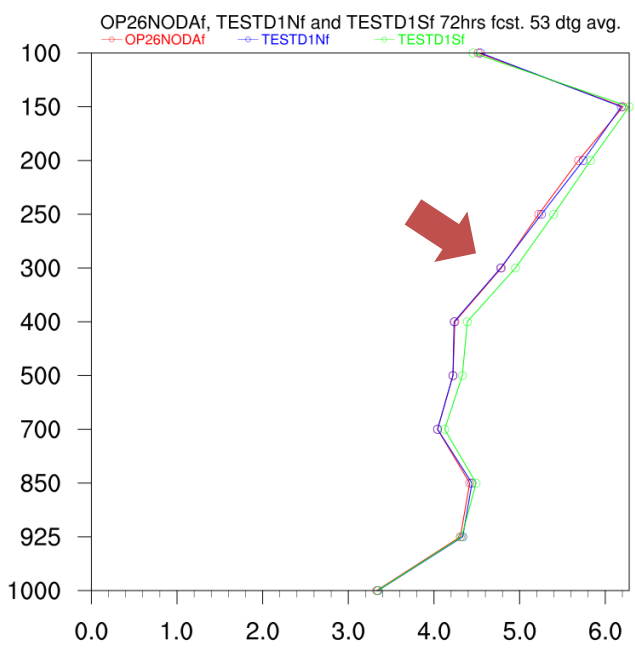
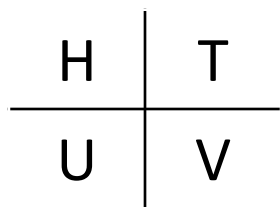
	N	O	S
Grid_x	221	221	221
Grid_y	147	127	107
實驗時間	2012 June & 2012 December		
預報時間	72 hours		
校驗對象	NCEP GFS Analysis		

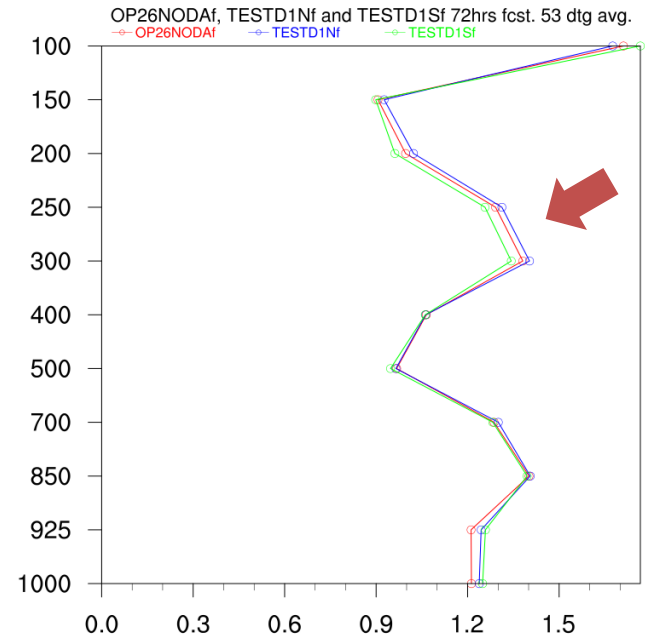
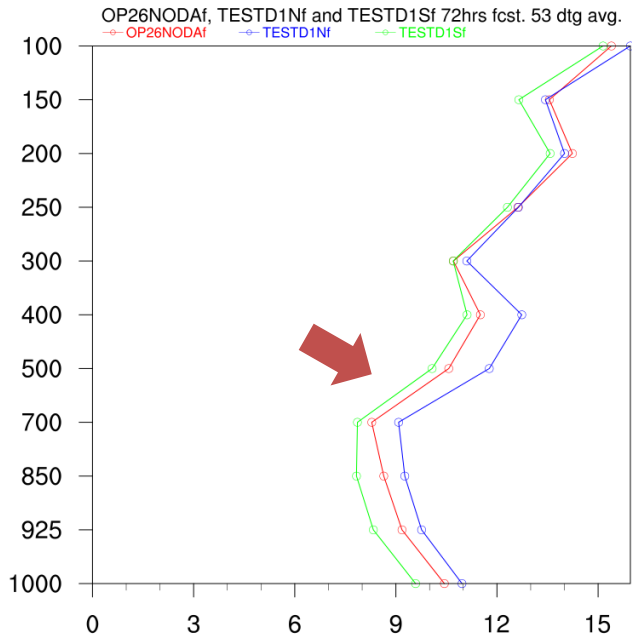
NCEP GFS六小時預報邊界

FORECAST BOUNDARY

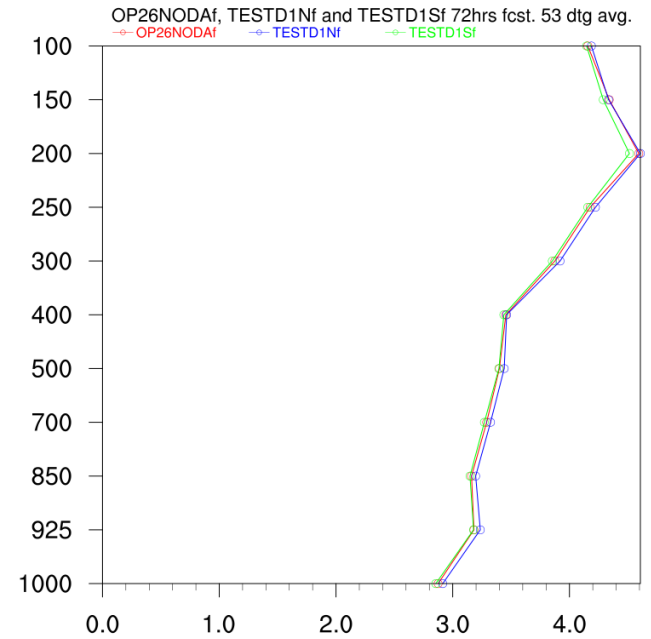
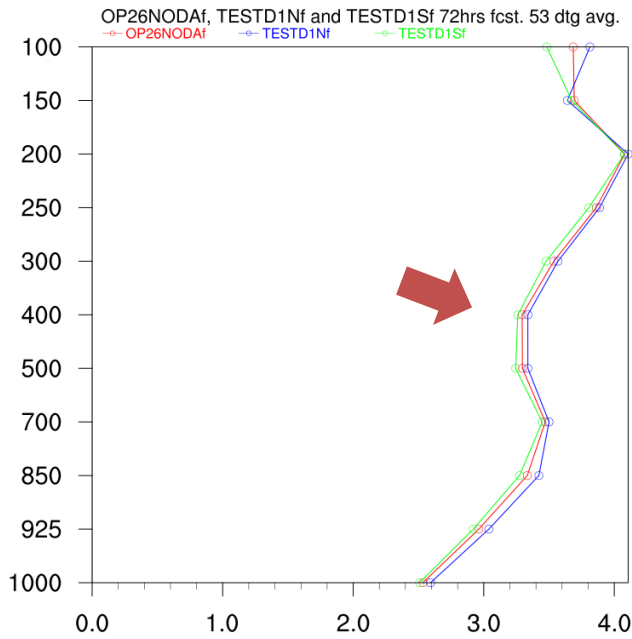
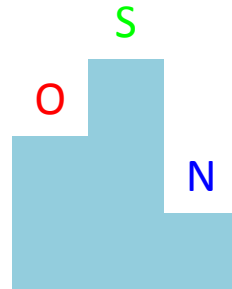
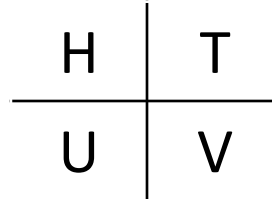


2012
June





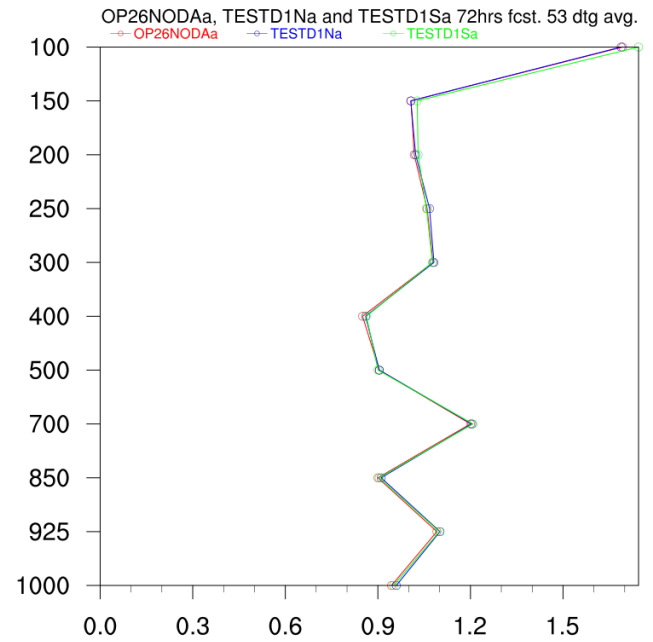
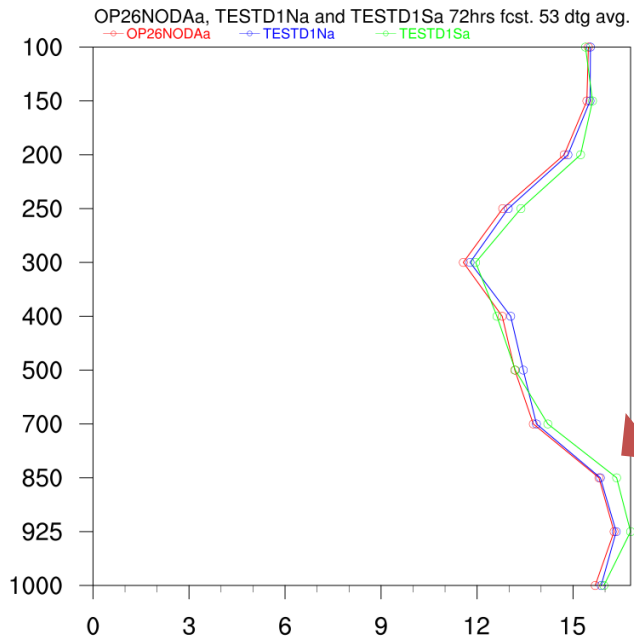
2012
Dec





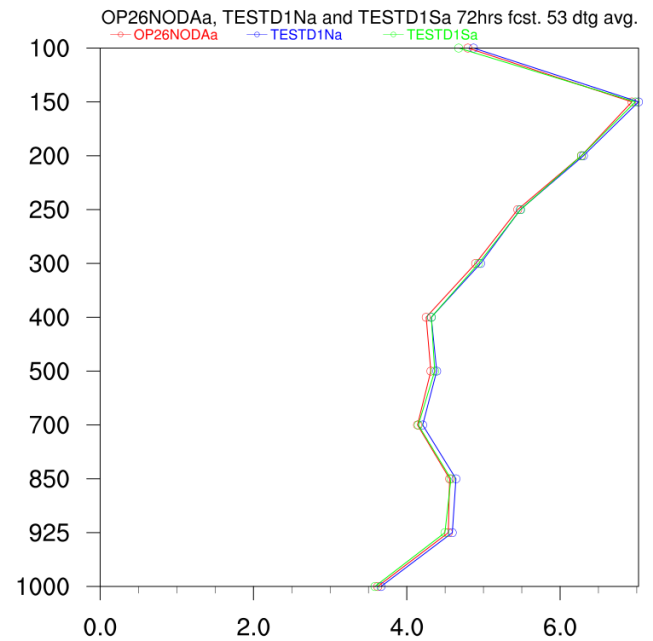
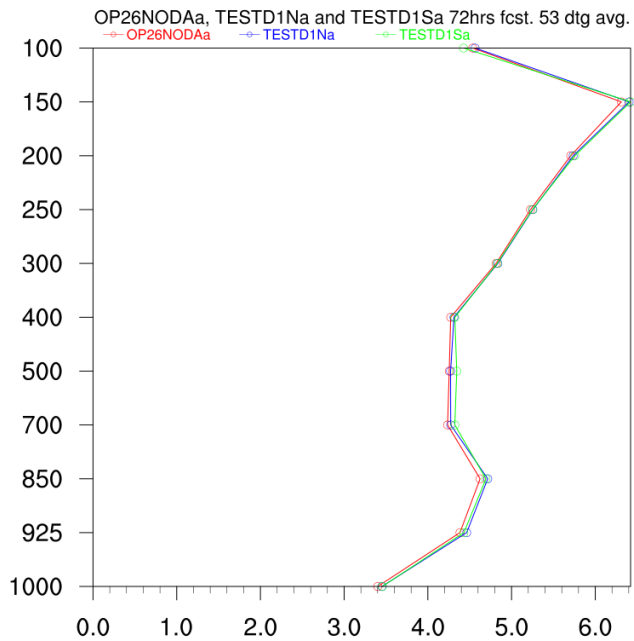
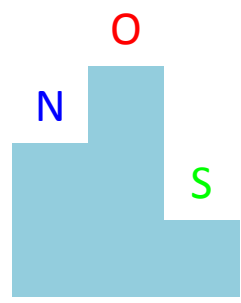
NCEP GFS六小時分析邊界

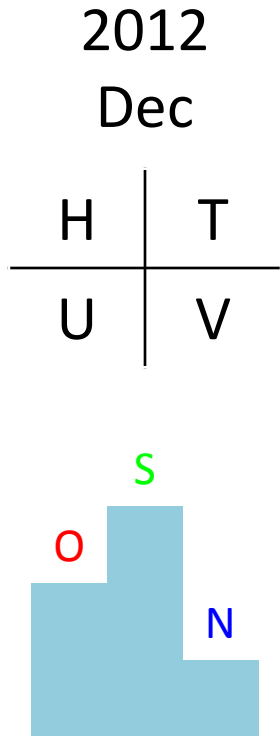
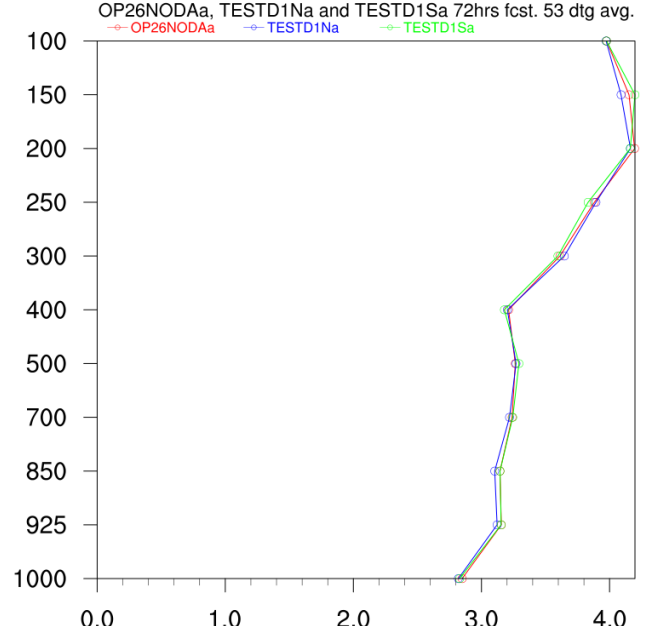
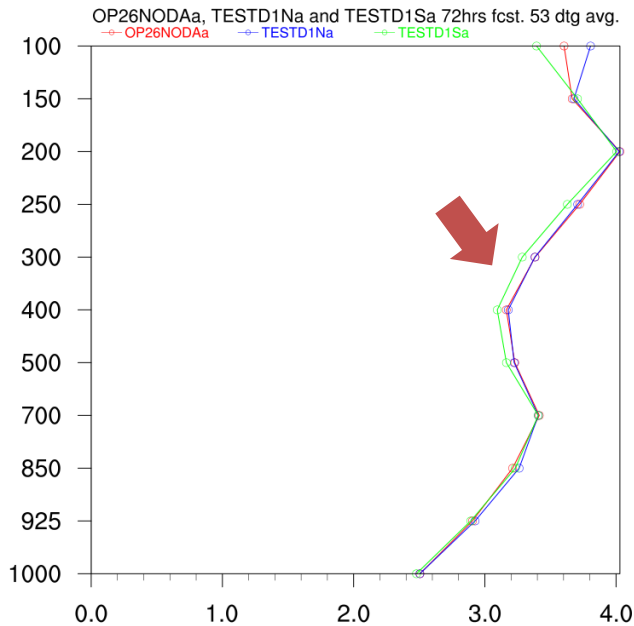
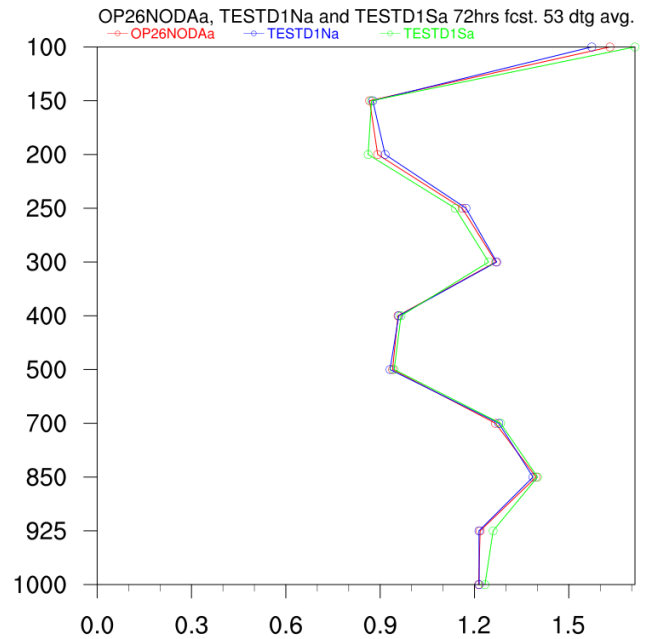
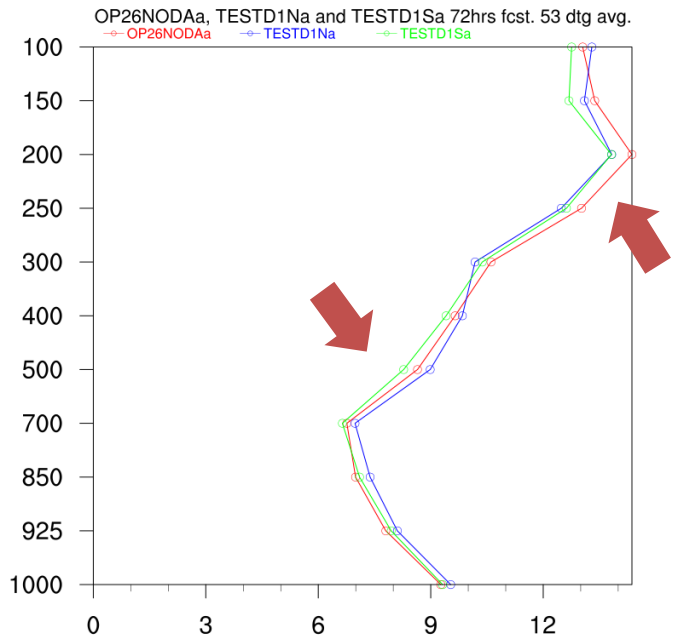
ANALYSIS BOUNDARY



2012
June

H	T
U	V





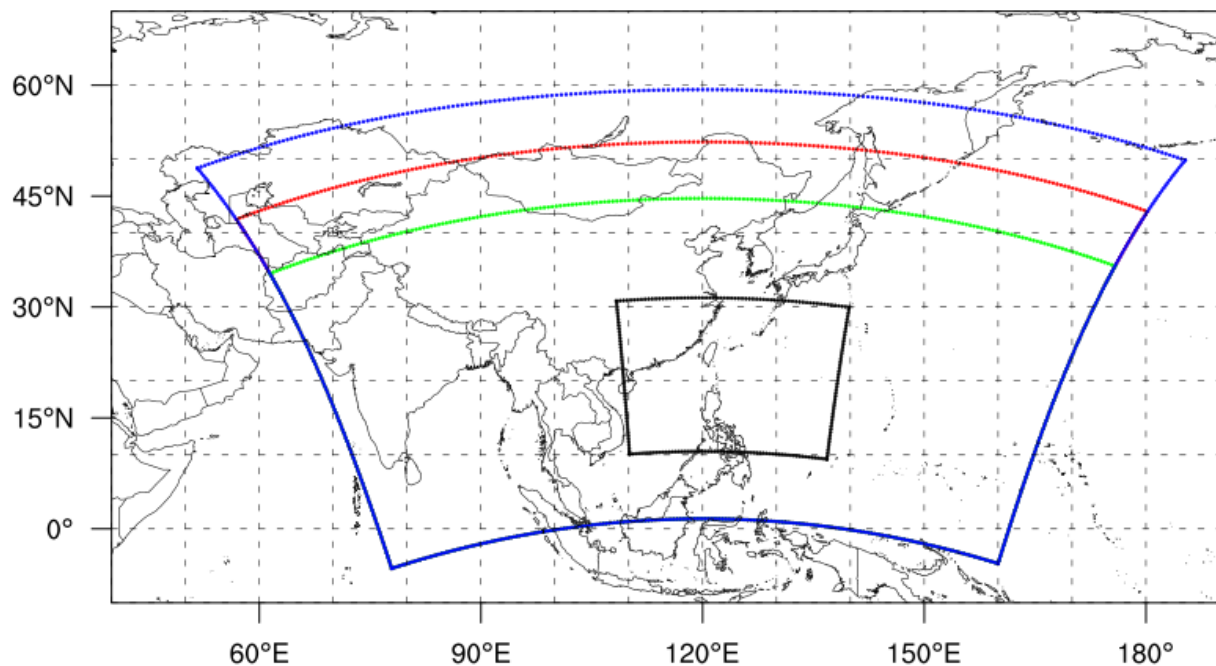
小結

- 整體來說，實驗O的預報結果較好，實驗S次之，實驗N的結果最差。
- 改以分析邊界條件進行預報，三組實驗的預報誤差差異減少許多。

NCEP GFS的預報誤差是造成WRF模式不同邊界位置的預報誤差有所差異的主因？

NCEP GFS預報誤差的
緯向平均

WRF模式預報誤差的
緯向平均



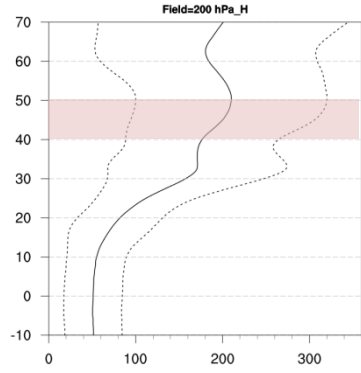
東經40°至西經170°、南緯10°至北緯70°

NCEP GFS預報誤差緯向平均

H RMSE Zonal Mean

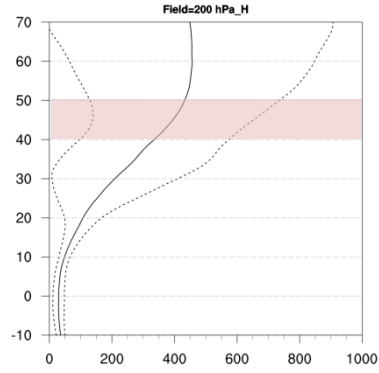
2012/1~3

NCEP72f and NCEPa 182 dtg avg.



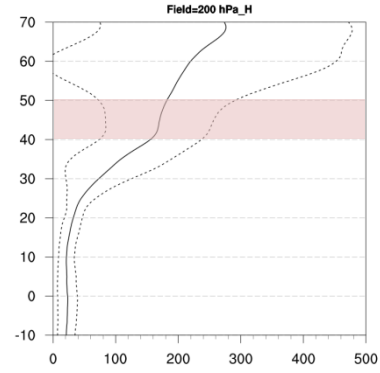
2012/4~6

NCEP72f and NCEPa 182 dtg avg.



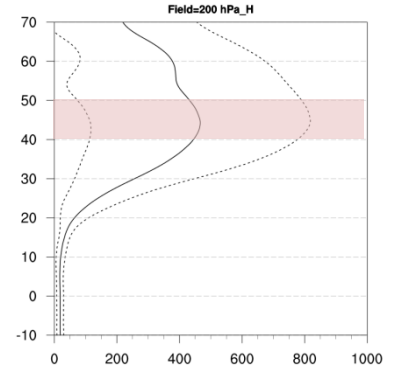
2012/7~9

NCEP72f and NCEPa 184 dtg avg.

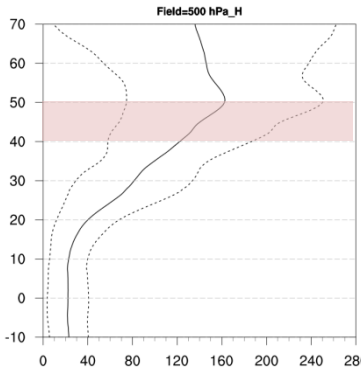


2012/10~12

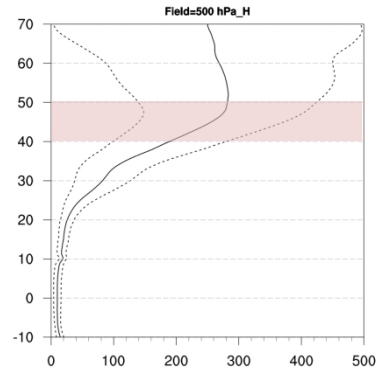
NCEP72f and NCEPa 180 dtg avg.



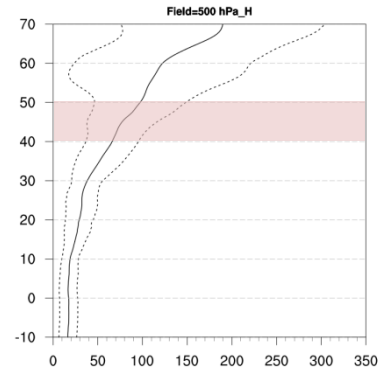
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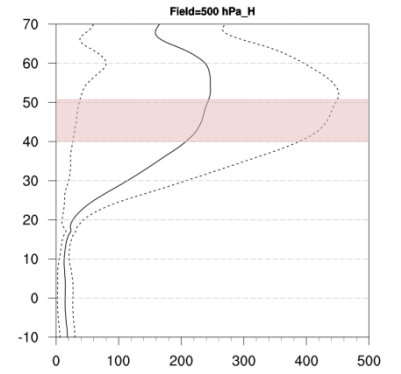
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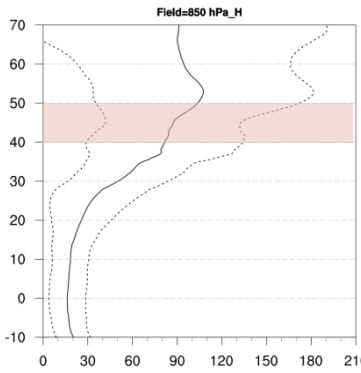
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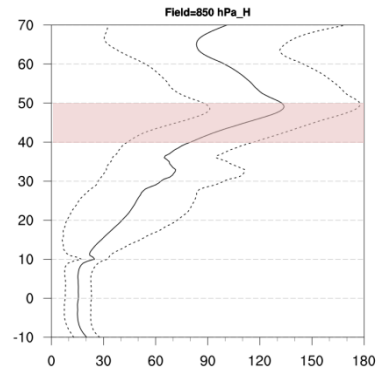
NCEP72f and NCEPa 180 dtg avg.



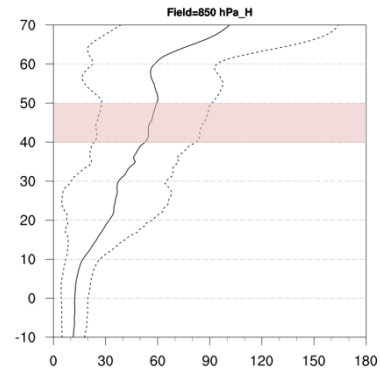
NCEP72f and NCEPa 182 dtg avg.



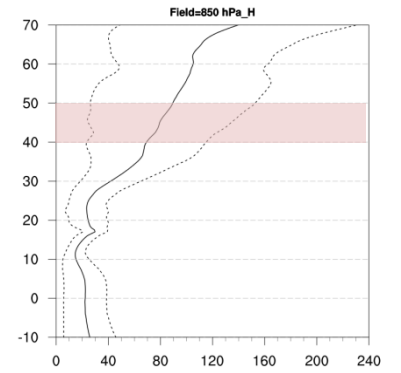
NCEP72f and NCEPa 182 dtg avg.



NCEP72f and NCEPa 184 dtg avg.



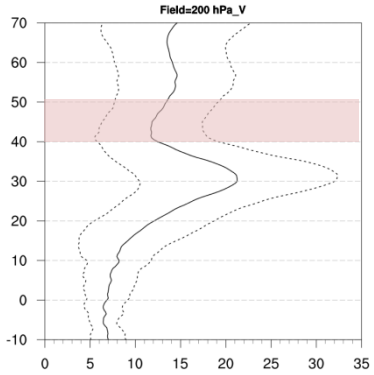
NCEP72f and NCEPa 180 dtg avg.



V RMSE Zonal Mean

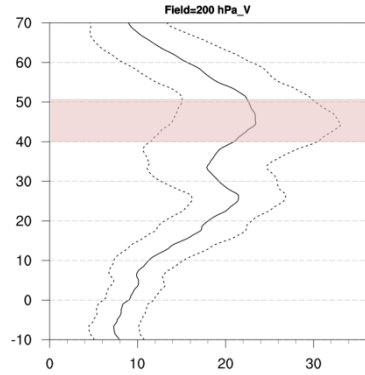
2012/1~3

NCEP72f and NCEPa 182 dtg avg.



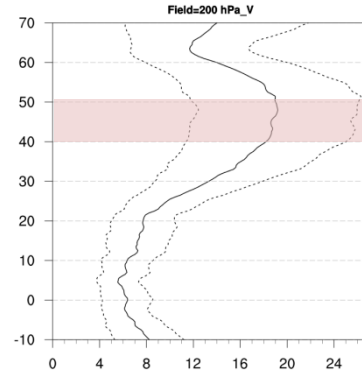
2012/4~6

NCEP72f and NCEPa 182 dtg avg.



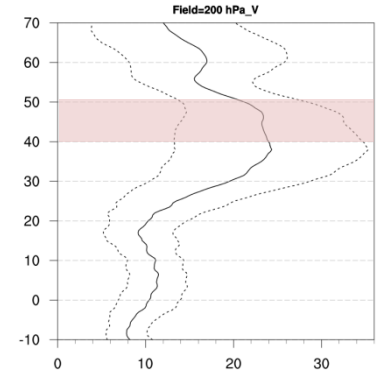
2012/7~9

NCEP72f and NCEPa 184 dtg avg.

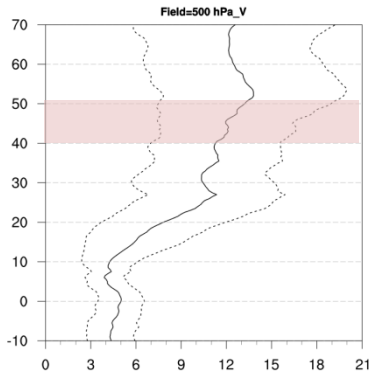


2012/10~12

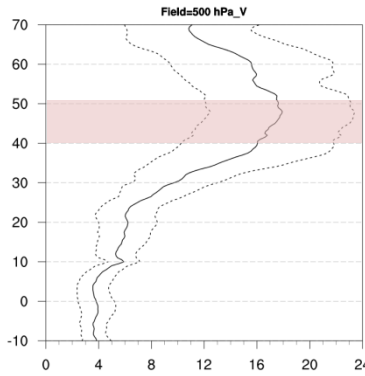
NCEP72f and NCEPa 180 dtg avg.



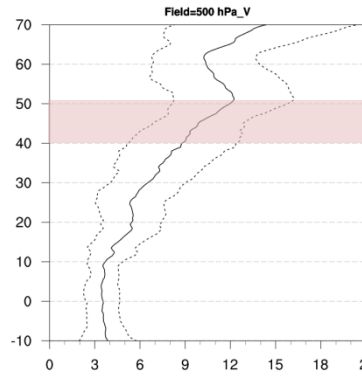
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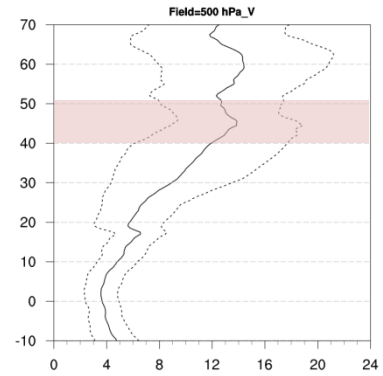
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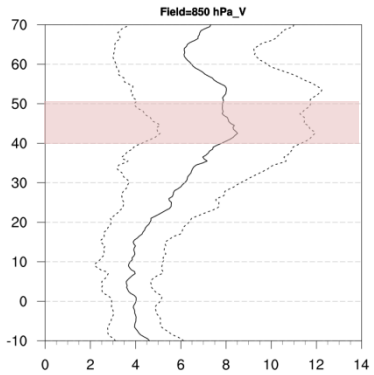
NCEP72f and NCEPa 184 dtg avg.



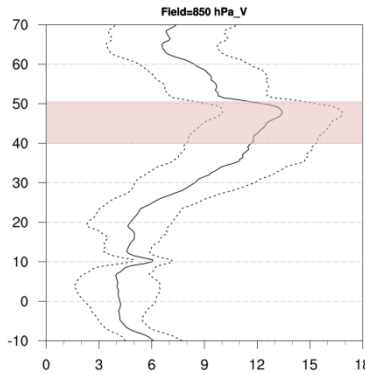
NCEP72f and NCEPa 180 dtg avg.



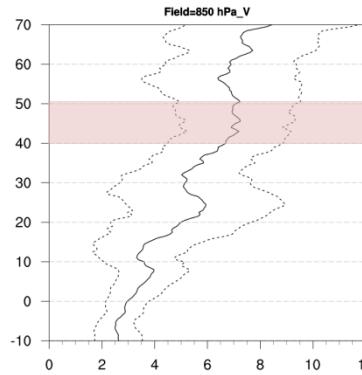
NCEP72f and NCEPa 182 dtg avg.



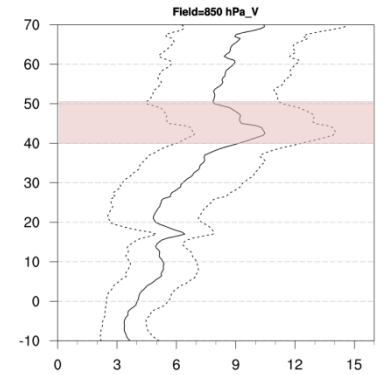
NCEP72f and NCEPa 182 dtg avg.

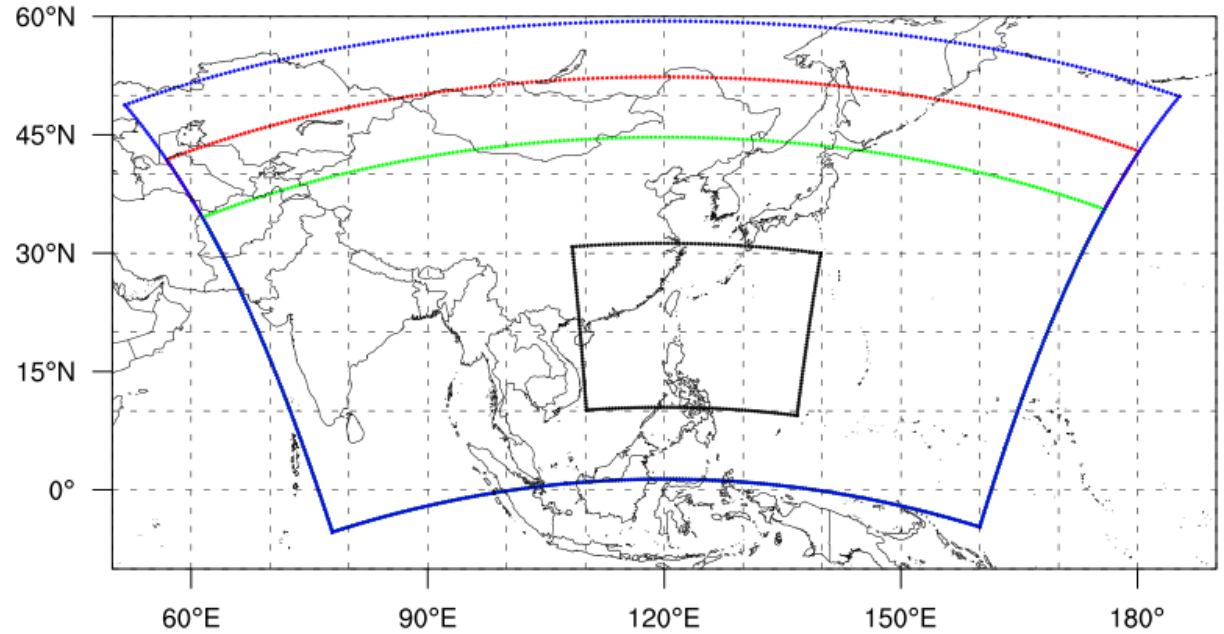


NCEP72f and NCEPa 184 dtg avg.



NCEP72f and NCEPa 180 dtg avg.





實驗O、N與S 2012年6月、12月

WRF模式預報誤差緯向平均

結論

- WRF模式的北側邊界位置越北(積分範圍越大)，模式的預報誤差會越大，但這情況主要是受到全球模式的預報誤差影響。
- 由於預報邊界條件所引入的誤差比例很低，因此改善WRF模式本身的預報仍是我們需要努力的方向。

Thanks for your attention

THE END

FORECAST BOUNDARY

2012 June

H							T						
	O		N		S			O		N		S	
	RMSE	VAR	RMSE	VAR	RMSE	VAR		RMSE	VAR	RMSE	VAR	RMSE	VAR
1000	15.05	35.86	15.22	34.88	14.8	35.87	1000	0.95	0.03	0.96	0.03	0.97	0.03
925	14.69	46.52	14.74	46.63	14.95	47.86	925	1.1	0.03	1.1	0.02	1.11	0.02
850	14.08	45.98	14.09	46.6	14.43	48.38	850	0.9	0.01	0.9	0.01	0.91	0.01
700	13.3	38.12	13.43	38.19	13.27	42.22	700	1.27	0.04	1.27	0.04	1.29	0.03
500	15.74	22.84	16.13	22.45	14.94	23.23	500	0.95	0.02	0.95	0.02	0.95	0.02
400	16.06	21.14	16.55	21.04	15.07	20.92	400	0.86	0.04	0.85	0.03	0.87	0.04
300	12.63	14.04	12.87	15.39	12.62	15.58	300	1.08	0.05	1.09	0.05	1.1	0.06
250	12.68	9.64	12.76	10.13	13.28	15.54	250	1.06	0.05	1.07	0.05	1.08	0.06
200	13.9	8.93	14.08	8.46	14.89	15.69	200	1.01	0.04	1.02	0.04	1.02	0.05
150	15.33	13.65	15.78	14.28	15.9	15.88	150	1.03	0.04	1.04	0.05	1.06	0.05
100	21.5	59.27	22.26	52.9	20.87	58.96	100	1.78	0.13	1.81	0.15	1.87	0.15

U							V						
	O		N		S			O		N		S	
	RMSE	VAR	RMSE	VAR	RMSE	VAR		RMSE	VAR	RMSE	VAR	RMSE	VAR
1000	3.33	0.61	3.35	0.64	3.34	0.59	1000	3.6	1.07	3.61	1.1	3.61	1.01
925	4.31	1.21	4.34	1.3	4.32	1.13	925	4.51	1.82	4.51	1.99	4.51	1.7
850	4.42	1.24	4.44	1.26	4.49	1.17	850	4.48	1.76	4.49	1.99	4.52	1.79
700	4.04	1.33	4.04	1.3	4.12	1.48	700	4	1.37	4.03	1.57	4.08	1.42
500	4.22	0.9	4.22	0.9	4.33	1.19	500	4.24	1.3	4.26	1.31	4.33	1.37
400	4.24	0.84	4.23	0.81	4.39	1.14	400	4.21	1.38	4.22	1.34	4.31	1.65
300	4.79	0.67	4.78	0.62	4.95	0.9	300	4.89	1.39	4.87	1.42	4.99	1.73
250	5.22	0.77	5.26	0.77	5.4	0.95	250	5.48	1.42	5.47	1.53	5.55	2.04
200	5.69	1.06	5.74	1.11	5.83	1.25	200	6.4	1.88	6.4	1.95	6.52	2.67
150	6.21	2.86	6.19	2.86	6.28	2.81	150	6.96	2.31	6.92	2.55	7.12	2.87
100	4.52	1.39	4.54	1.54	4.46	1.41	100	4.87	1.51	4.93	1.72	4.78	1.51

2012 December

H							T						
	O		N		S			O		N		S	
	RMSE	VAR	RMSE	VAR	RMSE	VAR		RMSE	VAR	RMSE	VAR	RMSE	VAR
1000	10.44	11.24	10.96	11.24	9.59	8.33	1000	1.21	0.04	1.24	0.05	1.25	0.05
925	9.18	9.71	9.76	9.79	8.33	7.45	925	1.21	0.04	1.24	0.05	1.26	0.05
850	8.64	7.84	9.26	7.88	7.83	6.33	850	1.4	0.06	1.41	0.07	1.4	0.05
700	8.28	7.53	9.08	8.13	7.86	5.85	700	1.29	0.06	1.3	0.06	1.28	0.04
500	10.57	10.85	11.77	14.97	10.08	10.51	500	0.97	0.05	0.96	0.05	0.95	0.05
400	11.51	13.18	12.74	18.79	11.11	13.42	400	1.06	0.05	1.06	0.06	1.06	0.05
300	10.71	11.98	11.1	18.76	10.7	10.81	300	1.38	0.23	1.4	0.25	1.34	0.21
250	12.62	13.65	12.64	16.13	12.31	13.35	250	1.29	0.18	1.31	0.2	1.26	0.17
200	14.24	17.95	14	16.8	13.58	17.92	200	1	0.15	1.02	0.16	0.96	0.13
150	13.55	23.67	13.44	21.33	12.65	22.1	150	0.91	0.06	0.93	0.07	0.9	0.06
100	15.39	21.69	15.96	25.13	15.15	20.93	100	1.71	0.1	1.68	0.08	1.77	0.1

U							V						
	O		N		S			O		N		S	
	RMSE	VAR	RMSE	VAR	RMSE	VAR		RMSE	VAR	RMSE	VAR	RMSE	VAR
1000	2.53	0.29	2.59	0.29	2.51	0.28	1000	2.88	0.31	2.91	0.32	2.86	0.34
925	2.96	0.41	3.04	0.38	2.92	0.41	925	3.18	0.41	3.24	0.44	3.18	0.43
850	3.33	0.41	3.42	0.4	3.27	0.39	850	3.16	0.32	3.2	0.34	3.15	0.32
700	3.47	0.38	3.5	0.34	3.45	0.36	700	3.29	0.32	3.32	0.37	3.27	0.34
500	3.3	0.37	3.34	0.37	3.24	0.34	500	3.4	1.08	3.44	1.26	3.4	1.03
400	3.29	0.55	3.34	0.69	3.26	0.48	400	3.46	1.08	3.46	1.1	3.44	0.99
300	3.54	0.71	3.57	0.84	3.48	0.68	300	3.88	1.22	3.92	1.29	3.85	1.2
250	3.86	0.74	3.89	0.79	3.81	0.75	250	4.18	1.38	4.22	1.43	4.16	1.34
200	4.08	0.79	4.11	0.75	4.08	0.76	200	4.59	1.22	4.61	1.25	4.51	1.12
150	3.69	0.96	3.64	0.72	3.67	0.77	150	4.34	1.38	4.34	1.13	4.29	1.23
100	3.69	0.82	3.81	0.94	3.48	0.69	100	4.16	2.03	4.19	2.09	4.15	1.85

ANALYSIS BOUNDARY

2012 June

H							T						
	O		N		S			O		N		S	
	RMSE	VAR	RMSE	VAR	RMSE	VAR		RMSE	VAR	RMSE	VAR	RMSE	VAR
1000	15.69	31.79	15.88	32.67	15.96	34.79	1000	0.94	0.03	0.96	0.03	0.95	0.03
925	16.28	45.58	16.35	47.45	16.8	51.34	925	1.09	0.03	1.1	0.03	1.1	0.03
850	15.81	45.92	15.85	47.76	16.36	51.28	850	0.9	0.01	0.91	0.01	0.9	0.01
700	13.76	43.08	13.86	43.91	14.21	47.77	700	1.2	0.03	1.2	0.03	1.21	0.03
500	13.18	20.91	13.44	20.77	13.19	25.89	500	0.9	0.01	0.9	0.02	0.9	0.02
400	12.79	14.52	13.05	15.11	12.62	19.52	400	0.85	0.03	0.86	0.03	0.86	0.04
300	11.57	13.04	11.78	14.44	11.96	19.93	300	1.08	0.04	1.08	0.05	1.08	0.06
250	12.8	14.26	12.97	15.07	13.37	22.85	250	1.06	0.05	1.07	0.05	1.06	0.06
200	14.72	18.72	14.84	18.09	15.24	26.49	200	1.02	0.04	1.02	0.04	1.03	0.05
150	15.43	18.77	15.53	16.66	15.61	20.03	150	1.01	0.04	1.01	0.05	1.03	0.05
100	15.48	22.45	15.54	21.92	15.39	23.54	100	1.69	0.11	1.69	0.13	1.74	0.12

U							V						
	O		N		S			O		N		S	
	RMSE	VAR	RMSE	VAR	RMSE	VAR		RMSE	VAR	RMSE	VAR	RMSE	VAR
1000	3.4	0.49	3.45	0.53	3.46	0.57	1000	3.62	1.09	3.66	1.14	3.58	1.09
925	4.38	1	4.46	1.14	4.43	1.11	925	4.54	1.83	4.59	1.97	4.5	1.79
850	4.62	0.99	4.72	1.14	4.69	1.18	850	4.56	1.82	4.64	2.01	4.58	1.97
700	4.24	1.27	4.27	1.32	4.32	1.53	700	4.14	1.35	4.21	1.49	4.15	1.45
500	4.26	0.81	4.27	0.91	4.35	1.09	500	4.31	1.25	4.39	1.23	4.36	1.39
400	4.27	0.8	4.31	0.85	4.32	1.04	400	4.25	1.35	4.32	1.36	4.32	1.76
300	4.81	0.59	4.84	0.69	4.83	0.84	300	4.9	1.4	4.96	1.48	4.94	1.78
250	5.23	0.68	5.25	0.85	5.25	0.88	250	5.45	1.43	5.48	1.51	5.49	1.75
200	5.71	1.17	5.74	1.23	5.76	1.43	200	6.28	1.63	6.3	1.67	6.28	2.15
150	6.31	3.43	6.4	3.75	6.42	3.45	150	6.94	2.84	7.02	3.04	6.98	3.15
100	4.54	1.32	4.56	1.36	4.43	1.23	100	4.8	1.61	4.87	1.74	4.68	1.43

2012 December

H							T						
	O		N		S			O		N		S	
	RMSE	VAR	RMSE	VAR	RMSE	VAR		RMSE	VAR	RMSE	VAR	RMSE	VAR
1000	9.27	6.64	9.53	6.33	9.32	6.68	1000	1.21	0.04	1.22	0.05	1.23	0.04
925	7.8	5.83	8.11	5.22	7.94	6.12	925	1.22	0.04	1.21	0.04	1.26	0.05
850	6.99	5.52	7.38	4.58	7.1	6.1	850	1.4	0.07	1.39	0.07	1.4	0.06
700	6.76	3.46	6.98	3.61	6.64	3.39	700	1.27	0.05	1.28	0.06	1.28	0.04
500	8.65	6.33	8.99	7.65	8.28	4.93	500	0.94	0.05	0.93	0.05	0.94	0.05
400	9.65	9.06	9.84	10.66	9.41	7.6	400	0.96	0.04	0.96	0.04	0.97	0.04
300	10.61	10.42	10.18	9.04	10.37	11.39	300	1.27	0.18	1.27	0.19	1.24	0.15
250	13.02	18.35	12.48	15.2	12.62	20.03	250	1.16	0.13	1.17	0.13	1.14	0.11
200	14.37	27.63	13.83	24.6	13.82	28.19	200	0.89	0.09	0.92	0.1	0.86	0.08
150	13.37	24.04	13.1	21.75	12.69	20.55	150	0.87	0.04	0.88	0.06	0.87	0.05
100	13.05	14.31	13.3	16.25	12.76	12.14	100	1.63	0.09	1.57	0.08	1.71	0.09

U							V						
	O		N		S			O		N		S	
	RMSE	VAR	RMSE	VAR	RMSE	VAR		RMSE	VAR	RMSE	VAR	RMSE	VAR
1000	2.51	0.26	2.5	0.24	2.48	0.26	1000	2.85	0.32	2.82	0.29	2.83	0.34
925	2.91	0.32	2.93	0.31	2.89	0.35	925	3.15	0.41	3.12	0.42	3.15	0.46
850	3.21	0.27	3.26	0.28	3.23	0.31	850	3.14	0.26	3.1	0.28	3.14	0.35
700	3.41	0.28	3.41	0.29	3.41	0.31	700	3.24	0.37	3.22	0.38	3.24	0.42
500	3.23	0.31	3.22	0.31	3.16	0.32	500	3.26	1.09	3.27	1.12	3.29	1.07
400	3.16	0.47	3.18	0.51	3.09	0.41	400	3.21	0.88	3.2	0.86	3.18	0.9
300	3.38	0.74	3.38	0.82	3.29	0.67	300	3.61	0.89	3.65	0.94	3.6	0.86
250	3.72	0.72	3.71	0.77	3.63	0.66	250	3.88	1.06	3.89	1.13	3.83	1.16
200	4.03	0.86	4.02	0.85	4	0.78	200	4.2	1.17	4.16	1.05	4.16	1.26
150	3.67	0.87	3.68	0.92	3.71	0.81	150	4.15	1.46	4.09	1.25	4.2	1.51
100	3.6	0.81	3.81	0.91	3.39	0.76	100	3.98	1.27	3.97	1.23	3.98	1.25