

NAR Labs 國家實驗研究院

台灣颱風洪水研究中心

EAKF系集資料同化系統探討GPSRO 掩星資料對梅姬颱風模擬之影響

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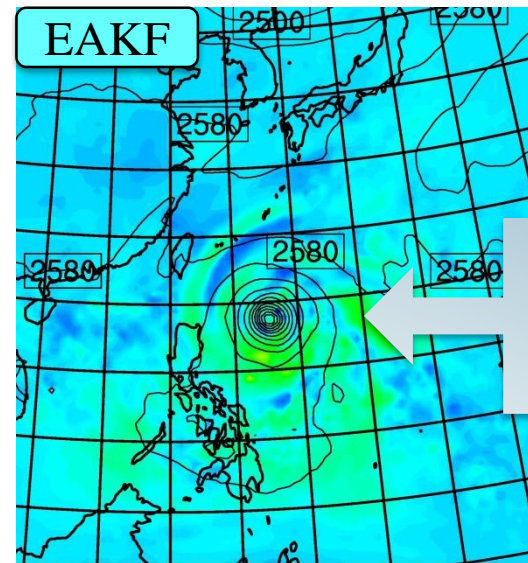
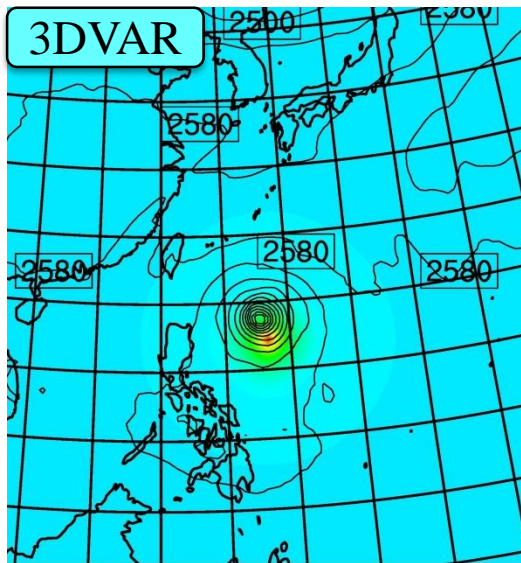
National Center for Atmospheric Research²

Outline

- 研究動機與EAKF資料同化流程
- 實驗設計
- 梅姬(Megi)颱風分析與校驗
- 總結

研究動機

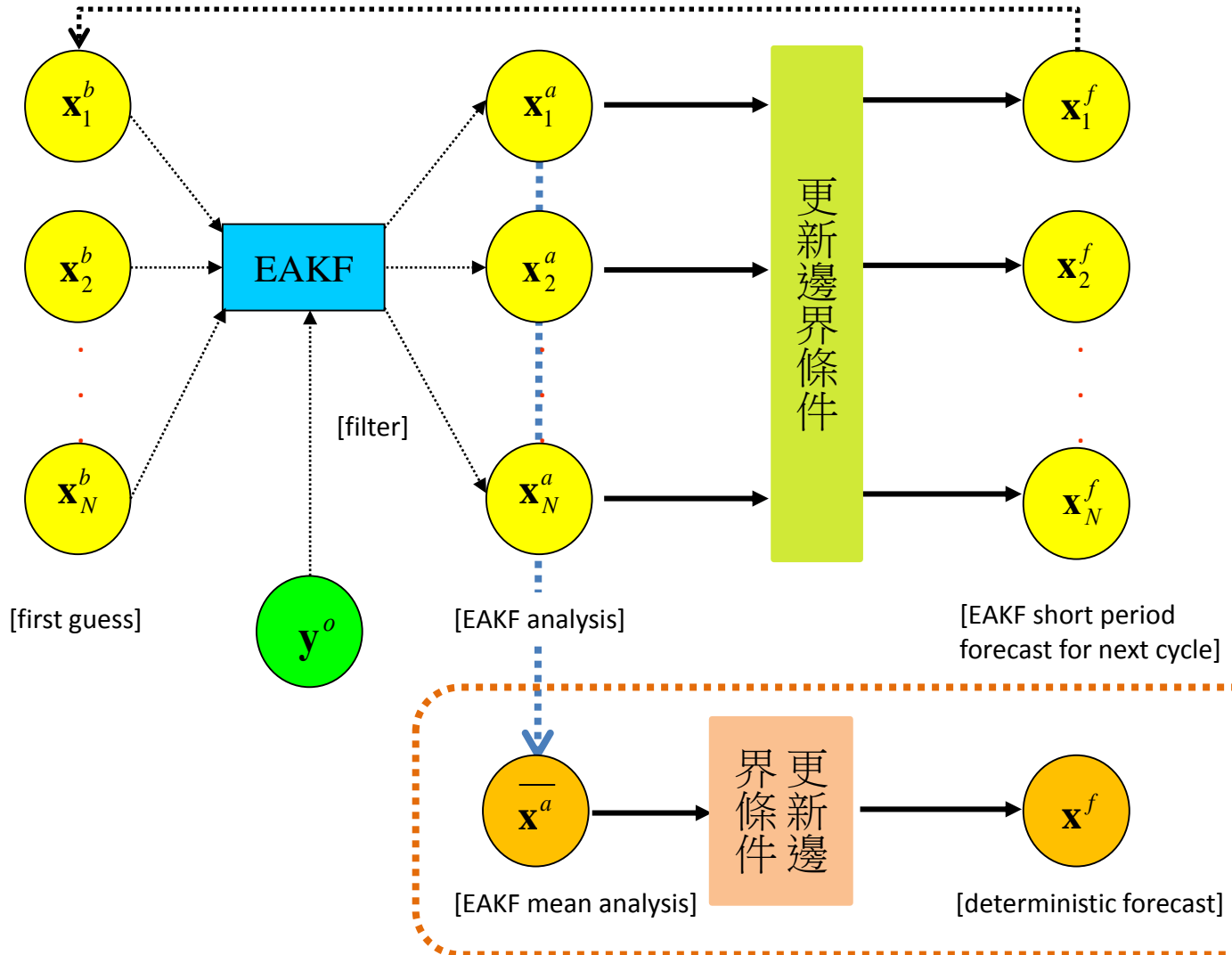
- 本中心針對過去劇烈天氣個案，使用WRFVAR進行同化福衛掩星資料之系統性校驗與效益評估。
- 系集卡爾曼濾波資料同化系統(EAKF)針對GPSRO觀測進行資料同化，並且探討對預報結果的影響，希望逐步提升GPS觀測資料於數值模式預報系統上的應用。
- EAKF與WRFVAR資料同化最大差異在於背景誤差更新。



Flow
dependent

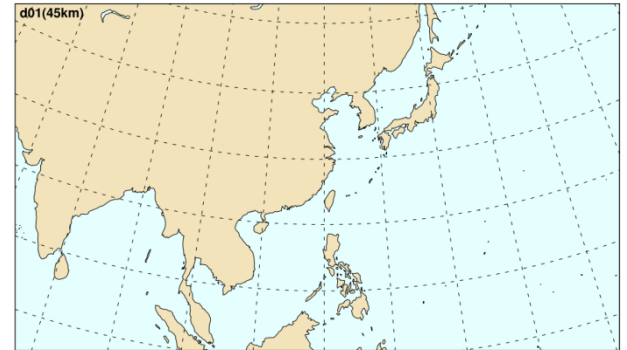
EAKF資料同化流程

[EAKF cycling]



實驗設計

- 模式：WRF v3.3.1 + WRFDA v3.3.1
- EAKF資料同化：DART v3.1
- 初始場資料：NCEP GFS (0.5 x 0.5)
- 系集樣本數：32
- 每6小時進行EAKF系集資料同化
- 實驗時間：2010101300~ 2010102012 (cycling run)
- 選取00Z 06Z 12Z 18Z系集平均，使用WRF進行72小時預報
- 選取00Z 06Z 12Z 18Z與NCEP分析場進行校驗



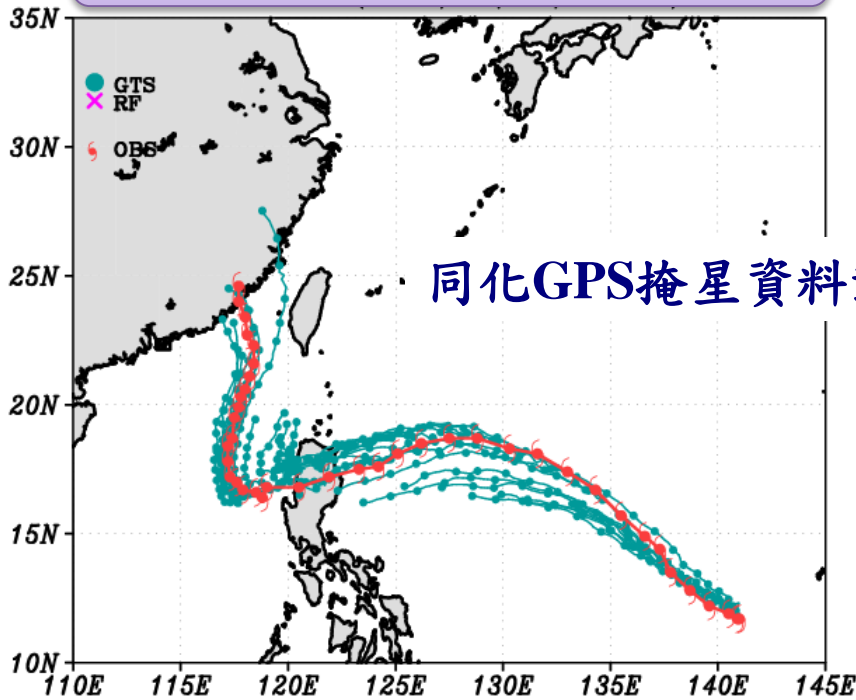
Experiments	Assimilated Data
GTS	the conventional data from CWB
RF	With GPSRO data

實驗期間GPSRO資料個數

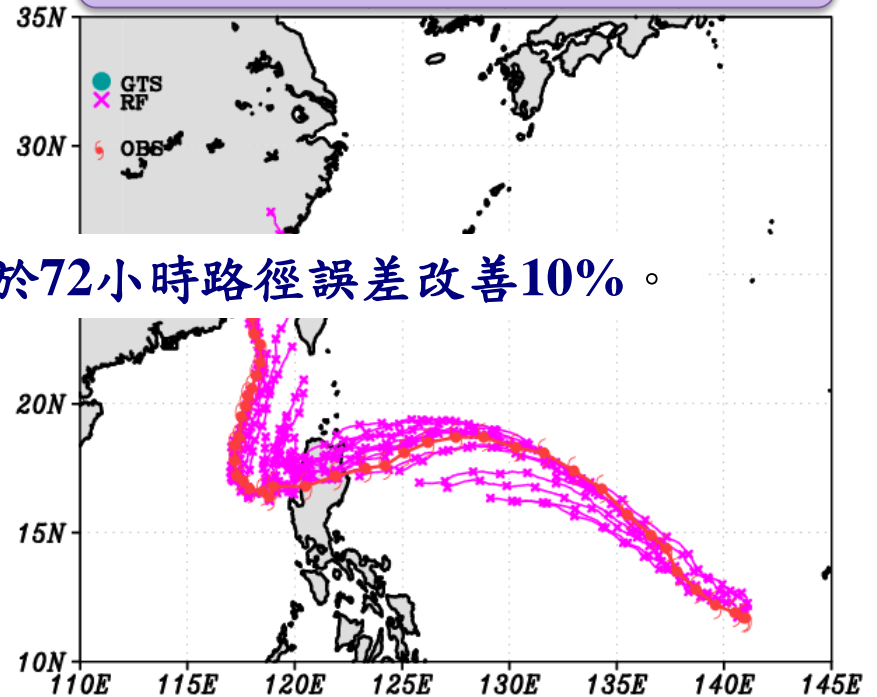
時間	13 Oct	14 Oct	15 Oct	16 Oct	17 Oct	18 Oct	19 Oct	20 Oct
0000 UTC	---	28	28	30	14	18	13	13
0600 UTC	---	27	33	25	25	26	31	33
1200 UTC	17	16	11	13	19	20	21	13
1800UCT	16	20	18	12	16	24	10	---

颱風路徑模擬

Without GPS



With GPS



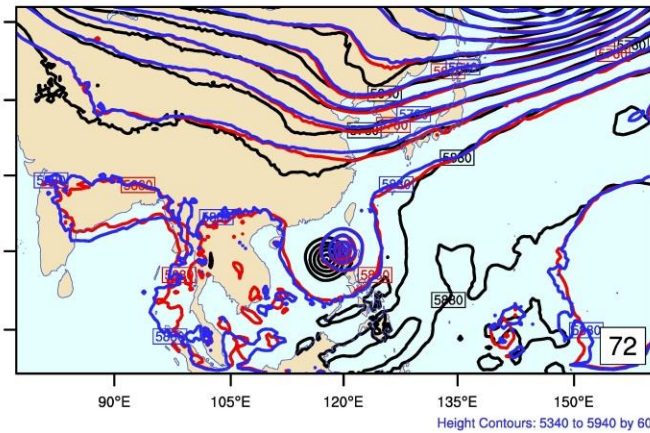
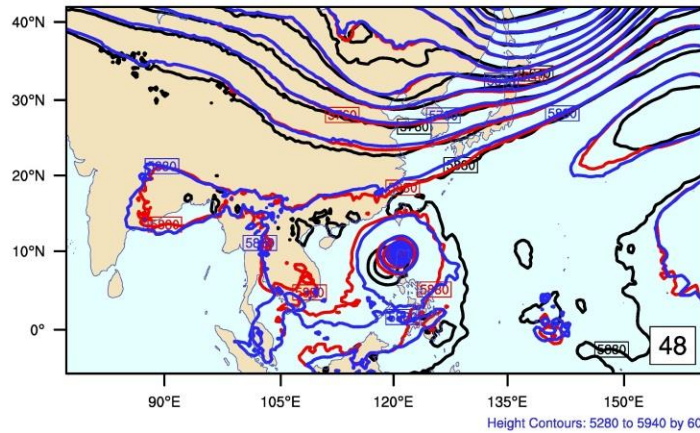
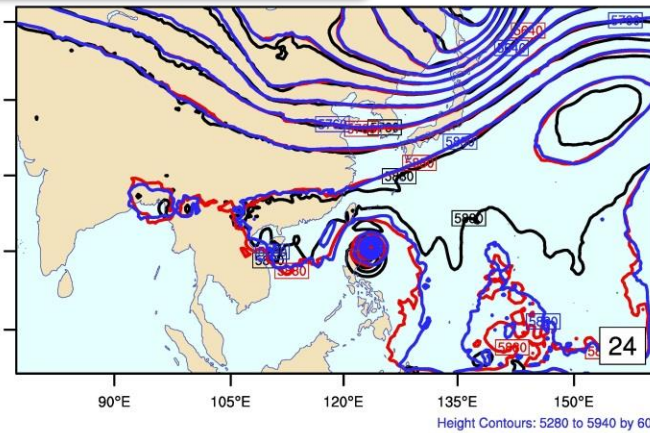
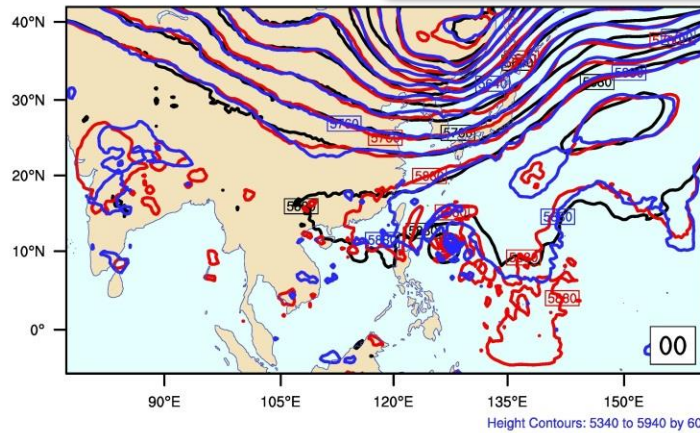
同化GPS掩星資料對於72小時路徑誤差改善10%。



Experiments	0fhr	24fhr	48fhr	72fhr
GTS	35	161	235	243
RF	22	123	196	216

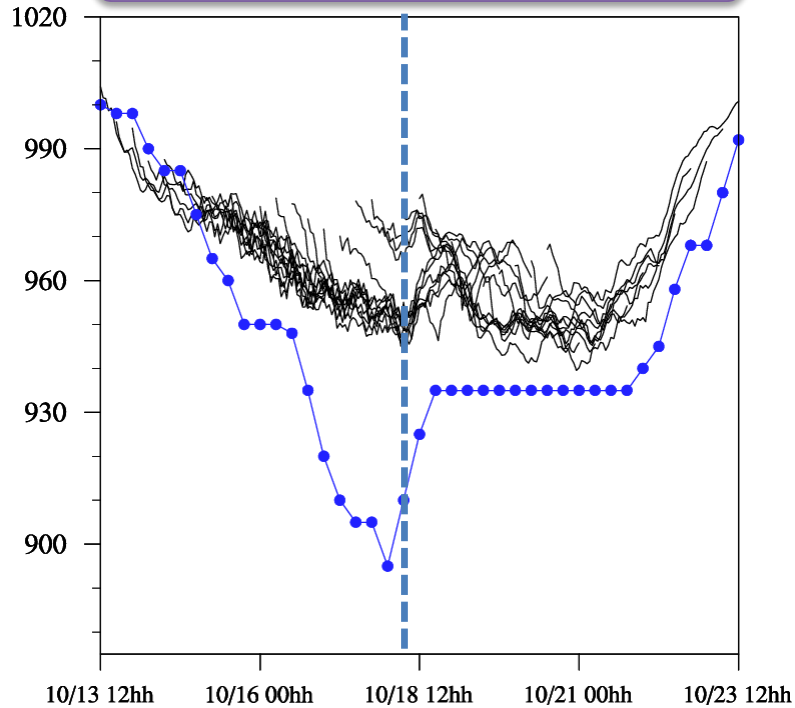
500mb 高度場

2010101700

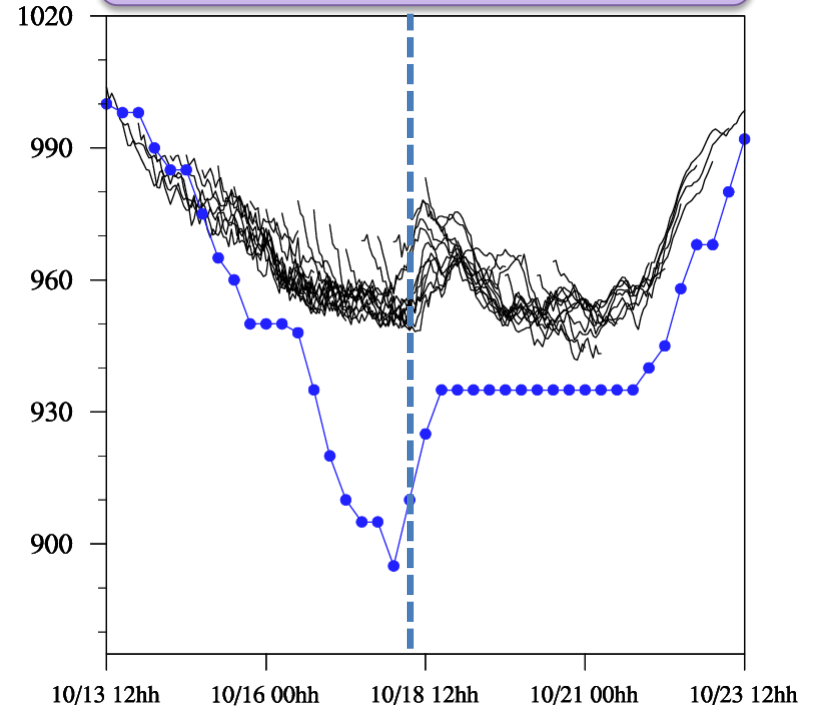


颱風強度模擬

Without GPS



With GPS

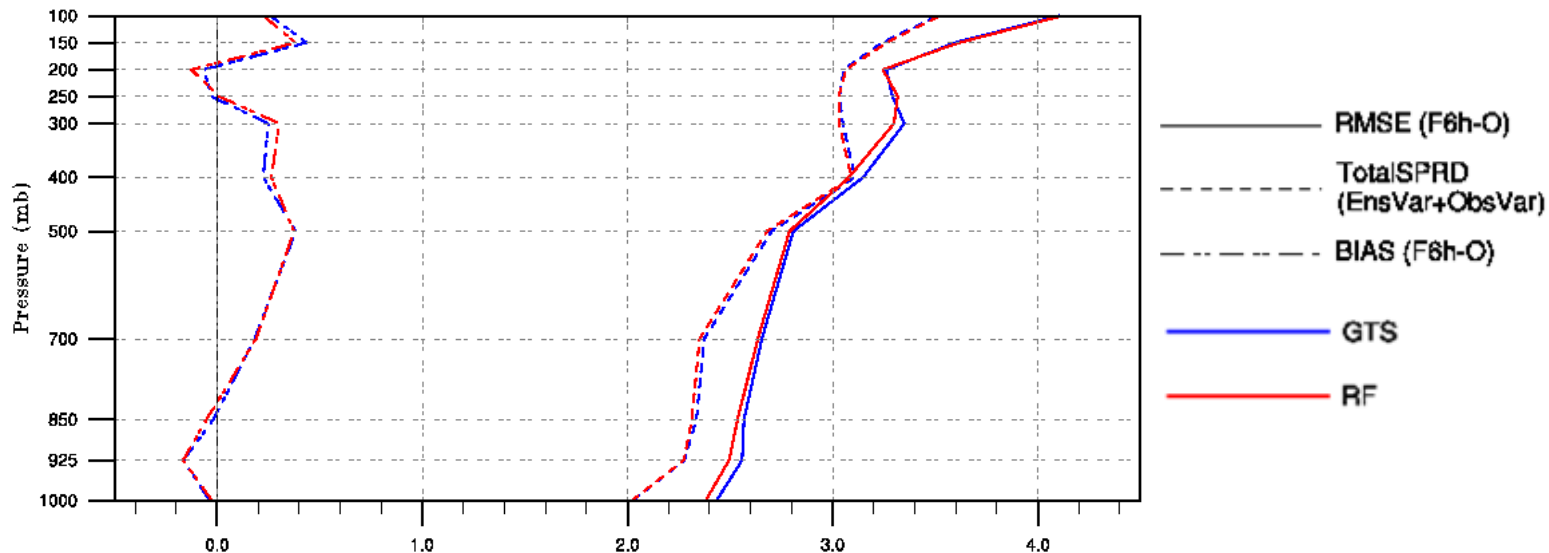


Experiments	0fhr	24fhr	48fhr	72fhr
GTS	35.608	25.77	25.651	26.652
RF	32.655	25.154	25.611	26.106

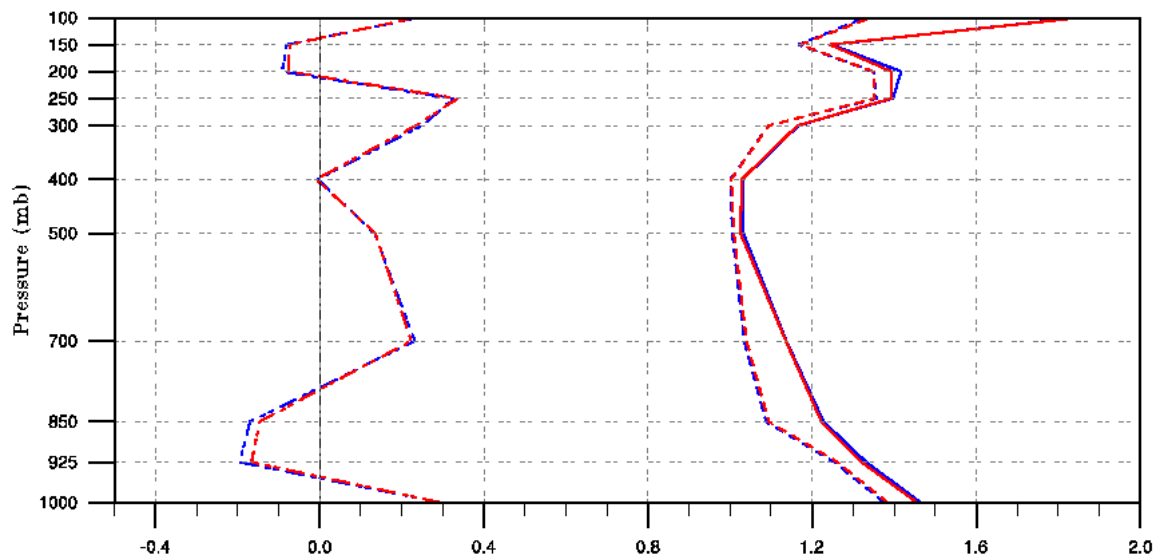
觀測點校驗

(against Radiosonde)

U



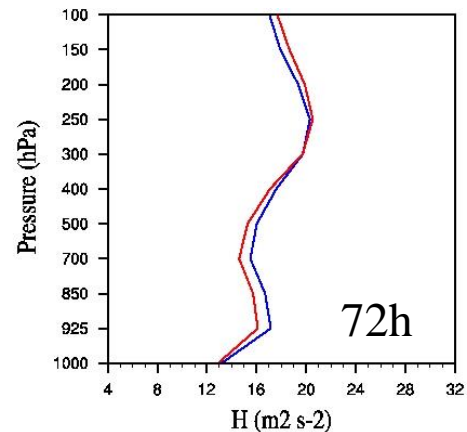
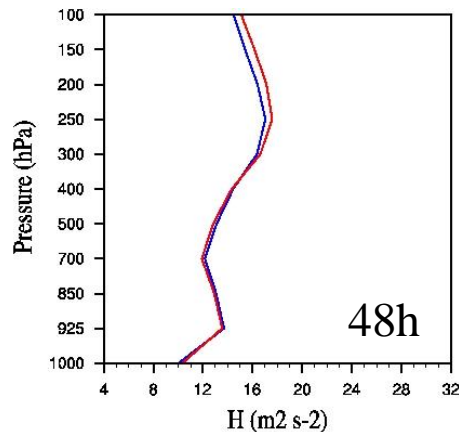
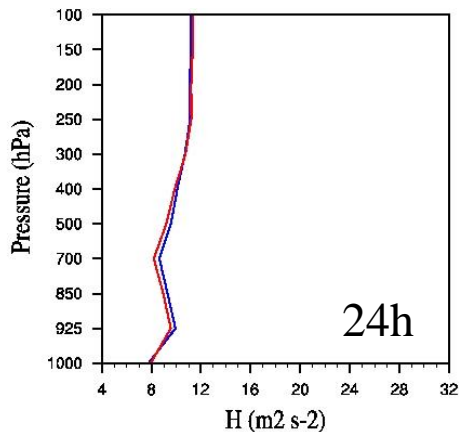
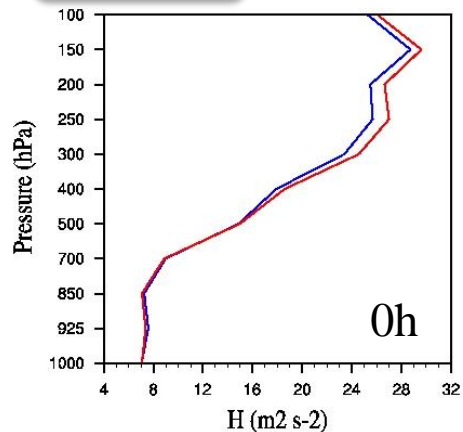
T



層場校驗(I) (against NCEP analysis)

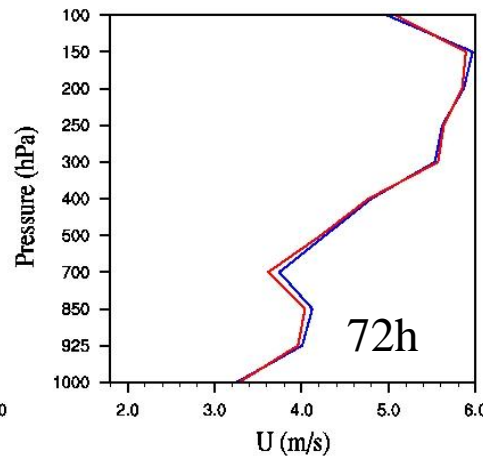
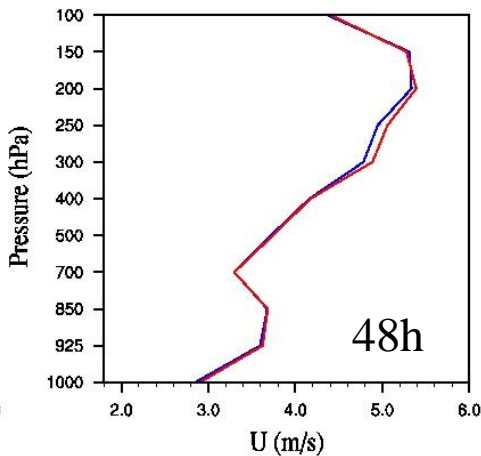
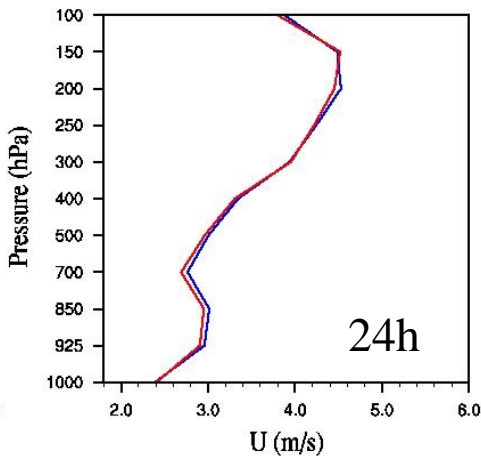
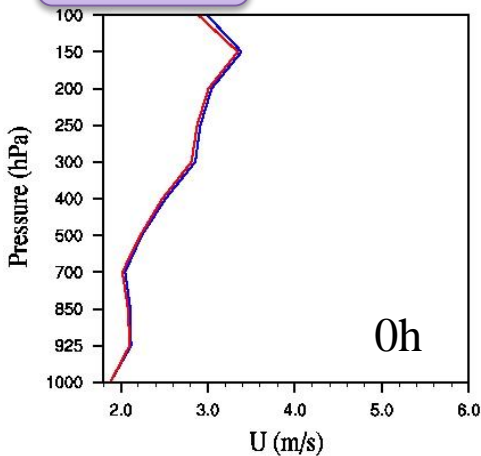
H

300hPa以下同化GPSRO觀測改善重力位高度場。



U

U風場與重力位高度場結果相似。



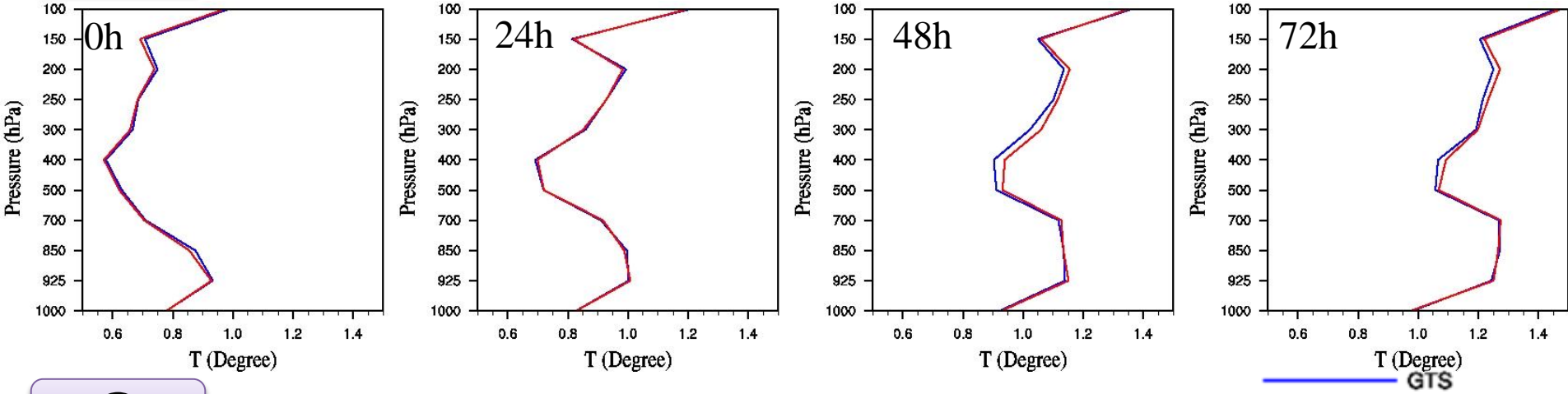
— GTS
— RF

層場校驗(II)

(against NCEP analysis)

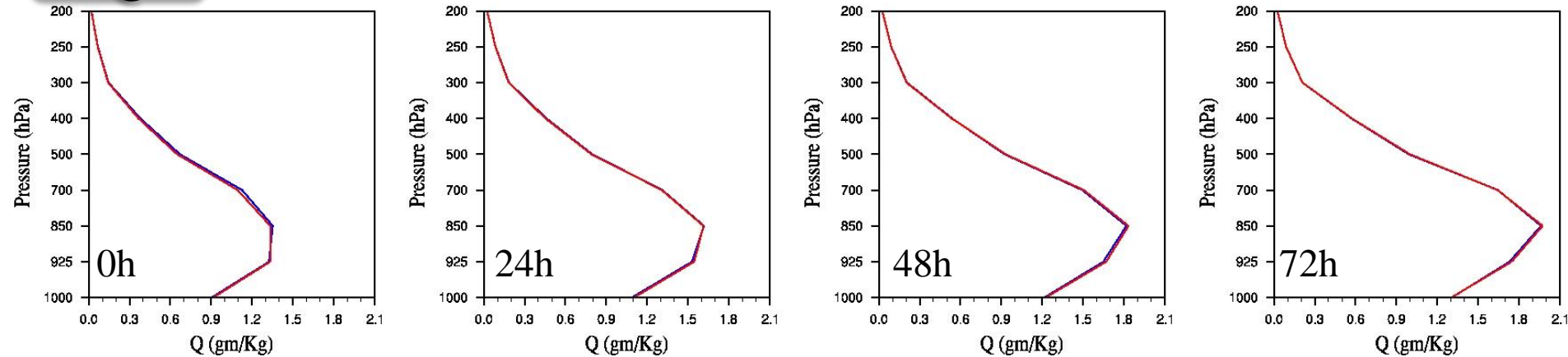
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同化GPSRO觀測在分析時改善溫度場。



Q

對水氣影響在分析時有改善。

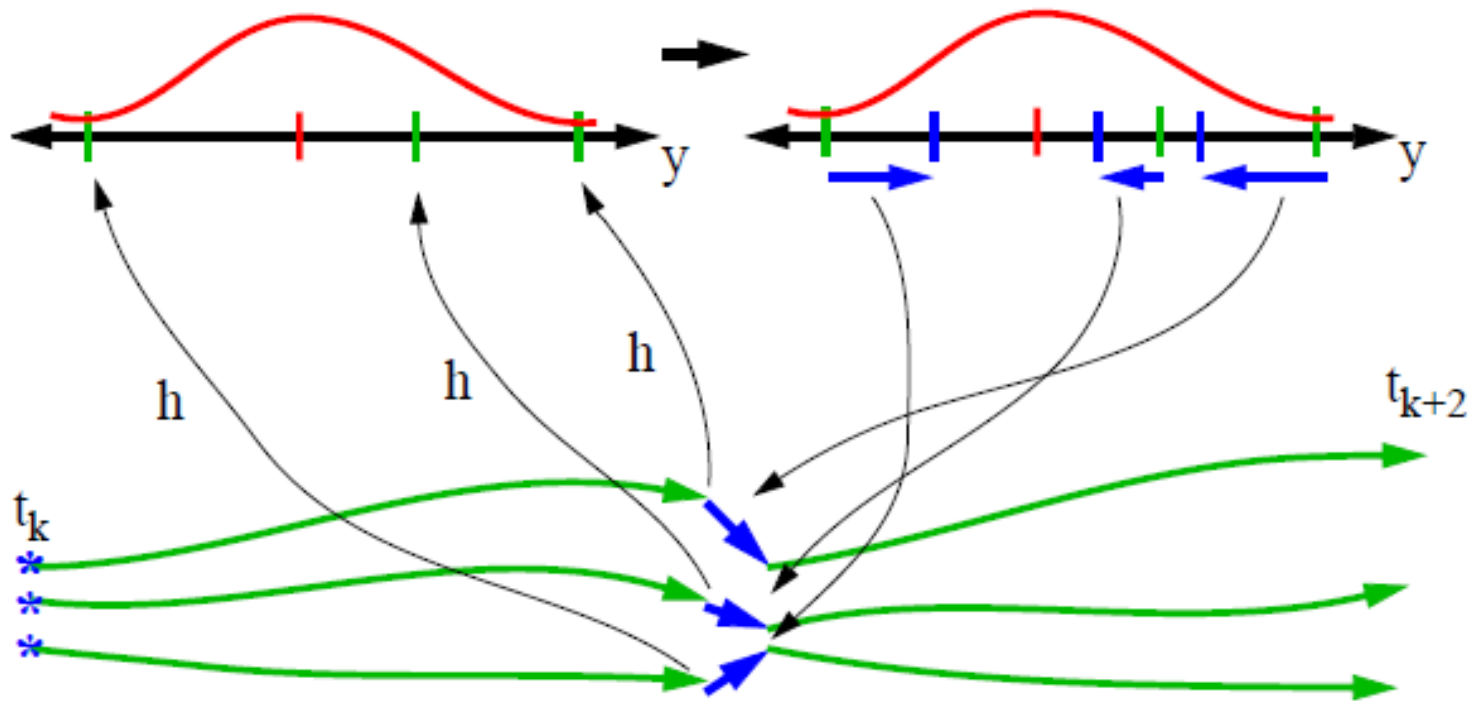


結論

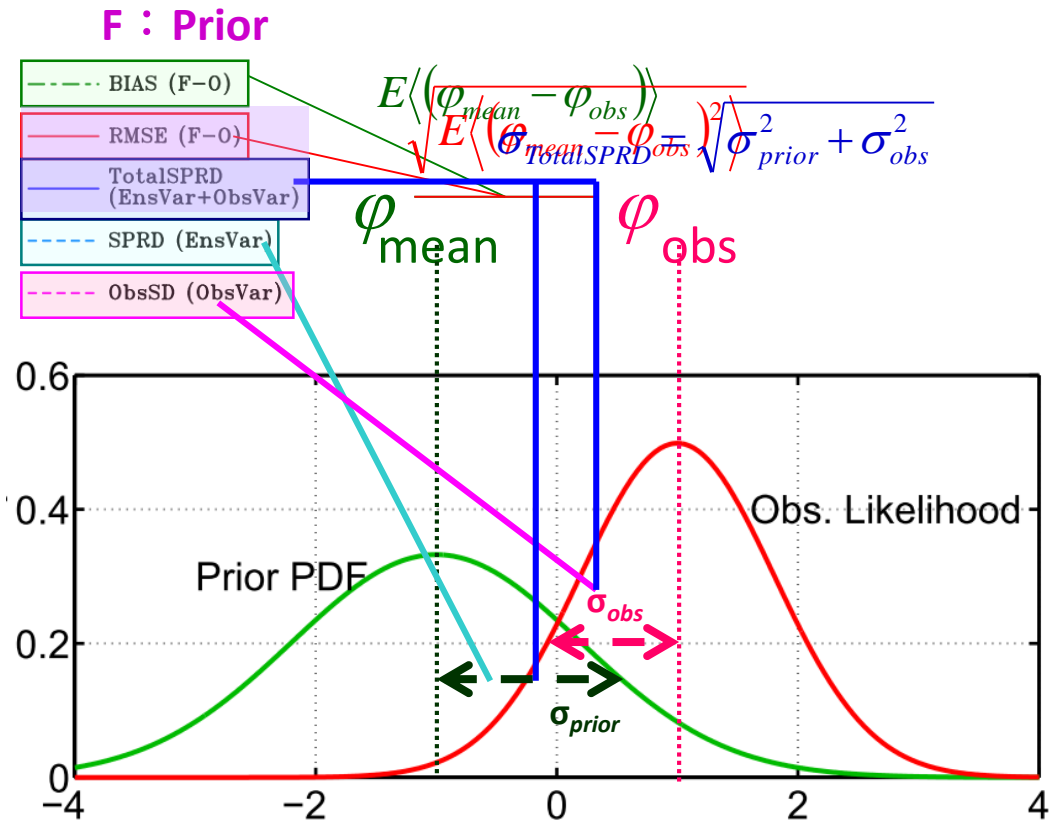
- 從29個分析預報時窗的預報路徑顯示，同化GPSRO觀測有較小的路徑誤差，在72小時路徑預報改善幅度達10%。
- 同化GPSRO觀測後模式颱風強度增強更接近觀測值。
- 同化GPSRO觀測使得300hPa以上重力位高度場的RMSE變差，但300hPa以下明顯有助於改善重力位高度場的預報。U風場與重力位高度場結果相似。
- 同化GPS RO觀測對於溫度與水氣場的分析場有些微改善，但在48與72小時預報同化GPSRO觀測使得500hPa以上溫度場的RMSE變差。

~END~

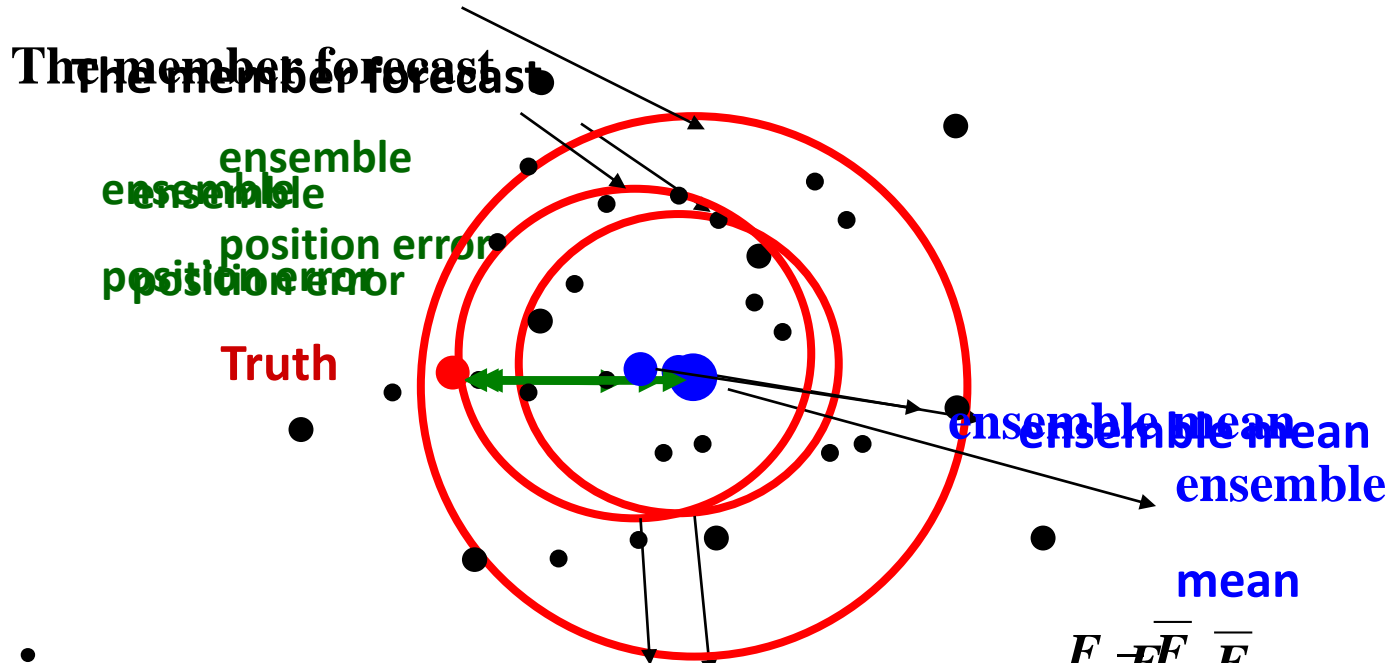
A schematic of EnKF



Spread 診断分析



The member forecast



perfect :
 Spread is sufficient.
Error=SPRD

$$SPRD = \frac{F - \overline{F} - \overline{F}}{N}$$

The mean of the distance between each member and ensemble mean

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