CWBGFS資料同化系統更新簡介及初步影響評估

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中央氣象局全球數值預報系統(CWBGFS)簡介

CWBGFS	
Horizontal res./vertical res.	T511L60 (25km/60levels)
Top	0.1hPa
Assimilation for GDAS	**GSI 3DEnsVar hybrid analysis (from NCEP GFS) with 36 EnKF members** **(GSI : Grid Statistical Interpolation system)**
Time windows	6 hours
Forecasts	(00/06/12/18Z) 384hours
Observations assimilated (from CWB amdp & NCEP bufr)	
conventional	SYNOP, SHIP,METAR,BUOY TEMP, PILOT, AIREP,NXTRAD,PROFILER
gpsro	COSMIC, METOP-A, TerrSAR-x
Atmospheric motion vectors (AMV ; SATWND)	VIS : Himawari-8; Meteosat IR : (同步) Himawari-8; Meteosat; GOES (繞極)AQUA/TERRA; NOAA15/18/19; Metop-A/B WV : Himawari-8 ; GOES
radiance	MW : AMSUA(NOAA15，NOAA18，METOP-A，AQUA) ATMS(Suomi NPP) IR : IASI(METOP-A); AIRS(AQUA)

GSI版本及更新

NCEP

Global **05/22/2012**
GSI/GFS
Q3FY2012.

Global **07/03/2013**

Global **8/20/2013**

Global **01/14/2015**
GSI/GFS
Q2FY2015

Global **05/12/2016**
GSI/GFS
Q3FY2016

CWBGFS/GSI

1. New/enhance observations assimilated :

METOP-B(AMSU-A,MHS,GRAS,GPSRO)
SUOMI NPP(CrIS)
Meteosat-10(SEVIRI)
SSMIS LAS data
AVHRR winds
additional satwnd data(AMVs) – hourly GOES/EUMETSAT
Modify thinning/weight in time for AMVs and radiances
All sky AMSU-A
Bias correction for aircraft observations
GPSRO QC enhancements

2. Assimilation scheme improvements

code optimization
4DEnsVar
stochastic physics in EnKF forecasts
CRTM2.0.5 => CRTM2.2.1

Radiometer Suite (VIIRS) winds
* Implement Geostationary Operational Environmental Satellites - R series (GOES-R) data read ability
* **Update Community Radiative Transfer Model (CRTM) to v2.2.1** with bug fixes in wind direction, use of FAST Microwave Emissivity Models (FASTEM-6 and FASTEM-X) reflection correction for cloudy situations
* **Improve bias correction for aircraft observations**
* Modify relocation and storm tracking to allow hourly tropical cyclone relocation
* **Modify thinning/weight in time for Atmospheric Motion Vectors (AMVs) and radiances**
* Upgrade data assimilation monitoring package

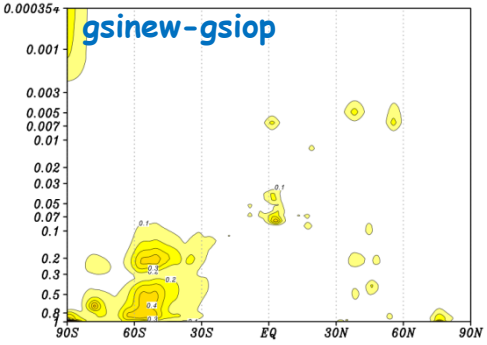
Ref : http://www.emc.ncep.noaa.gov/gmb/gdas/

RMS of T/U analysis difference (3DVAR)

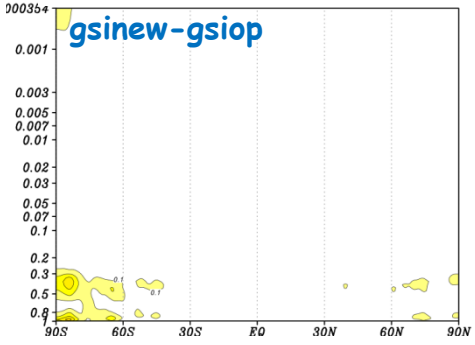
case : 2016060800

RMS of T_diff

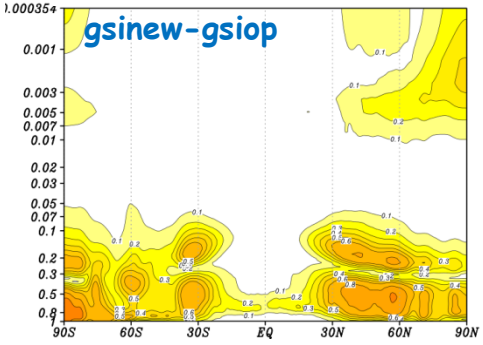
conventional obs only



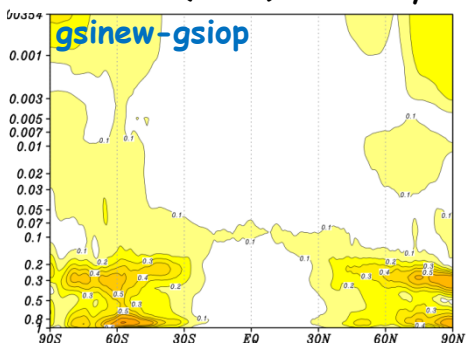
gosro obs only

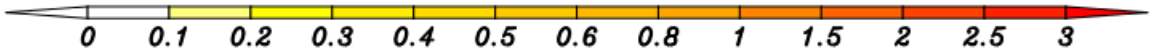


radiance(IR) obs only



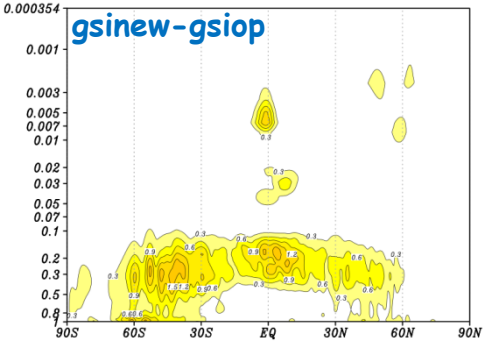
radiancd(MW) obs only



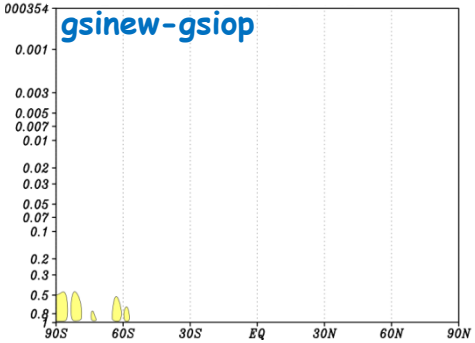


RMS of U_diff

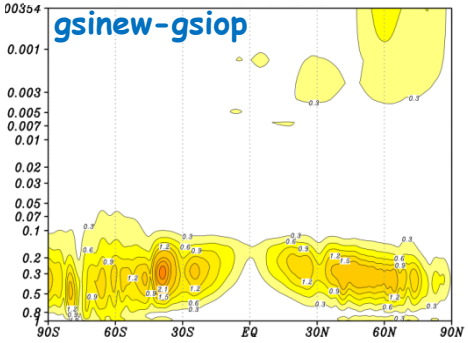
conventional obs only



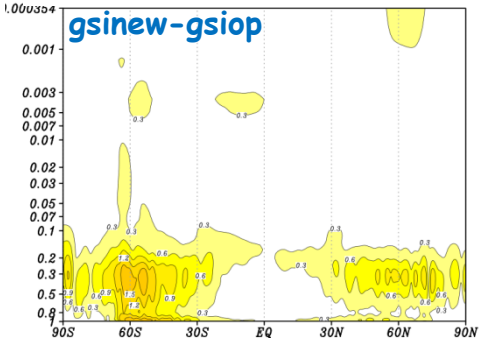
gosro obs only

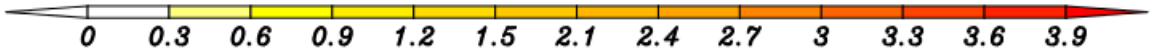


radiance(IR) obs only



radiancd(MW) obs only



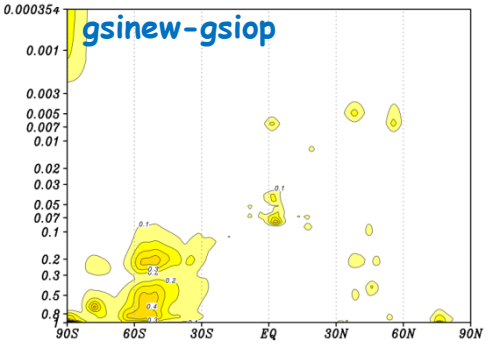


RMS of T/U analysis difference (3DVAR)

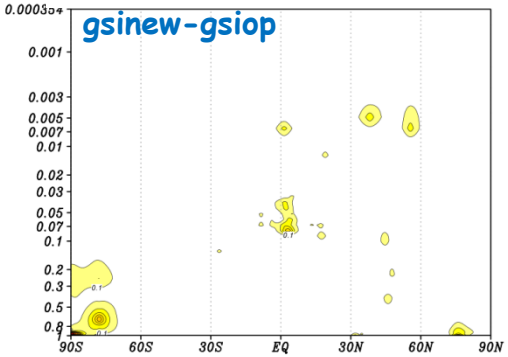
case : 2016060800

RMS of T_diff

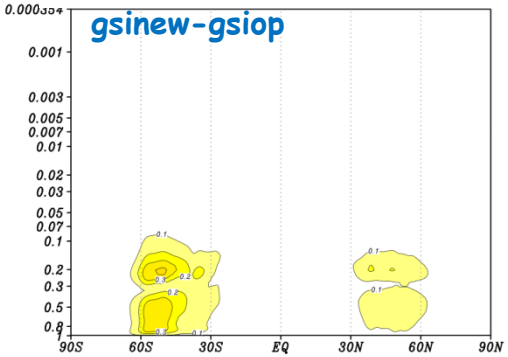
conventional obs only

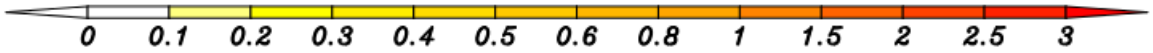


Ps/T/q (in prepbufr) only



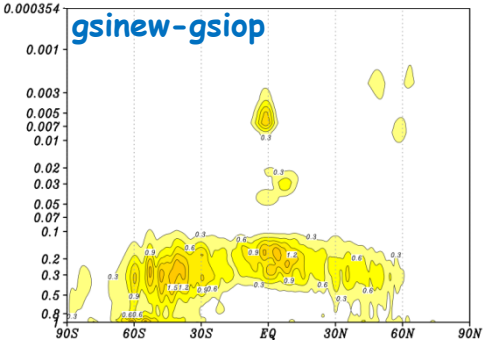
satwnd(AMV) only





RMS of U_diff

conventional obs only



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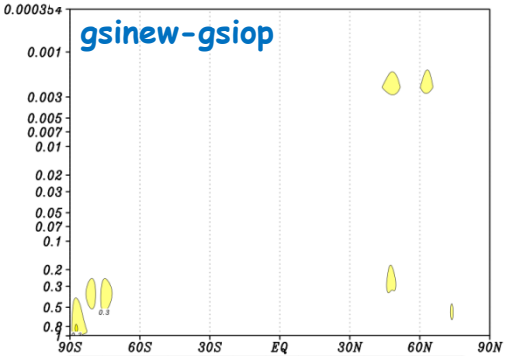
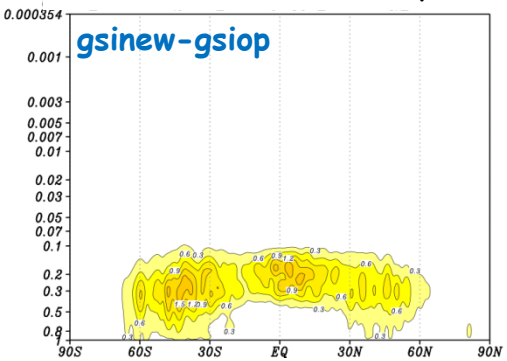
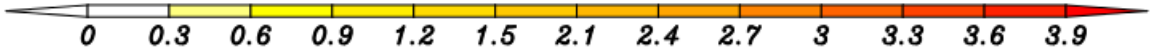


satwnd(AMV) only





對CWBGFS預報的影響

準平行測試實驗設計

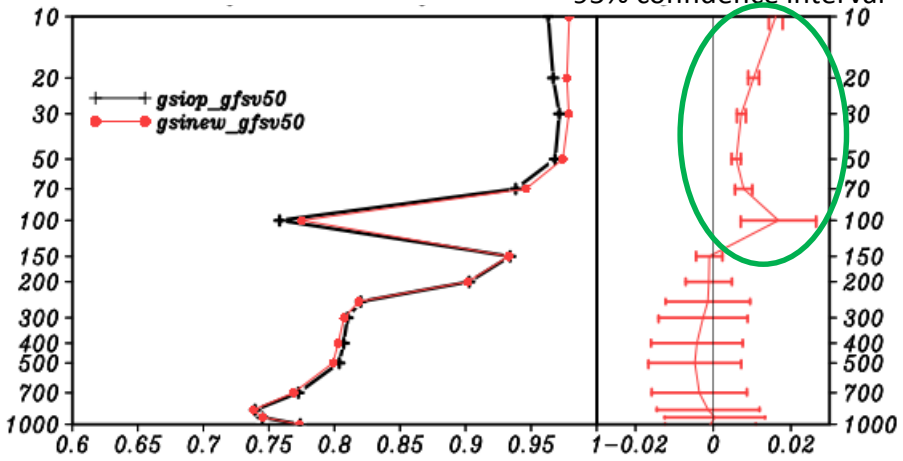
Experiments	gopm50	gv13m50
analysis	gsi_op (3dvar)	gsi_new (3dvar)
forecast model	gfsV5.0	
resolution	T511L60	
Observations assimilated	Same as the operation (SYNOP, SHIP,METAR,BUOY TEMP, PILOT, AIREP,NXTRAD,PROFILER gpsro, SATWND, radiance)	
update cycle forecast	6hrs update cycle as operation 00Z/12Z, 5-day forecast	
experiment period	2015062600-2015073112	
verify period	2015070100-2015073112	

Height anomaly correlation of day-5 forecast

15070100-073112 avg by NCEP analysis

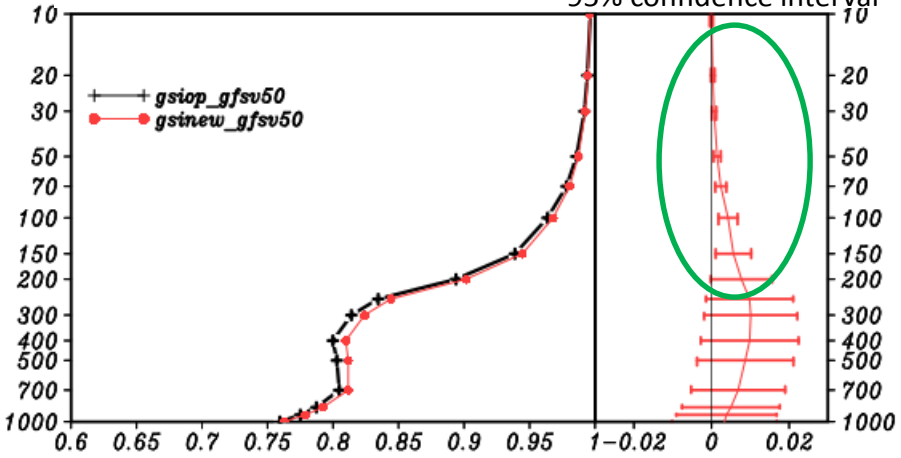
北半球， anomaly correlation

(gsinew-gsiop) &
95% confidence interval



南半球， anomaly correlation

(gsinew-gsiop) &
95% confidence interval

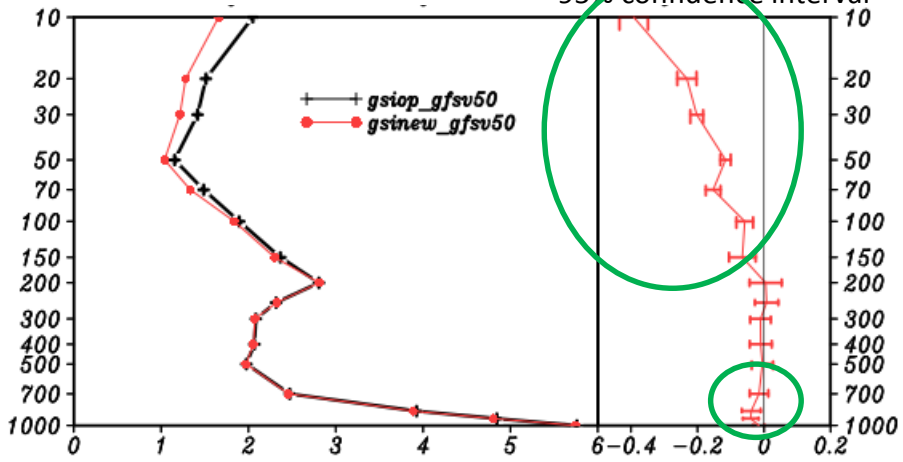


T/U RMS of day-5 forecast

15070100-073112 avg by NCEP analysis

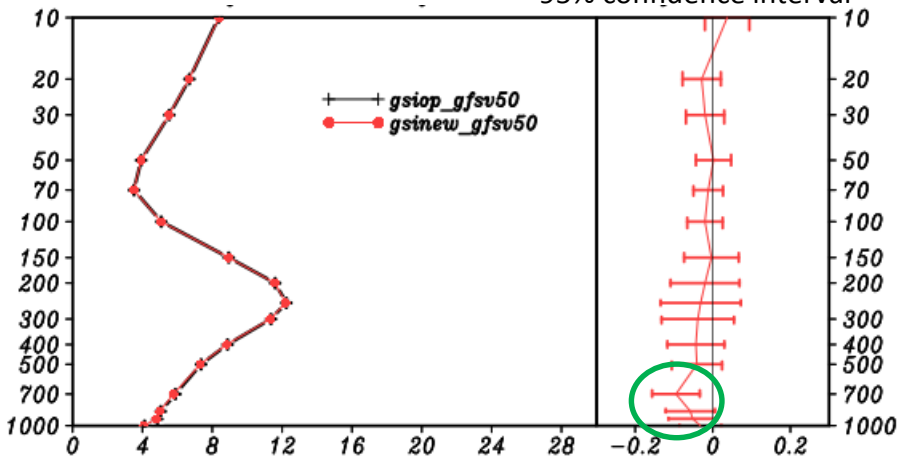
北半球， T rms

(gsinew-gsiop) &
95% confidence interval



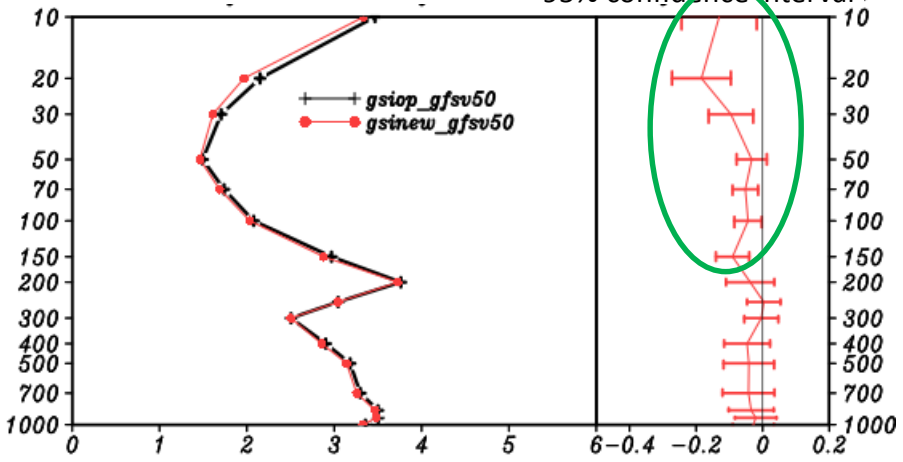
北半球， U rms

(gsinew-gsiop) &
95% confidence interval



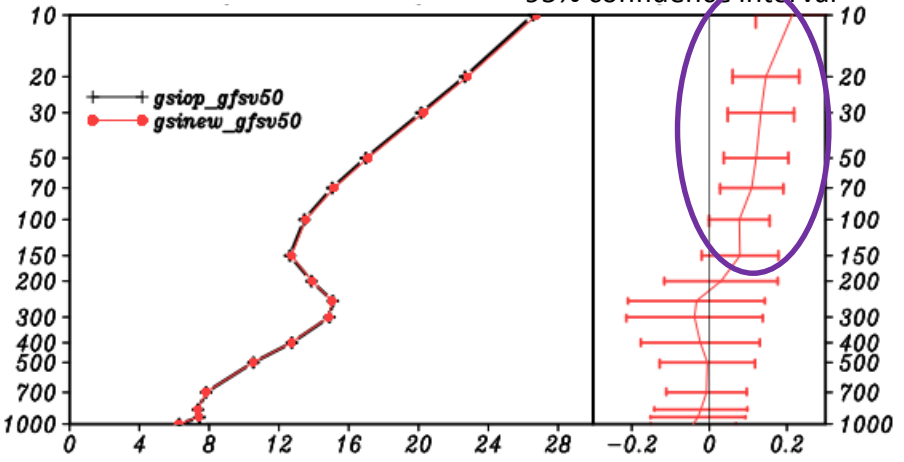
南半球， T rms

(gsinew-gsiop) &
95% confidence interval

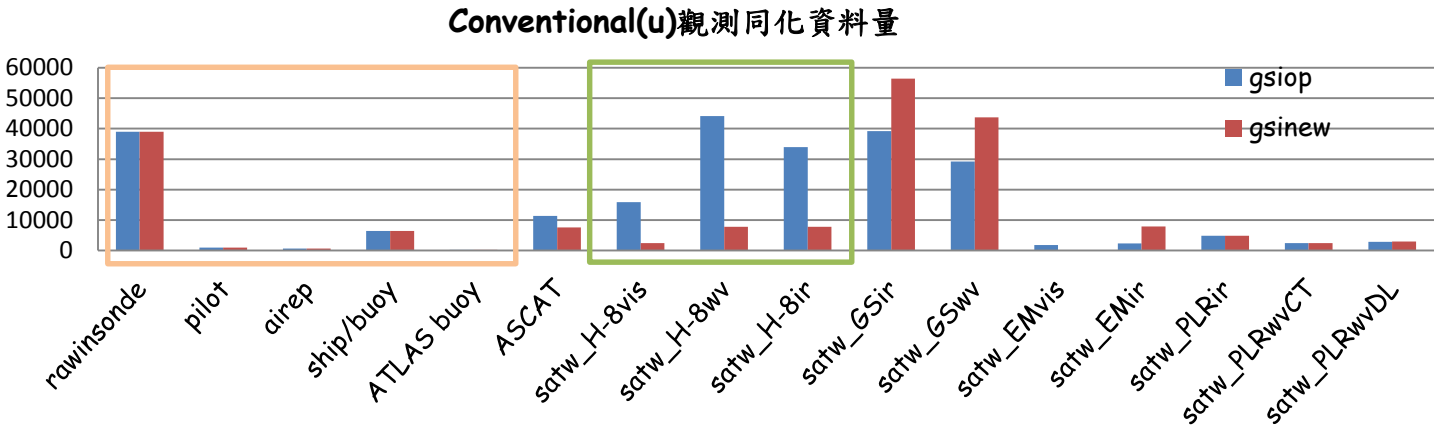


南半球， U rms

(gsinew-gsiop) &
95% confidence interval

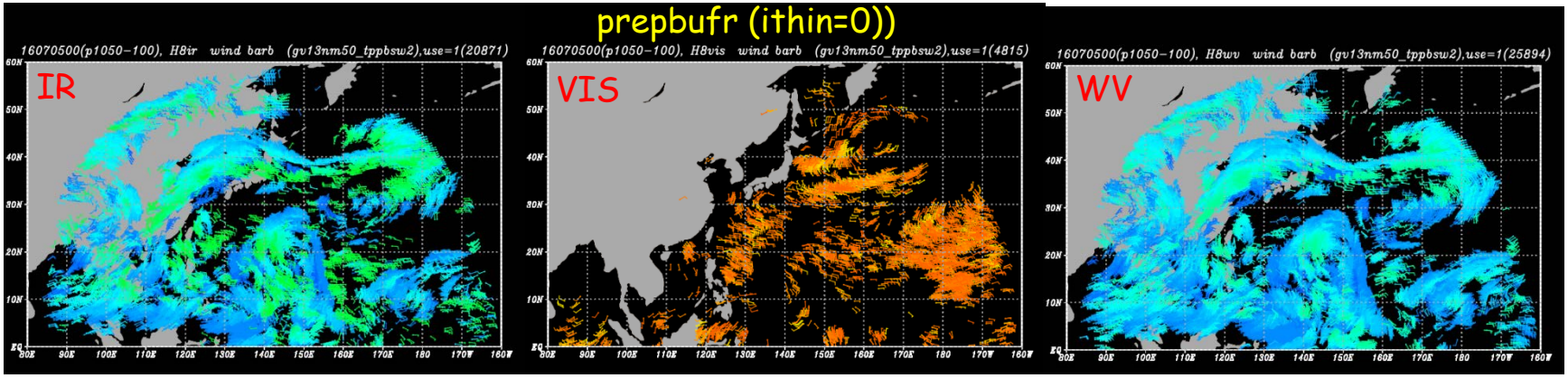


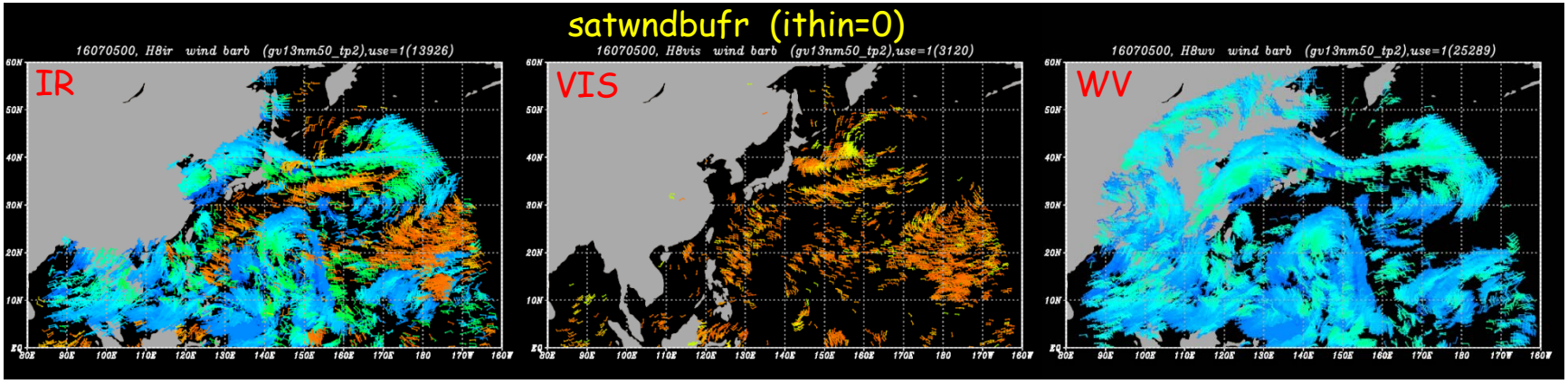
衛星風(SATWND)觀測資料

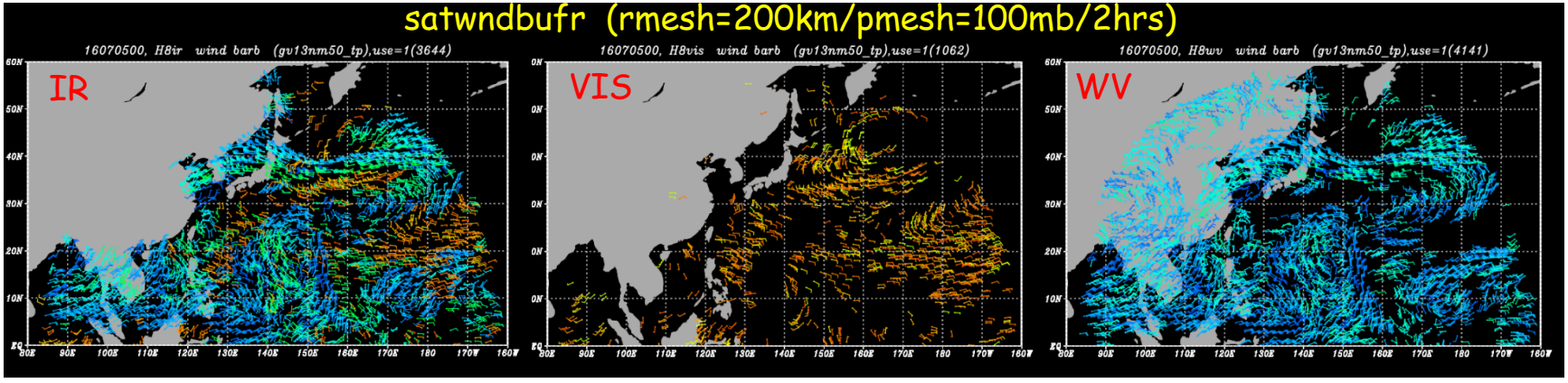


項目	gsi_op	gsi_new	說明
輸入觀測資料檔	prepbufr	satwndbufr	➢ satwndbufr 為原始資料檔，經過NCEP DA前處理QC後輸出至prepbufr資料檔，提供其資料同化使用。 ➢ NCEP GDAS 已改為直接用satwndbufr資料。
觀測資料種類	Himawari-8(VIS/WV/IR) Meteosat(VIS/IR) GOES(IR/WV) AQUA/TERRA(IR/WV)	Himawari-8(VIS/WV/IR) Meteosat(VIS/WV/IR) GOES(IR/WV) NOAA 15/18/19(IR) METOP-A/B (IR) AQUA/TERRA(IR/WV)	
資料的thinning	無進一步thinning	**1. Thinning with 200km/100mb/2hrs :** Himawari-8(VIS/WV/IR) METEOSAT(VIS/IR/WV) **2. no thinning : GOES(IR/WV)**	

Himawari-8 SATWND – case 16070500





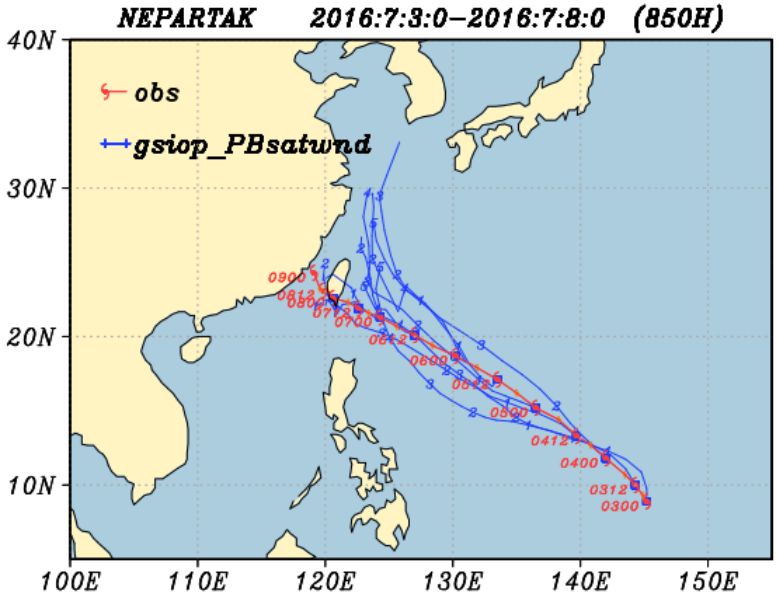


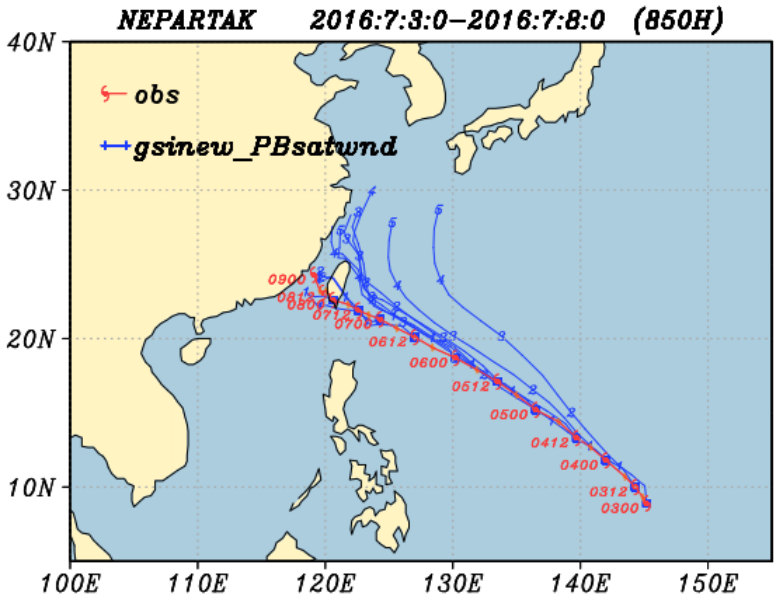
Himawari-8 SATWND 資料同化實驗

Forecast model	CWBGFS T511L60 model
Experimental period	16062900-16070812
Verified period	16070300 – 16070800 (00/12Z) (typhoon NEPARTAK)
Observations	Observations assimilated by operational CWBGFS
Data assimilation (3Dvar) experiments :	
gsiop_PBsatwnd	(gsi_op) ; (PrepBufr satwnd obs)
gsinew_PBsatwnd	(gsi_new) ; (PrepBufr satwnd obs)
gsinew_NOsatwnd	(gsi_new) ; (NO satwnd obs)
gsinew_satwnd_200	(gsi_new) ; (satwndbufr satwnd obs with thinning 200km/100mb)
gsinew_satwnd_nothn	(gsi_new) ; (satwndbufr satwnd obs without(no) thinning)

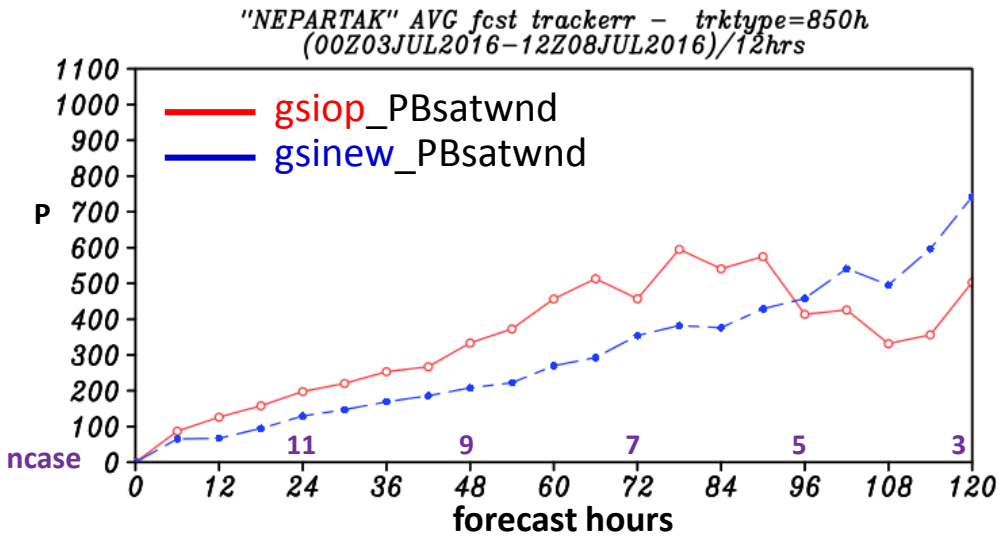
NEPARTAK颱風路徑預報

gsiop v.s. gsinew





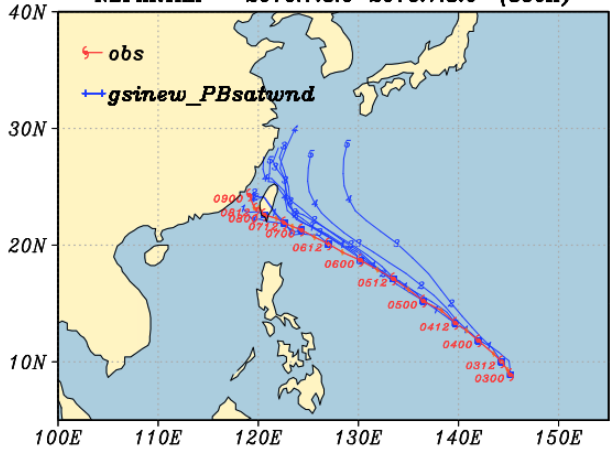
gsiop_PBsatwnd	(gsi_op) ; (PrepBufr satwnd obs)
gsinew_PBsatwnd	(gsi_new) ; (PrepBufr satwnd obs)



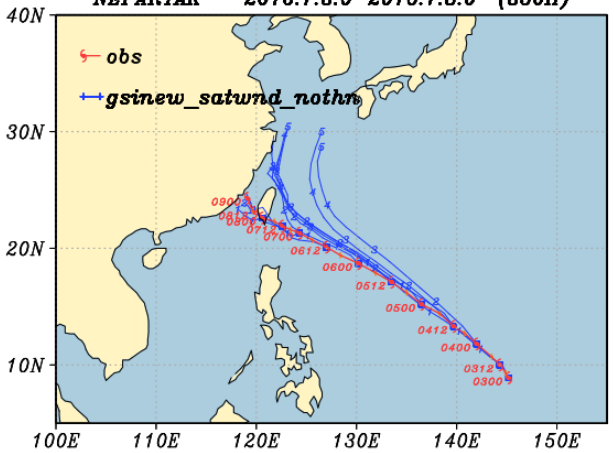
NEPARTAK颱風路徑預報

gsi_new with different SATWND usage

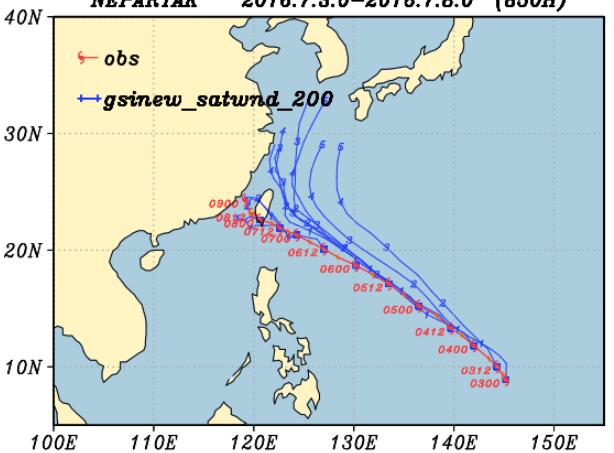
PBsatwnd



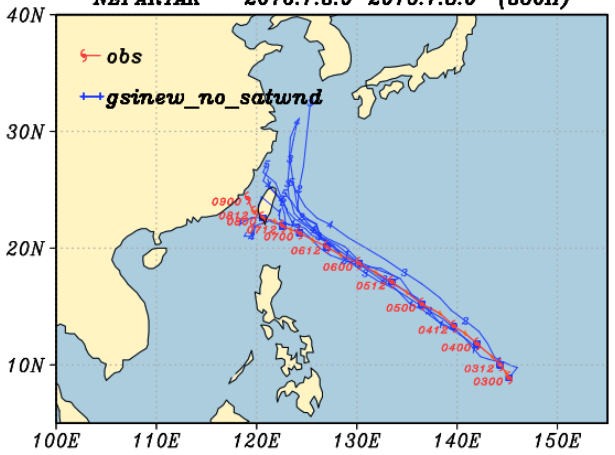
satwnd_no_thin

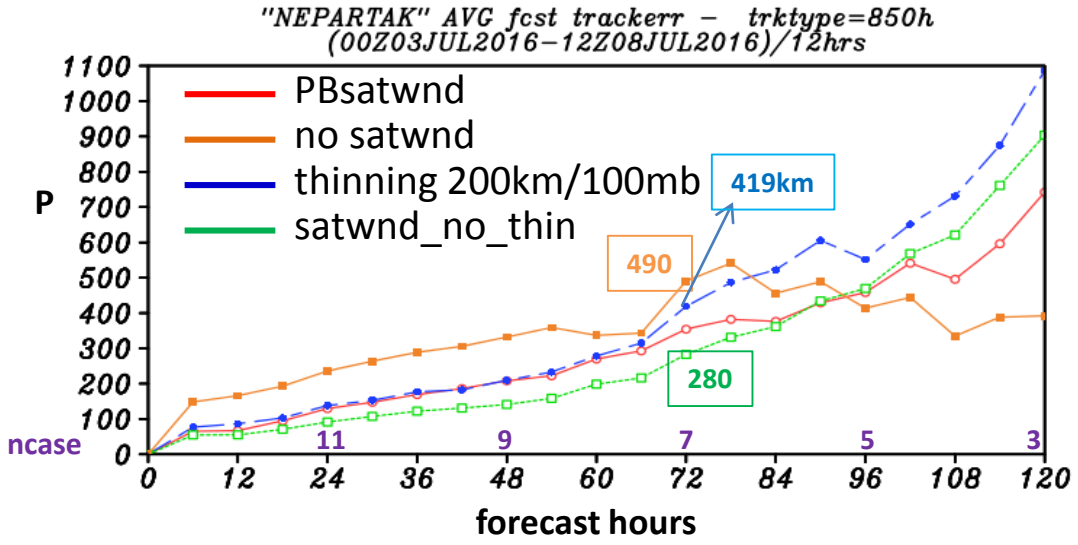


thinning=200km/100mb



no satwnd





summary

1. 新版GSI對CWBGFS的初步影響評估 :

(1) 分析：對衛星紅外線輻射觀測資料及衛星雲導風觀測資料的同化影響最明顯。

(2) 預報：距平相關顯示對流層的差異不顯著，100hPa以上平流層表現顯著較好。
北半球近地面及平流層預報誤差有顯著改善，
南半球平流層風場預報誤差明顯增大。

2. 衛星雲導風觀測資料同化策略對尼伯特颱風路徑預報的影響 :

(1) 新版與作業版GSI的颱風預報路徑特性不同。

(2) 衛星風的同化策略對颱風路徑預報有明顯的影響。

3. 持續進行新版GSI作業化之研究與發展:

(1) 進行更多颱風個案的測試。

(2) 評估同化高密度分布的衛星風觀測資料對大尺度場預報的影響。

(3) 研究/調整其他觀測資料類別同化策略，並增加新觀測資料的使用。

(4) 建構測試3DEnsVar hybrid 資料同化系統(將上線作業的系統)。

(5) 發展4DEnsVar hybrid 資料同化系統(長程作業目標）。