Impact Studies of Higher Resolution COMS AMV in the Operational KMA NWP System

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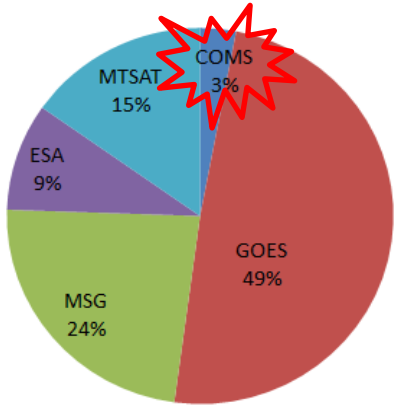
COMS AMV in the KMA System (Since Dec. 2011)

❖ KMA global system
- Resolution: N512L70 (UM) (~25km / top = 80km)
- Target Length: 288hrs (00/12UTC), 87hrs (06/18UTC)
- Initialization: Hybrid Ensemble 4DVAR

AMVs



FSO
KMA Global System
(Summer 2015)

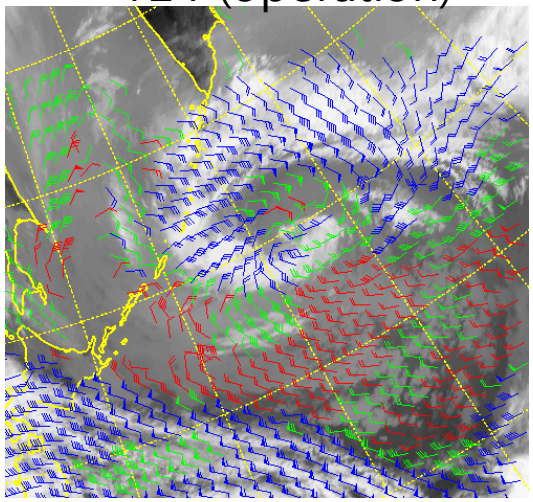
❖ COMS AMV (in operation)
- Target size 24 X 24 (about 96 km resolution)
- IR, WV, VIS channels with other AMVs (GOES, Meteosat, Himawari-8, and polar orbit satellites)
- Thinning (2 degrees, 100 hPa, 60 min)

❖ Higher resolution COMS AMV (now testing)
- Target size: 16x16 (about 64 km resolution), optimal target selection

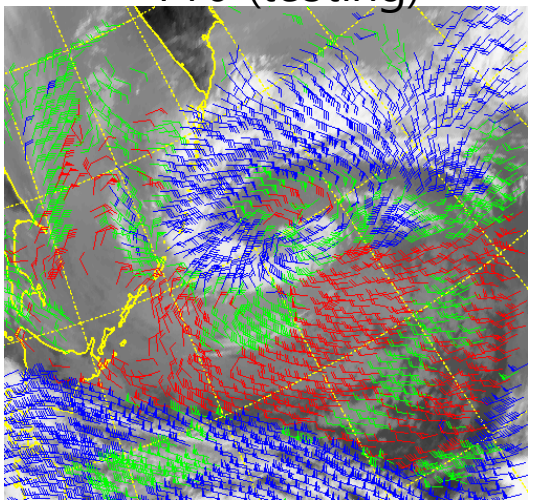
➔ In this presentation,
"The impact of T16 in the KMA global system" will be presented.

Higher Resolution AMV (by NMSC)

T24 (operation)



T16 (testing)



Red 1000 ~ 700 hPa
Green 700 ~ 400 hPa
Blue above 400 hPa

➔ **In the T16 AMV,**
- Data Increased
- Less slow bias & RMSE

	Sonde	IR		SWIR		VIS		WV	
		T24	T16	T24	T16	T24	T16	T24	T16
'14. 7	Number of Vector	25514	**53817**	7816	**17622**	4900	**9799**	32098	**66290**
	BIAS	-1.89	**-1.48**	-2.02	**-1.63**	-0.69	**-0.43**	-0.65	**-0.39**
	RMSE	5.04	**4.97**	4.79	**4.71**	3.52	**3.46**	5.25	5.25
'15. 1	Number of Vector	40835	**87832**	6979	**14372**	11054	**22364**	57283	**127230**
	BIAS	-1.13	**-0.70**	-1.39	**-1.08**	-0.72	**-0.43**	-0.13	**0.12**
	RMSE	4.64	**4.58**	4.55	**4.51**	4.32	**4.30**	**4.57**	4.65

Preliminary Results (1/2)

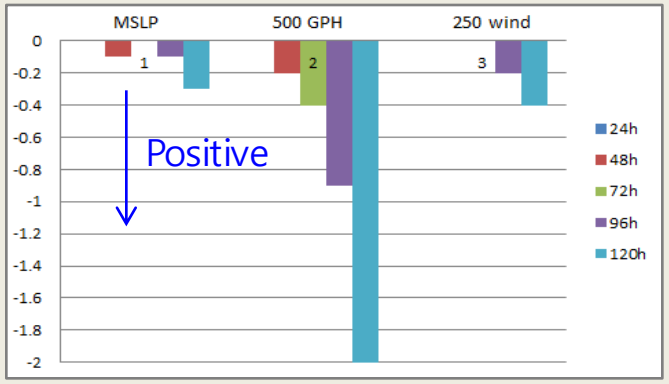
- Experiments (using T16) on the seasons
- Verification and comparison (control: T24)

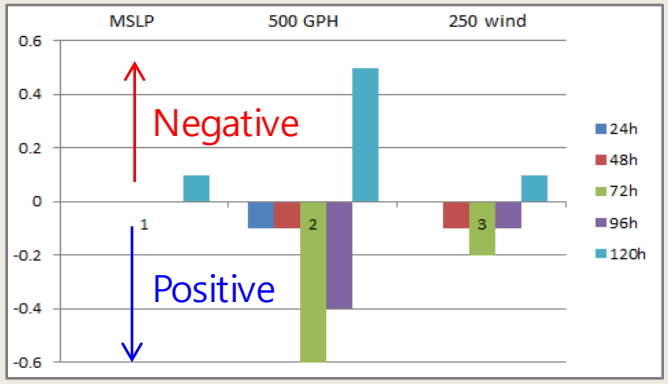
➔ **In the forecast,**

Forecast RMSE difference (T16-T24) against analysis

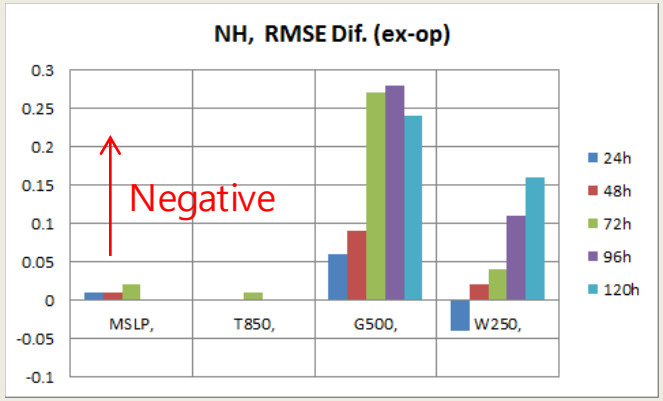
NH | **SH**

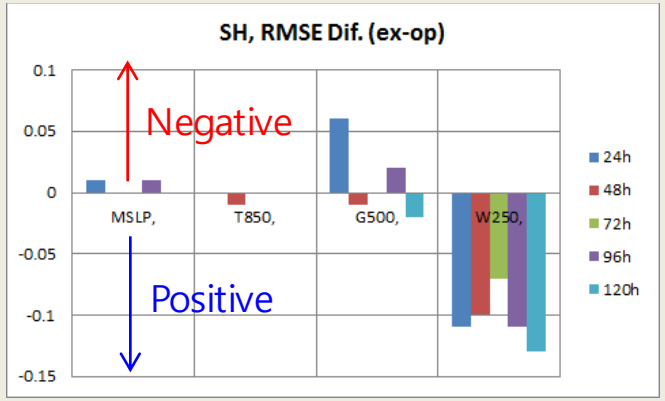
'13. 12 Winter
positive





'14. 7 Summer
negative





Preliminary Results (2/2)

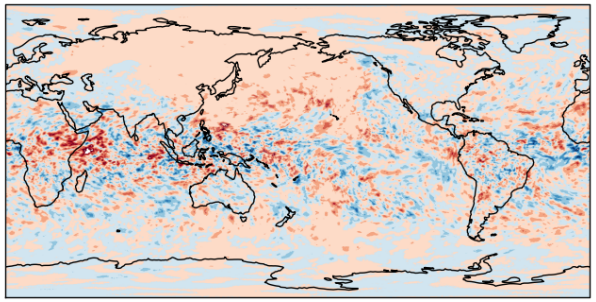
❖ Winter (2013.12)

- AMV has slow biases in jet region

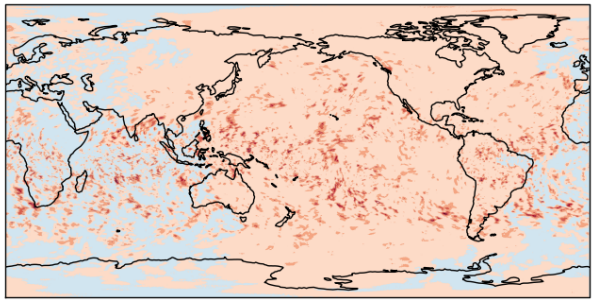
➔ By using higher resolution AMV, slow biases reduced in the analysis

Mean analysis difference, T16-T24 (Red color : T16 makes the wind speed faster)

U at 150 hPa (m/s)



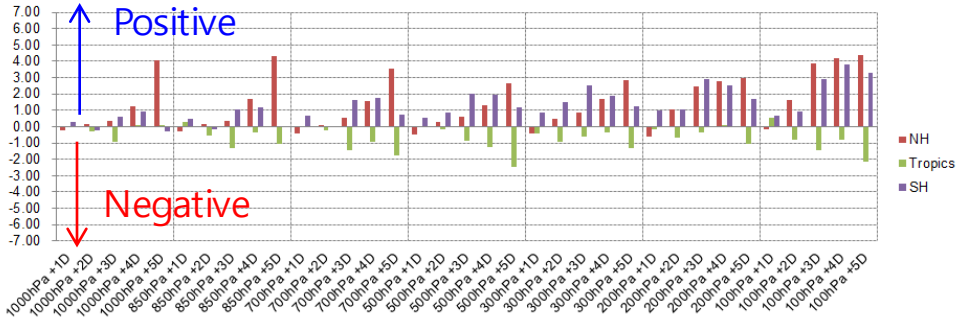
V at 200 hPa (m/s)



➔ Forecast error decreased

Percentage improvement of RMSE(%) against Analysis

Geopotential Height



To lead better performance in Summer

- What can we try?
  - ① Blacklisting
    - Towards increased use of T16 data reflecting seasonal variation
  - ② Error profile
    - Apply height assignment error of T16 according to seasons
  - ③ Thinning (2 degrees → 1.5 degrees)

➔ By monitoring T16 AMV, new blacklisting strategy and error profiles are derived.

New experiments

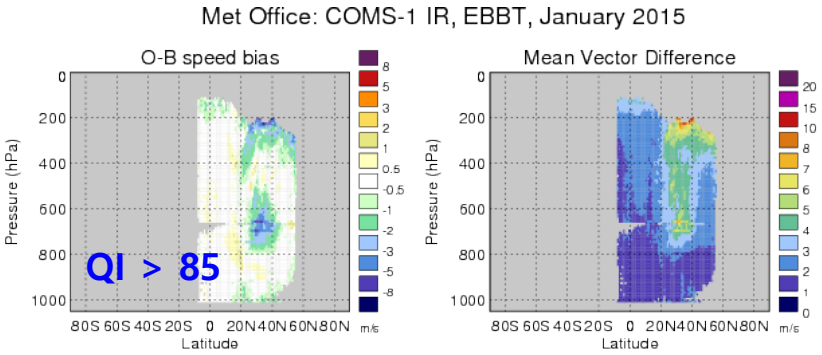
	Experimental setting
Preliminary	Operational setting ➔ Positive in winter, but negative in summer
Experiment V1	Very detailed blacklisting
Experiment V2	Operational setting, but use all AMV with QI >80
Experiment V3	**V1** blacklisting + New error profile

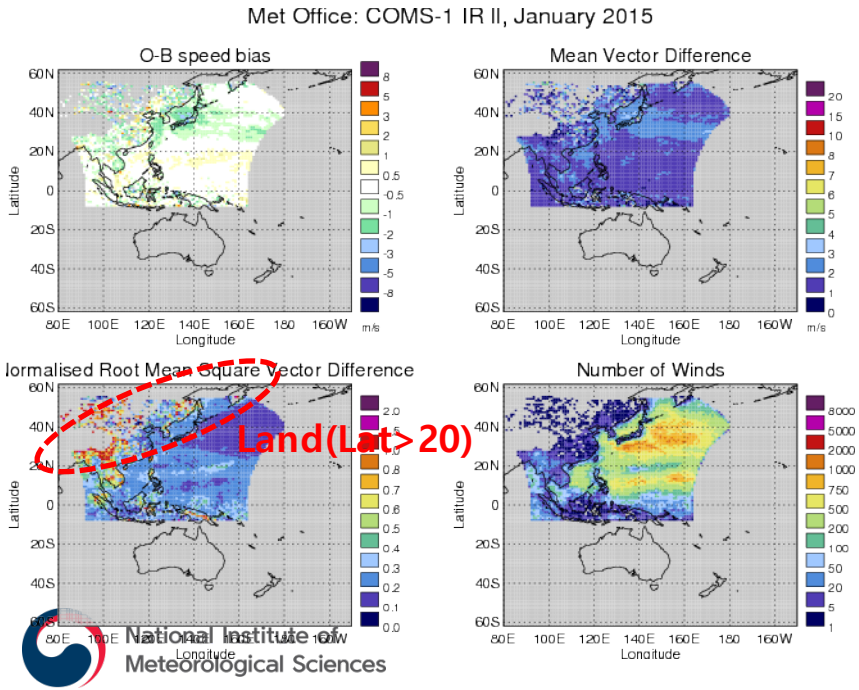
⇩

Test again!

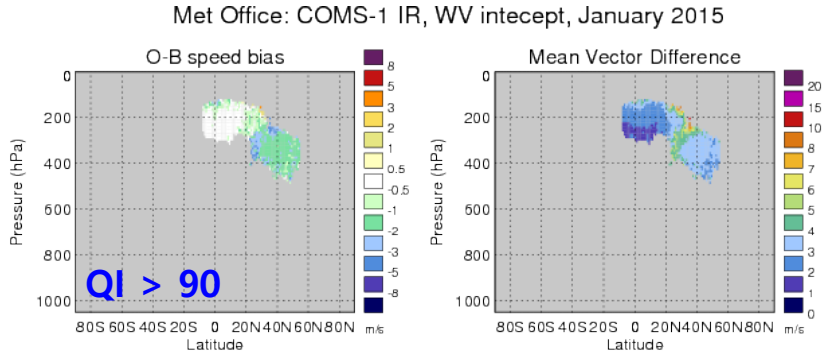
Blacklisting (1/2)

- Remove low level wind over land
  - P(lat>20) > 800 hPa & over land
- EBBT
  - QI < 85
- WV-Int, STC
  - QI < 90





❖ **Operational blacklisting**



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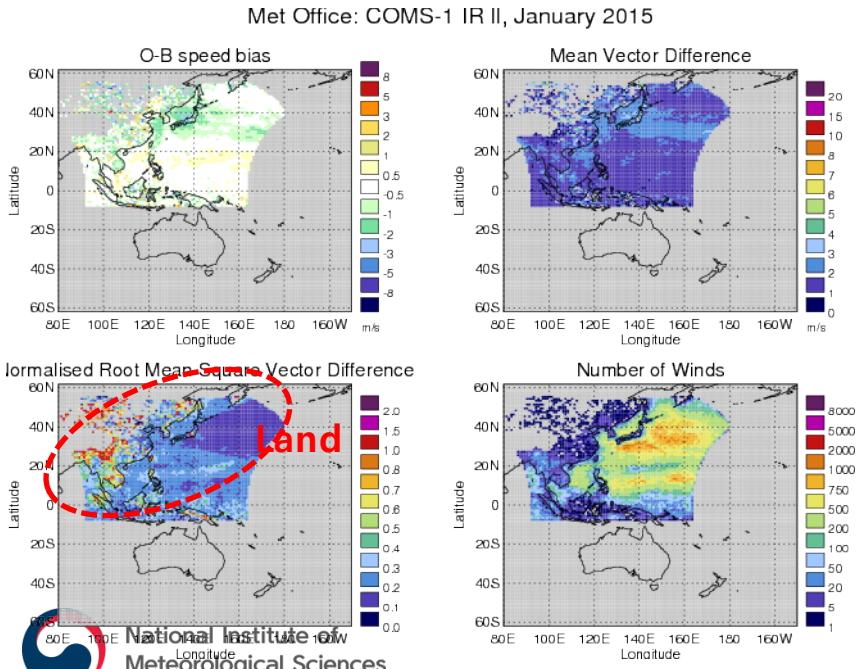
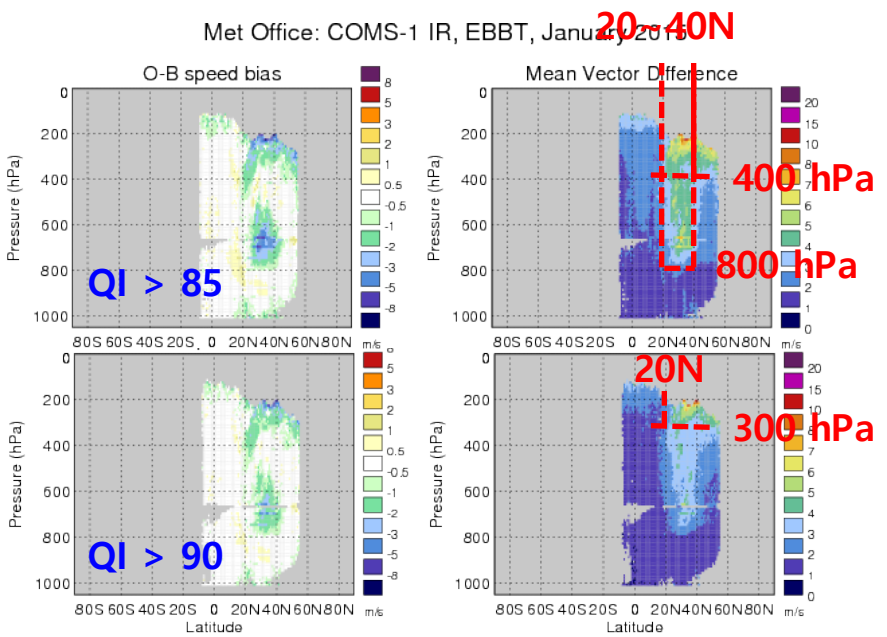
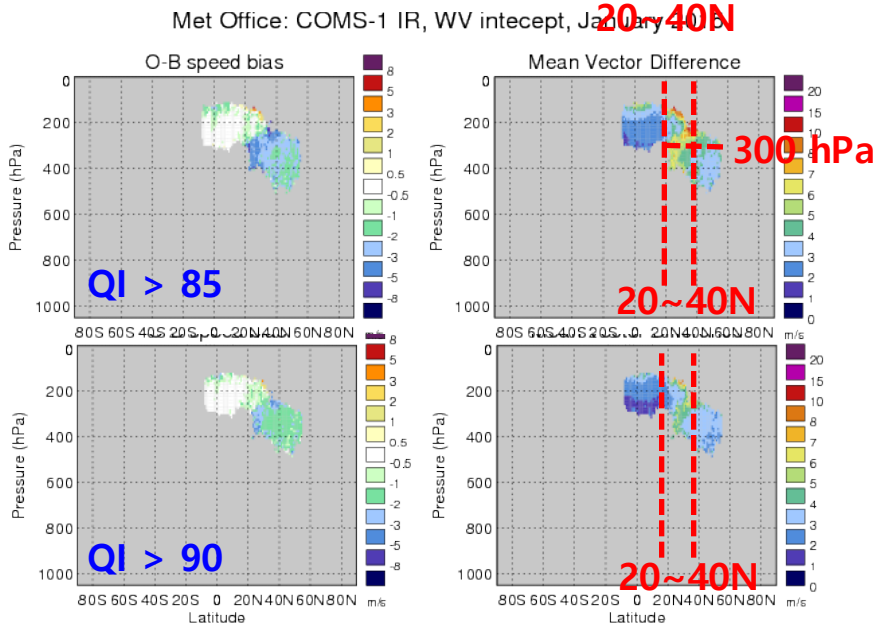
Blacklisting (2/2) ❖ Detailed blacklisting

- Remove low level wind over land
  - P > 800 hPa, over land
- EBBT
  - QI < 85
  - QI < 90 & P(20<lat<40) < 800 hPa
    P(lat>20) < 400 hPa
  - P(lat>20) < 300 hPa
- WV-Int, STC
  - QI < 85
  - 20<lat<40
  - QI < 90, P(20<lat) < 300 hPa







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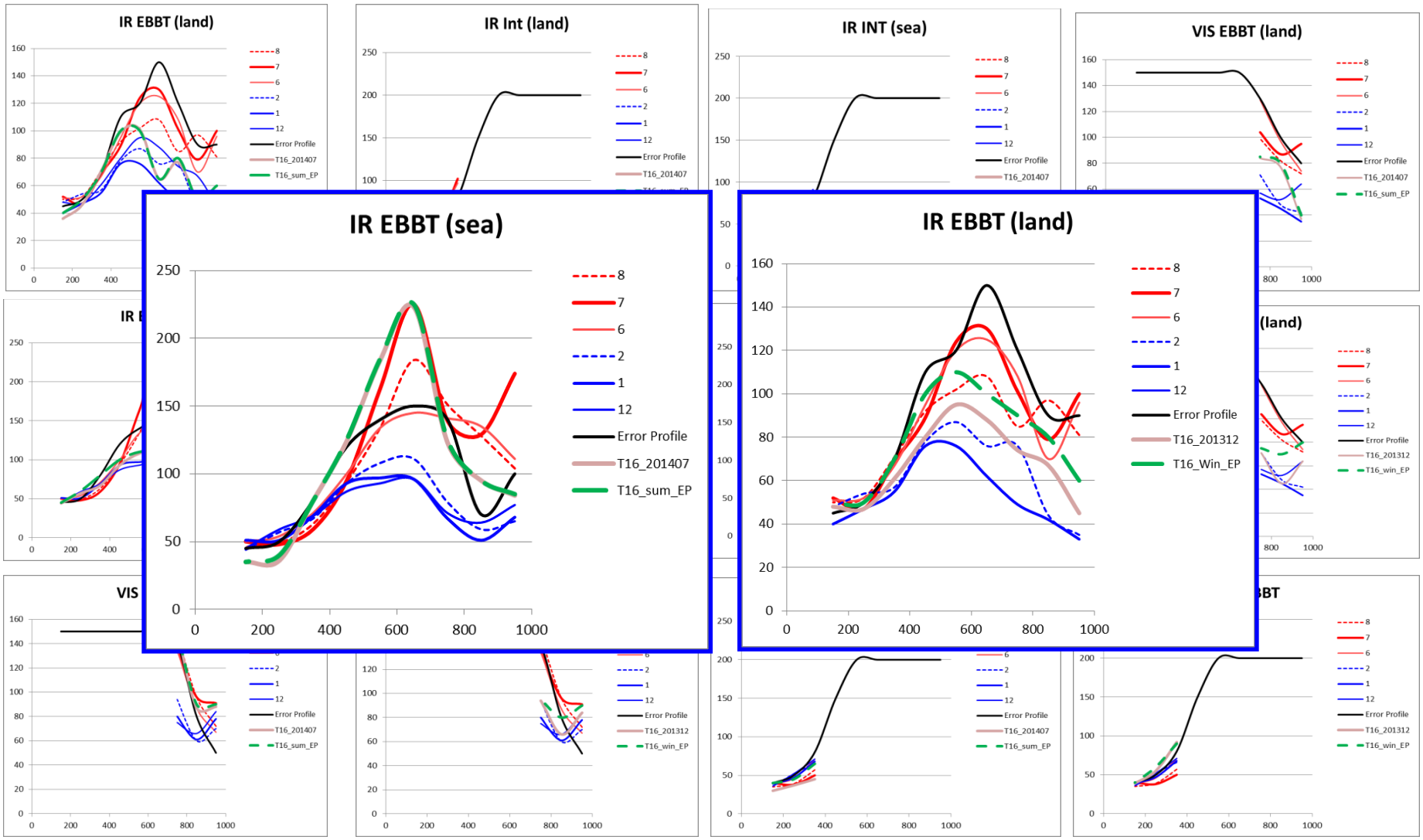
Error Profile



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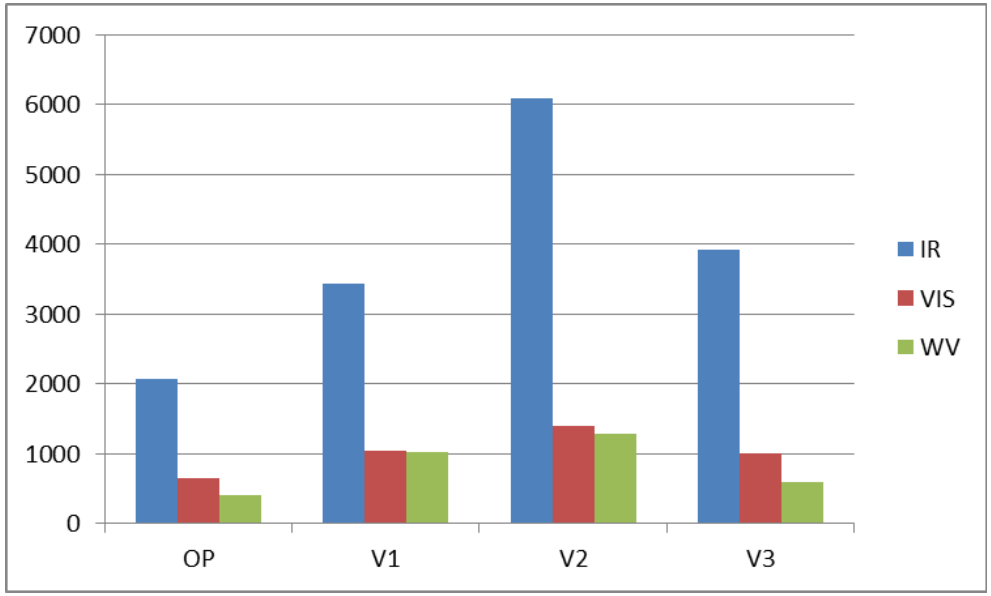
Data use

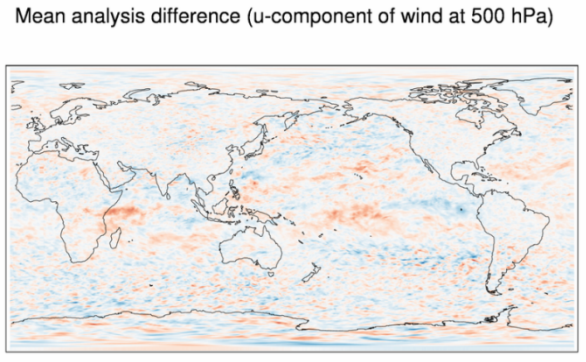
The number of data used in VAR

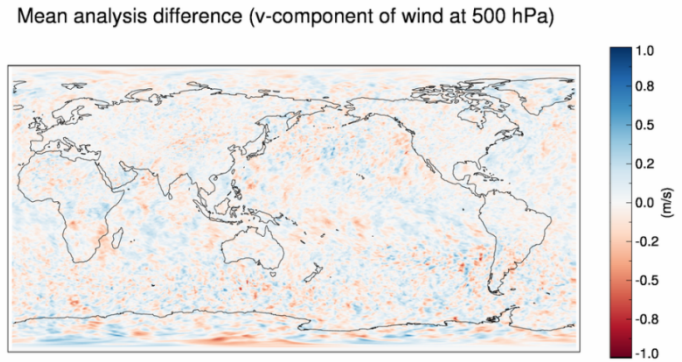


➔ **The number of data used in VAR increased when using detailed blacklisting(V1) and the poor QI condition(< 80, V2)**

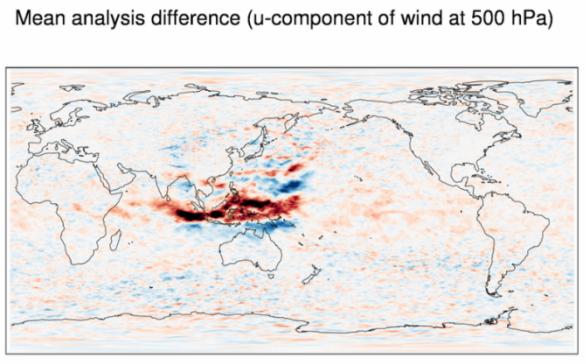
U,V Mean analysis difference (T16-T24)

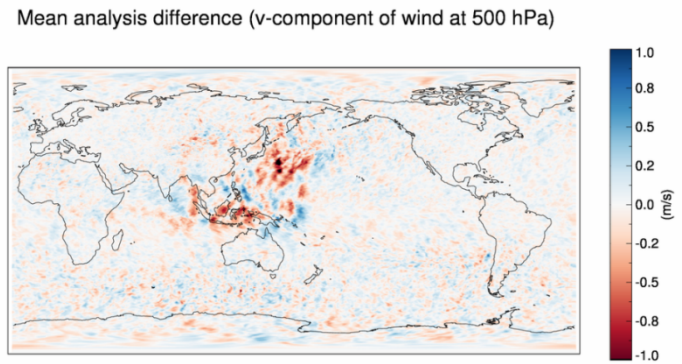
V1



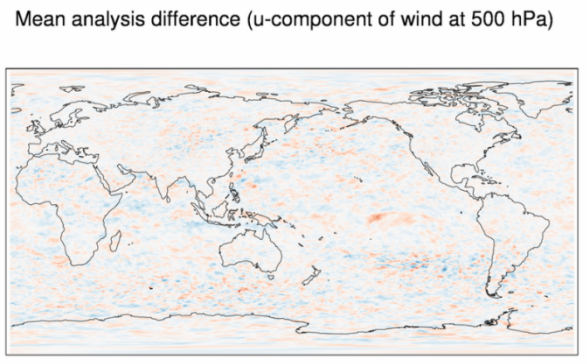


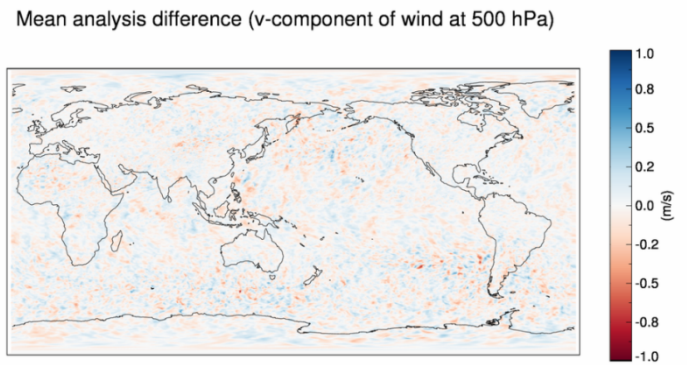
V2





V3





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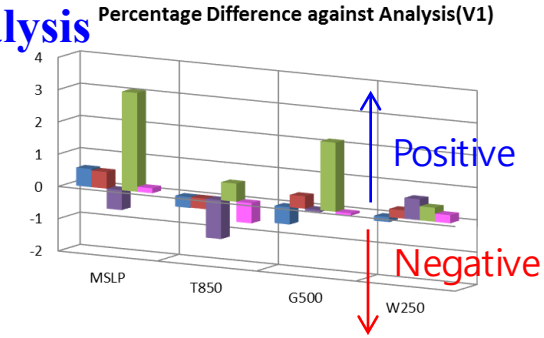
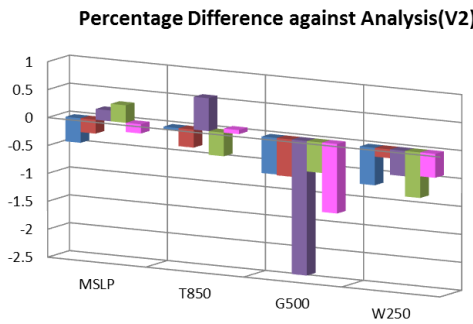
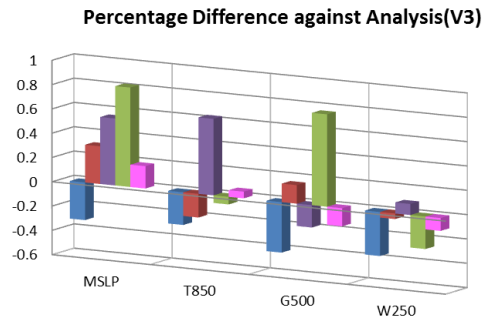
Forecast impact (201407)

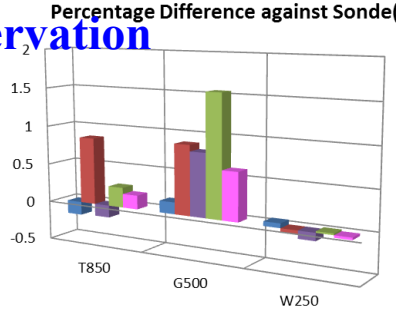
Analysis

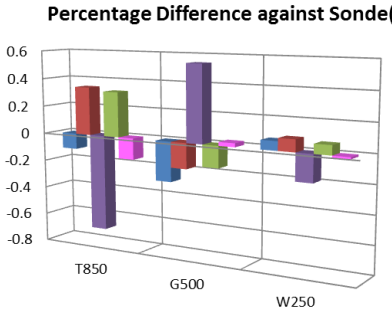


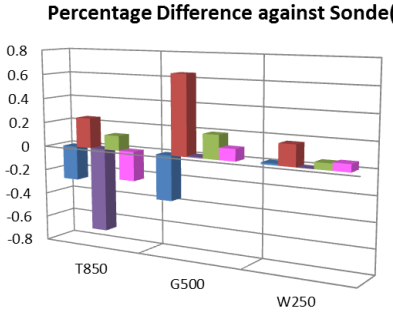




Observation







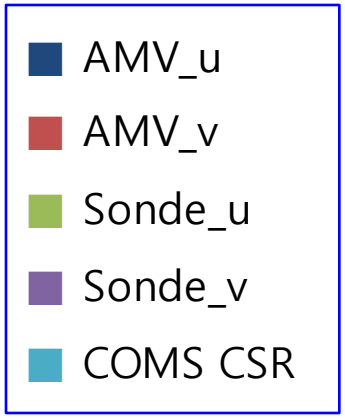
Analysis

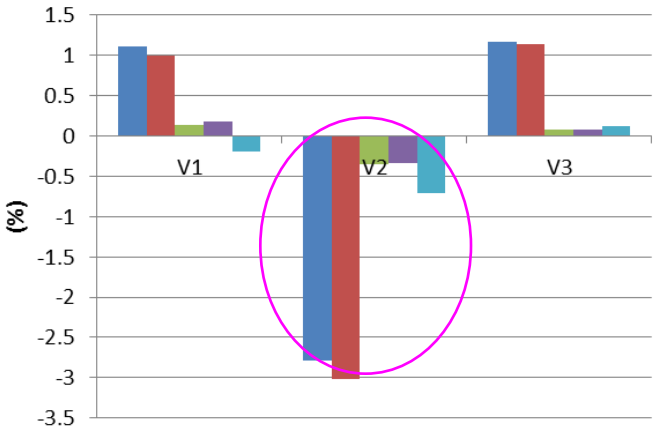
Global (asia)	MSLP	T850	G500	W250	Mean
V1	**0.15 (3.06)**	-0.62 **(0.56)**	-0.07 (2.14)	**0.25 (0.44)**	-0.07 **(1.55)**
V2	-0.16 **(0.31)**	**0.07 (-0.42)**	-1.24 (-0.54)	-0.42 (-0.82)	-0.44 (-0.37)
V3	**0.18 (0.82)**	**0.06 (-0.06)**	-0.15 **(0.76)**	-0.11 (-0.27)	-0.00 **(0.31)**

Observation

Global (Asia)	T850	G500	W250	Mean
V1	**0.18 (0.26)**	**0.62 (1.55)**	-0.03 **(0.02)**	**0.25 (0.61)**
V2	-0.15 **(0.32)**	**0.03** (-0.15)	-0.01 (0.07)	-0.05 **(0.08)**
V3	-0.24 **(0.02)**	**0.10 (0.19)**	**0.06 (0.05)**	-0.03 **(0.12)**

Percentage changes in BG fits to Obs(%)



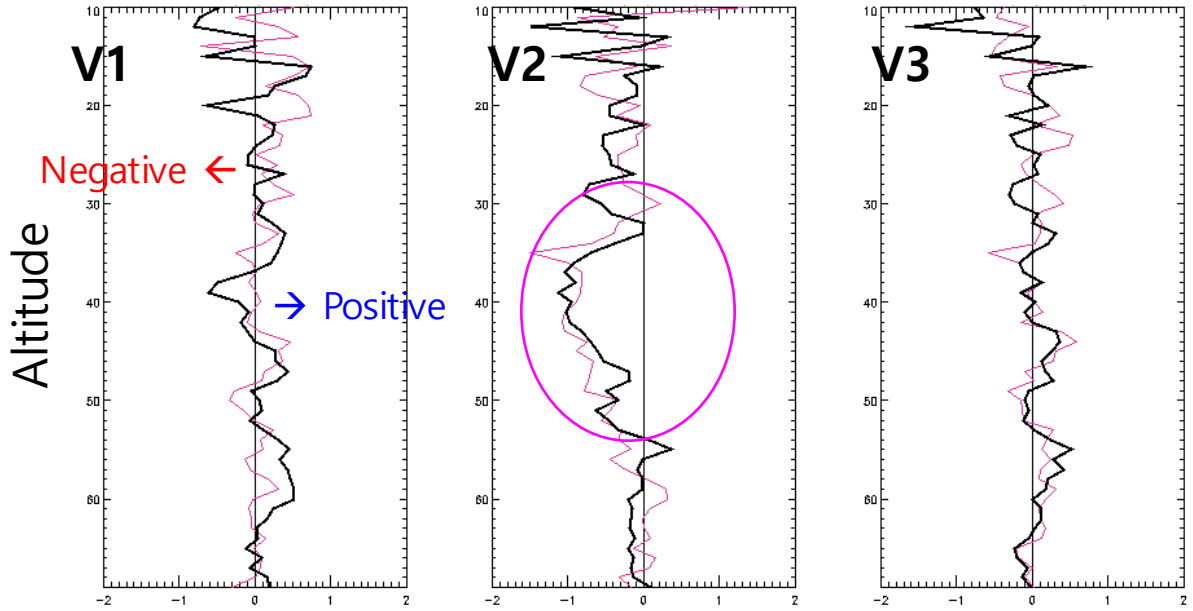


Positive
: Close to the Background

Negative

➔ BG fits got closer in V1 and V3, but much bigger in V2(QI<80)

Vertical BG fits to Sonde



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Summary and Plans

- COMS AMV have been used in the KMA operation system for 5 years.
- To improve the performance of COMS data in the model, higher resolution AMV products were introduced, and tested in the model.
  - ① Positive in winter analyzing the background wind speed faster
  - ② Initially negative in summer, but positive after the adjustment of blacklisting
  - ③ Detailed blacklisting works well, and leads the forecast to be improved
  - ④ Error profile should be tuned properly, and tested again

- Higher resolution COMS AMV(T16) will be tested in the higher resolution global model (N768) before operation, and also in the local model (1.5km) with Himawari-8 AMV.

Thank you.