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Recent Work on AMV and Operational Implementation of Satellite Wind Products at the Meteorological Service of Canada

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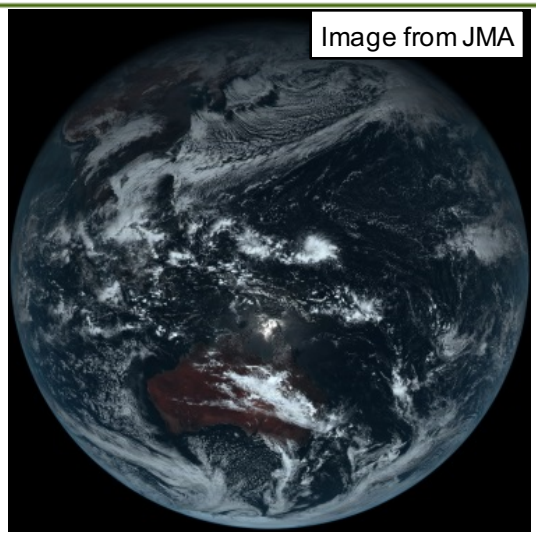
Outline

- Operational implementation of new satellite winds on March 2016 :
  - Suomi NPP VIIRS polar winds
  - Replacement of MTSAT-2 by Himawari-8 AMVs
    - AMV data volume issue
    - Operational strategy to get similar volume of data
  - RapidScat marine winds

- Impact of all these changes on the Global Deterministic Prediction System (GDPS)

Replacement of MTSAT-2 by Himawari-8 wind products

MTSAT-2 AMVs	Band	Wavelength [μm]	Spatial Resolution/ Quantization	Himawari-8 AMVs
	1	0.47	1 km/11 bit	
	2	0.51	1 km/11 bit	
VIS →	3	0.64	0.5 km/11 bit	← VIS
	4	0.86	1 km/11 bit	
	5	1.6	2 km/11 bit	
	6	2.3	2 km/11 bit	
	7	3.9	2 km/14 bit	
	8	6.2	2 km/11 bit	← WV
WV →	9	6.9	2 km/11 bit	← WV
	10	7.3	2 km/12 bit	← WV
	11	8.6	2 km/12 bit	
	12	9.6	2 km/12 bit	
	13	10.4	2 km/12 bit	← IR
IR →	14	11.2	2 km/12 bit	
	15	12.4	2 km/12 bit	
	16	13.3	2 km/11 bit	



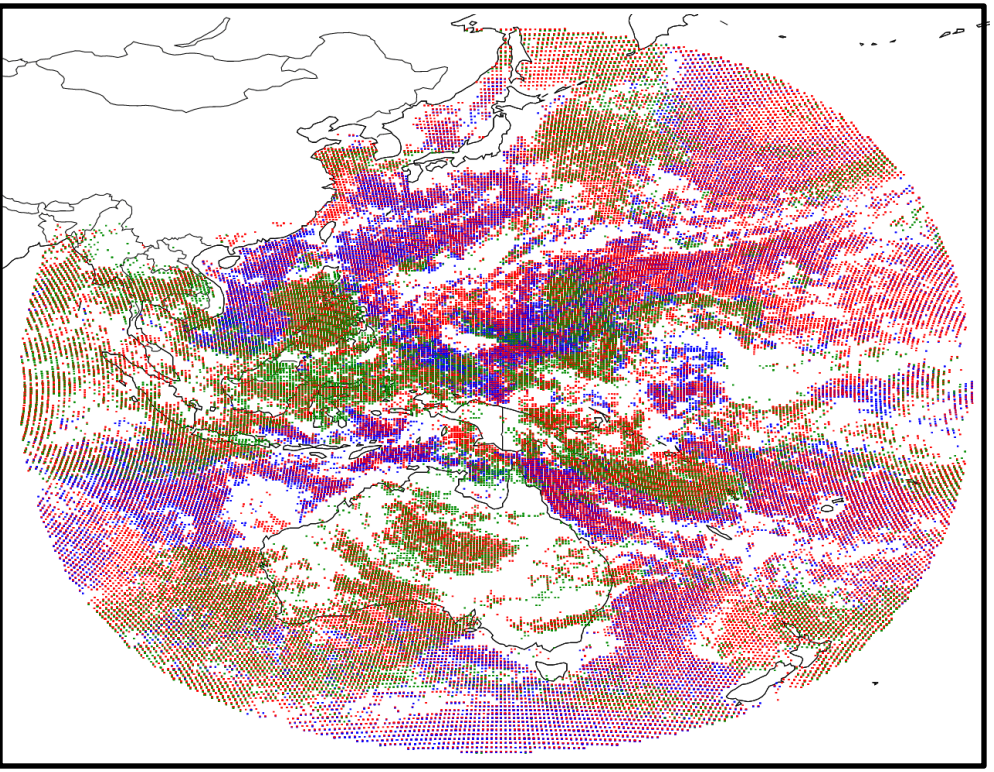
Examples of data coverage after blacklisting for 0600 UTC 28 October 2015

IR
VIS
WV

Himawari-8

283 430 wind vectors

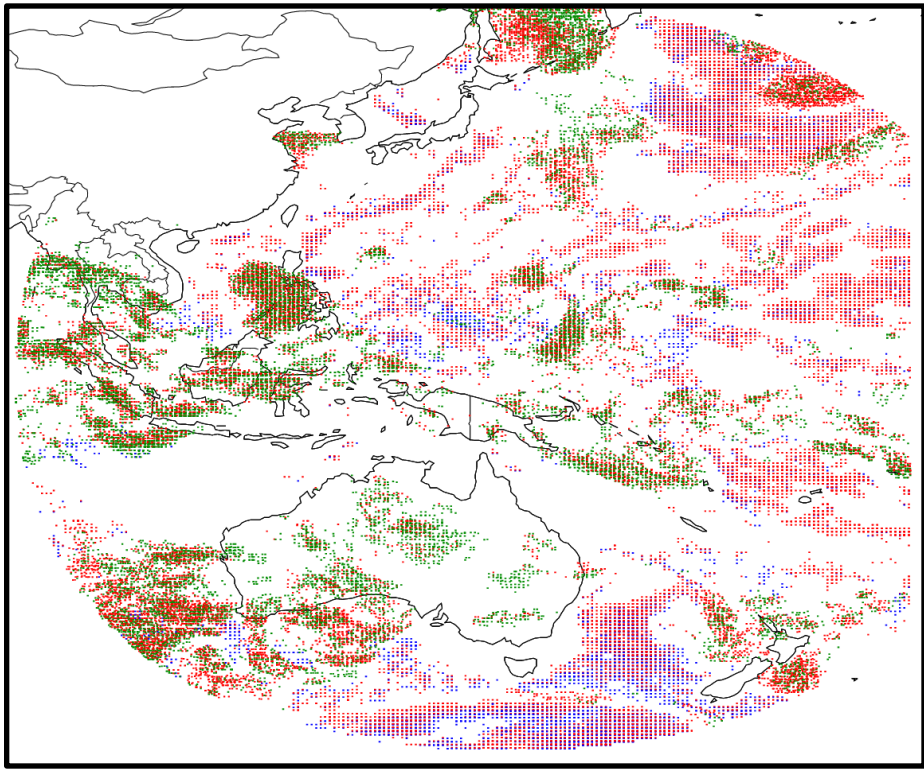
QI $\geq$ 85



MTSAT-2

47 514 wind vectors

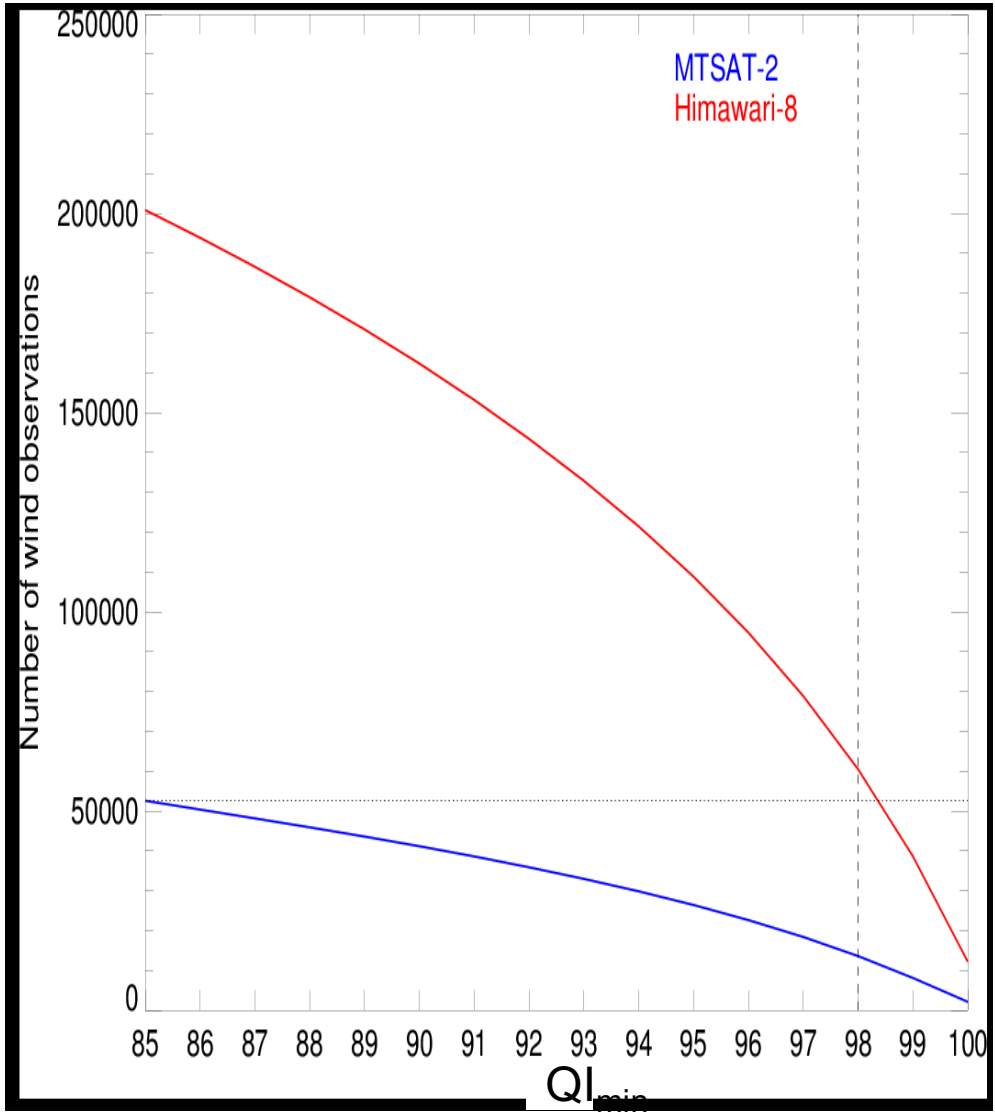
QI $\geq$ 85



Average number of wind vectors in the 6-h assimilation time window after blacklisting

- The left panel shows the number of wind vectors for which the quality indicator range from QI_{min} to 100.
- Period

  15 Dec 2015 – 15 Jan 2016
- The number of wind vectors from Himawari-8 with QI $\geq$ 98 is roughly the same as the number of wind vectors from MTSAT-2 with QI $\geq$ 85.



AMV data selection for Himawari-8

Band	Wavelength [μm]	Spatial Resolution/ Quantization	Himawari-8 AMVs
1	0.47	1 km/11 bit	
2	0.51	1 km/11 bit	
3	0.64	0.5 km/11 bit	← VIS
4	0.86	1 km/11 bit	
5	1.6	2 km/11 bit	
6	2.3	2 km/11 bit	
7	3.9	2 km/14 bit	
8	6.2	2 km/11 bit	← WV
9	6.9	2 km/11 bit	← WV
10	7.3	2 km/12 bit	← WV
11	8.6	2 km/12 bit	
12	9.6	2 km/12 bit	
13	10.4	2 km/12 bit	← IR
14	11.2	2 km/12 bit	
15	12.4	2 km/12 bit	
16	13.3	2 km/11 bit	

Hourly data used

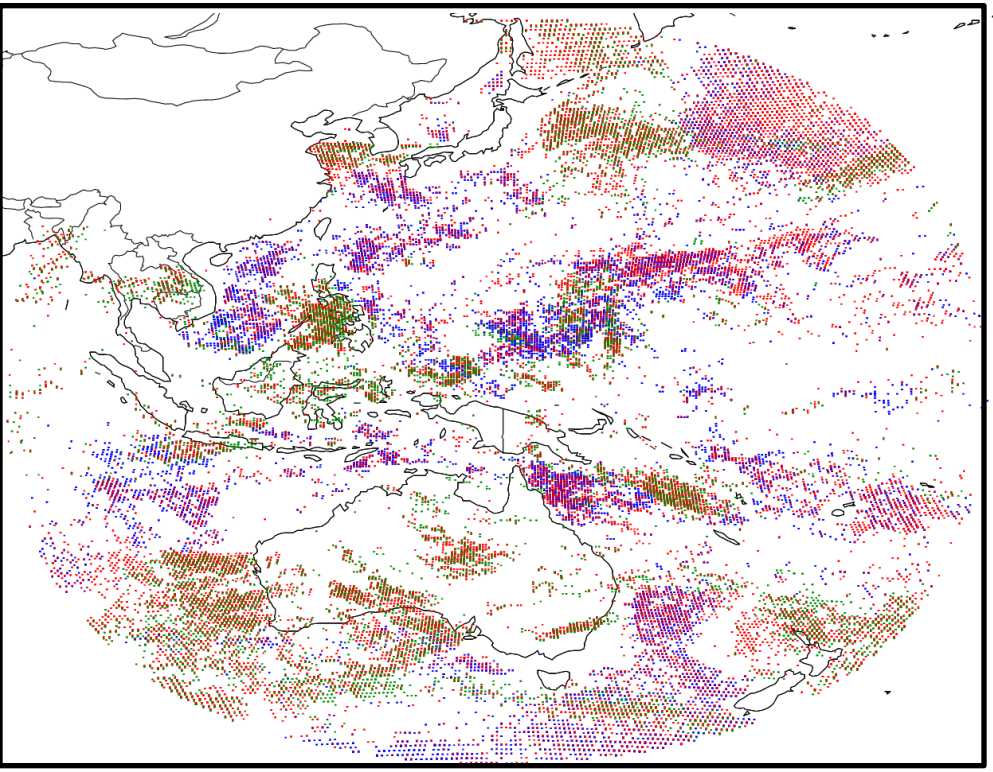
Thinning: $1.5^{o} \times 1.5^{o}$ x 10 levels

Data with QI ≥ 98

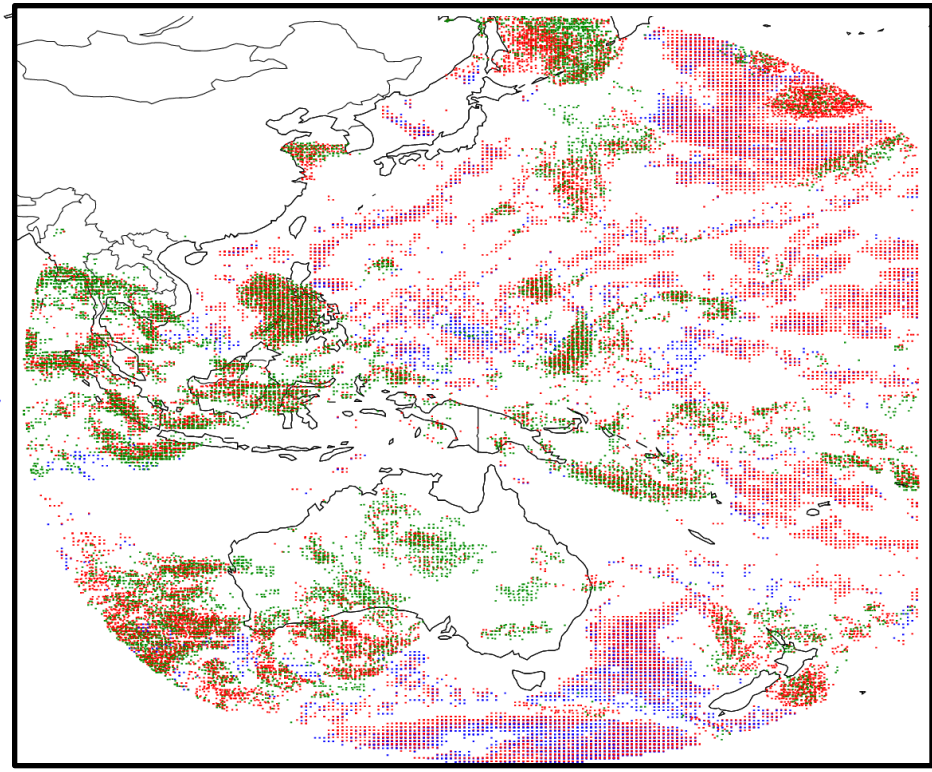
Data coverage after revised backlisting for 0600 UTC 28 October 2015

IR
VIS
WV

Himawari-8
63 698 wind vectors
QI ≥ 98

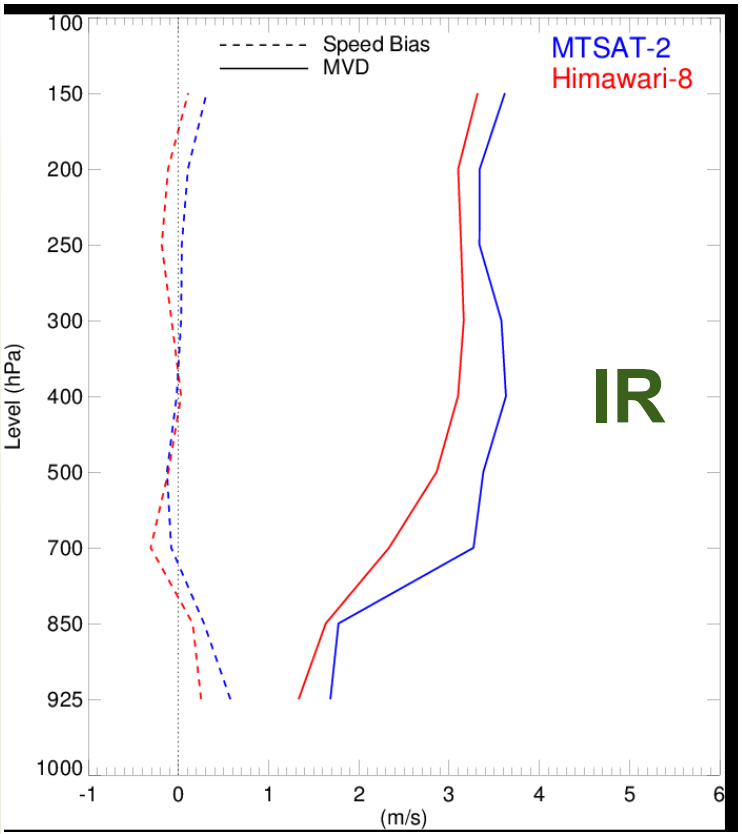


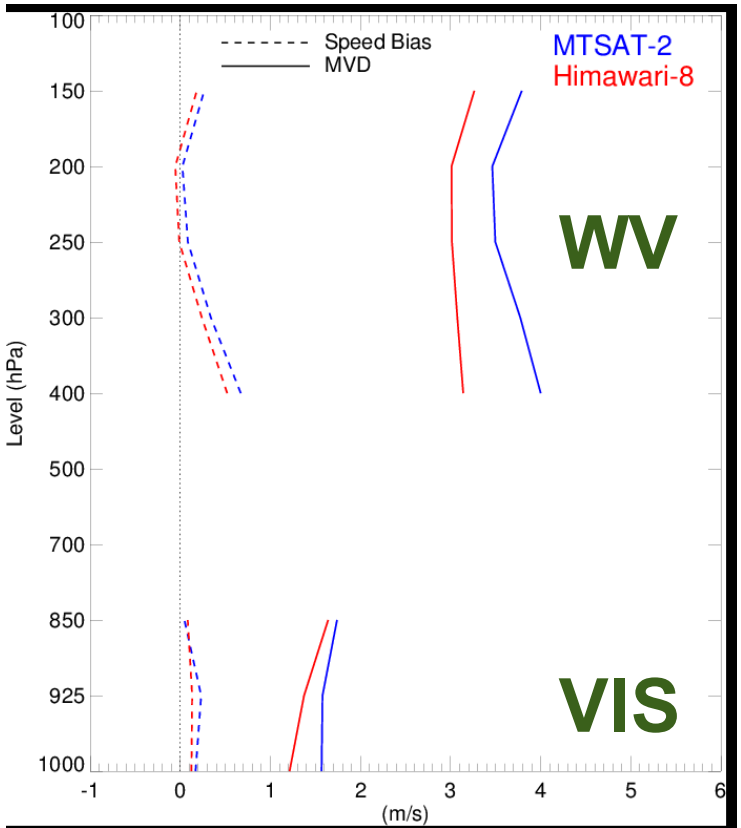
MTSAT-2
47 514 wind vectors
QI ≥ 85



Monitoring of O-B for AMVs from Himawari-8 and MTSAT-2

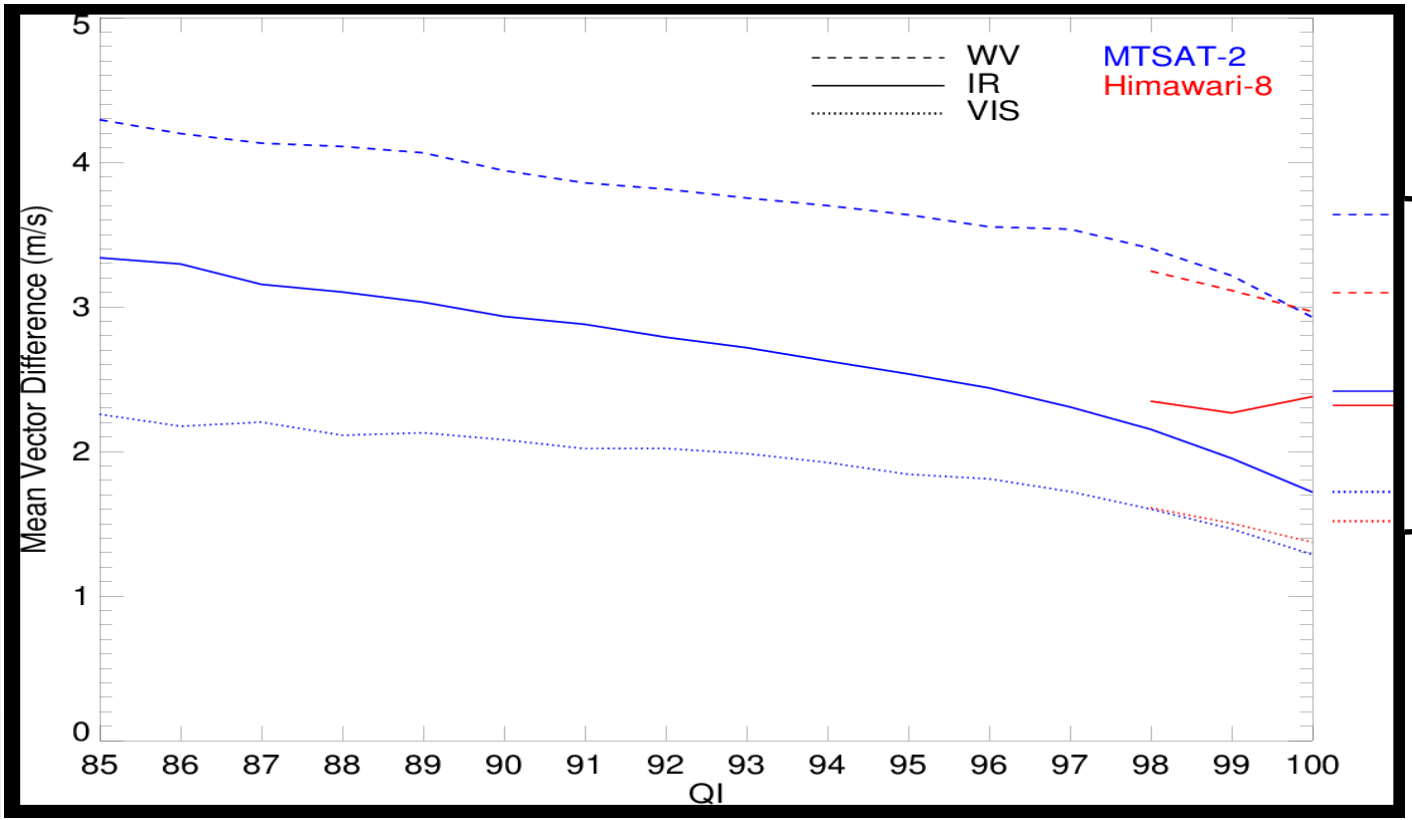
- Period : 15 Dec 2015 – 15 Jan 2016
- The MVD of the selected Himawari-8 data is roughly 15% smaller than those of MTSAT-2





Monitoring of O-B for AMVs from Himawari-8 and MTSAT-2

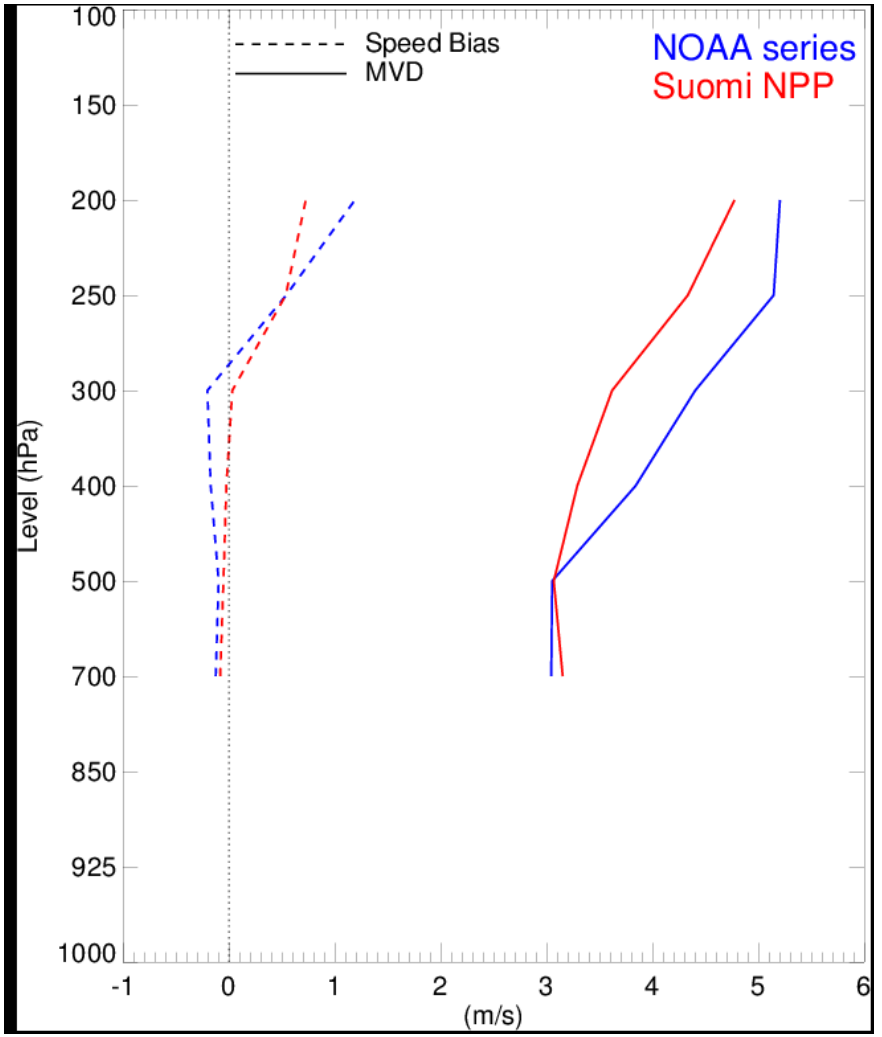
- Period:15 Dec 2015 – 15 Jan 2016
- Overall, O-B MVDs are smaller for the Himawari-8 data that are assimilated. However, data with QI ≥ 98, MVD are generally greater for IR and WV channels.



Monitoring of O-B for AMVs from S-NPP and NOAA satellites

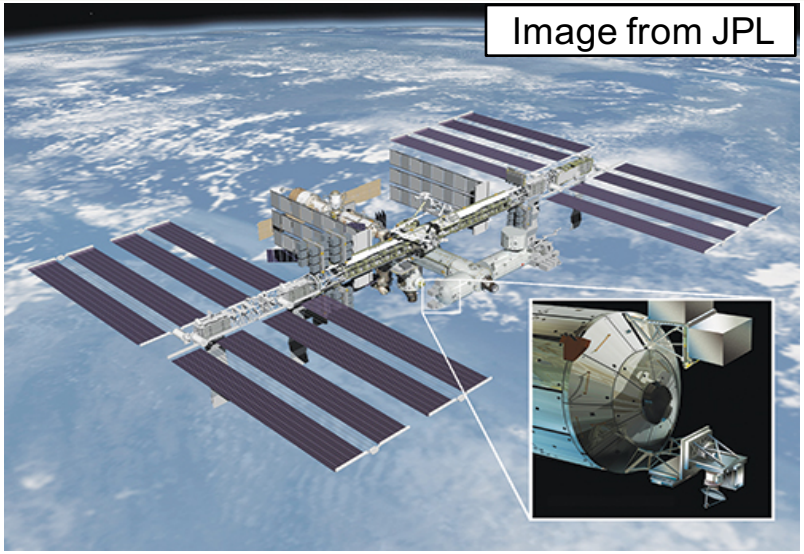
- Observations from NOAA/NESDIS
- Data thinned to 180 km
- Same data selection process used for both AVHRR and VIIRS AMVs
- Average number of AVHRR/VIIRS polar winds assimilated per day
  - **NOAA-15 : 986**
  - **NOAA-18 : 1184**
  - **NOAA-19 : 1782**
  - **S-NPP : 4178**
- Generally better MVD and Speed bias for VIIRS

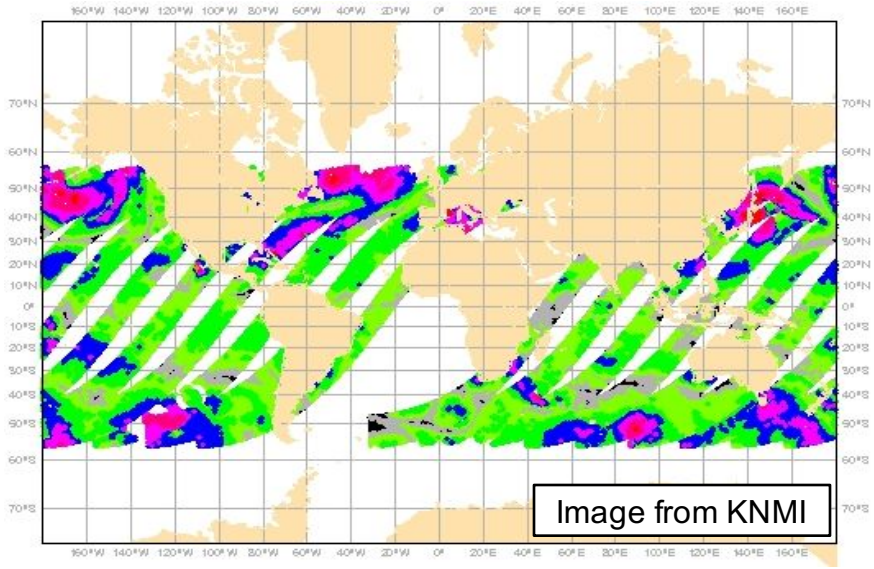
15 Dec 2015 – 15 Jan 2016



Assimilation of RapidScat winds

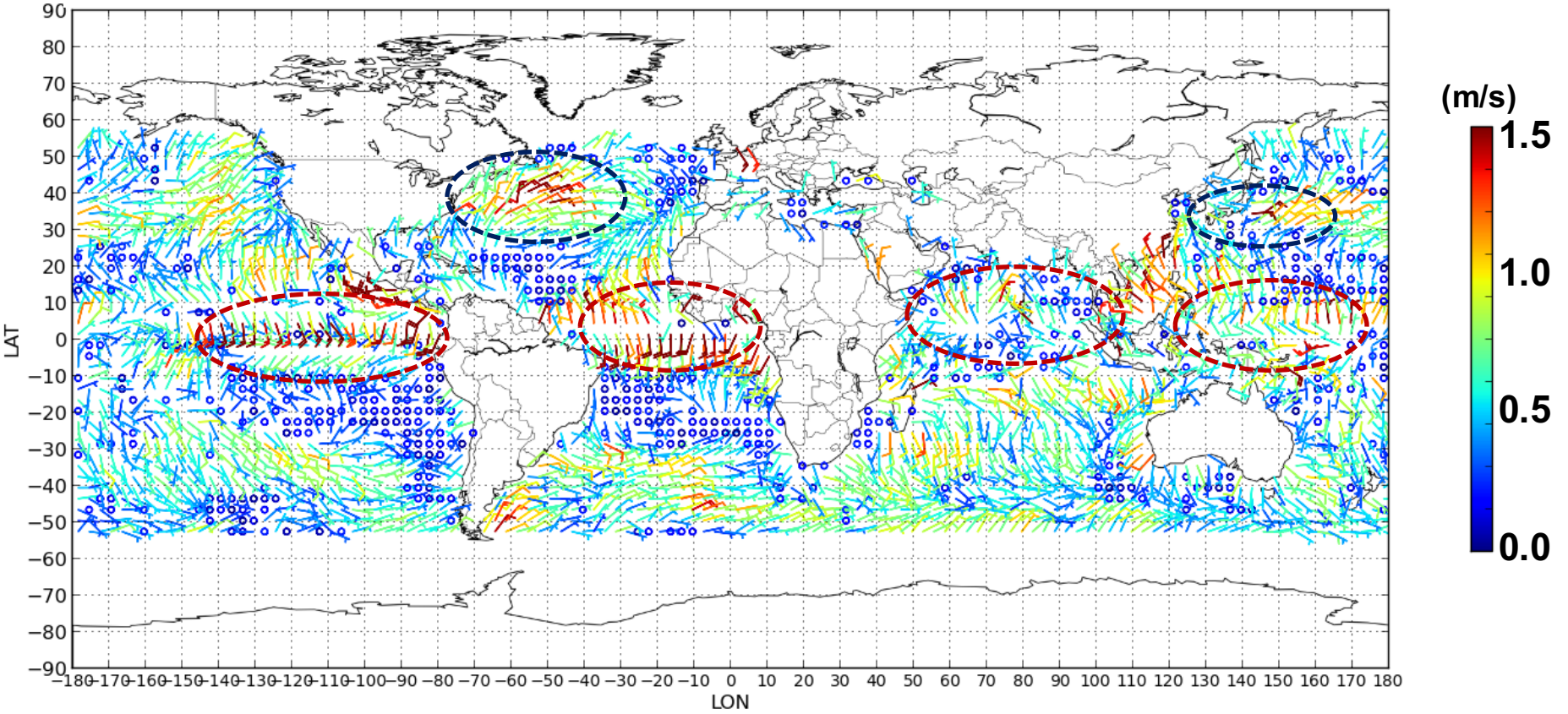
- Retrieval wind product from KNMI
  - 50 km resolution
  - Equivalent neutral wind
- Data thinned to 100 km
- Subtraction of 0.2 m/s to transform equivalent neutral wind to real 10-m wind
- Same selection and quality control processes as for ASCAT from Metop-A and B, which are assimilated
- When ASCAT and RapidScat data are collocated, priority is given to the ASCAT data
- Represents on average about 28 000 additional marine wind vectors assimilated per day





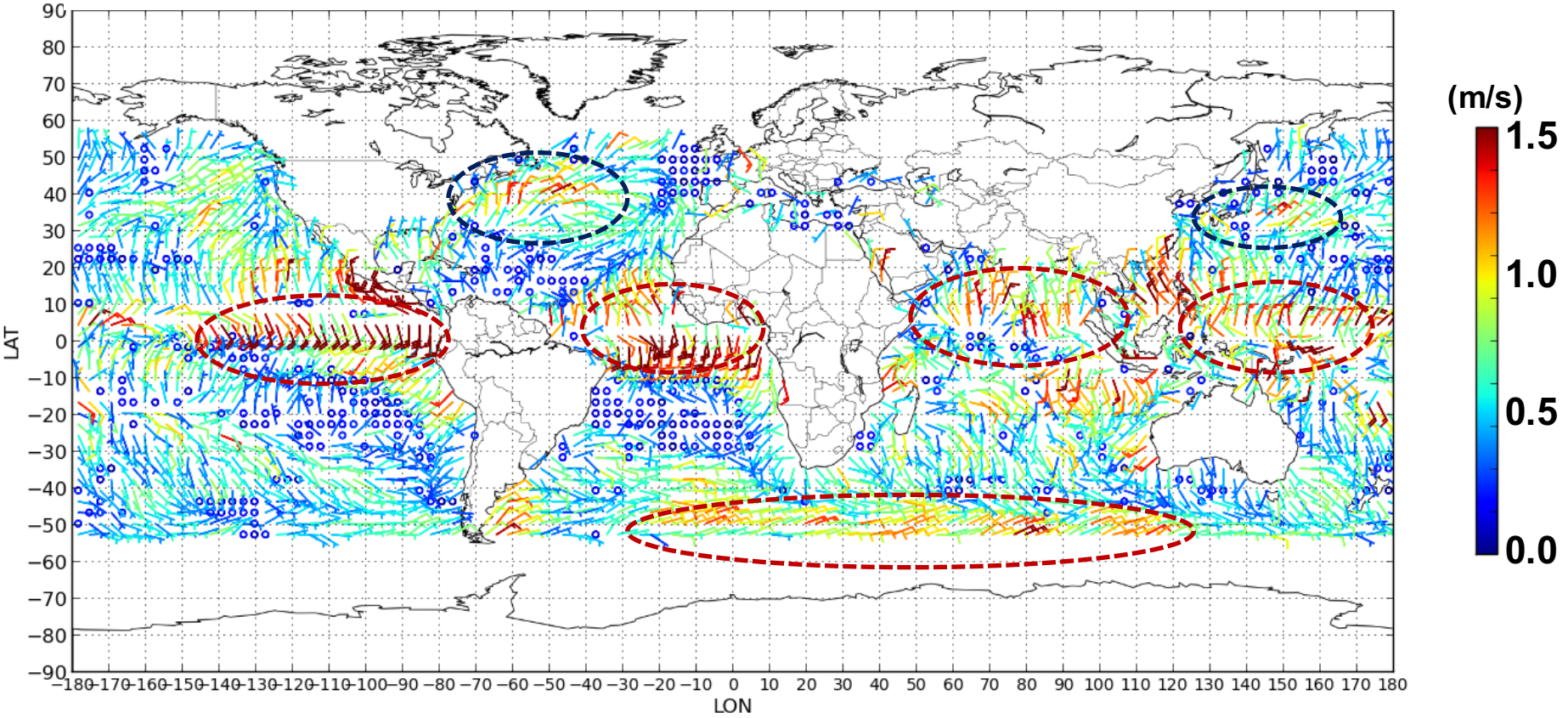
Mean O-B for ASCAT data for January 2015

- ASCAT winds faster than predicted in the Gulf Stream and Kuroshio regions
- Discrepancies between the observed and predicted ITCZ zone



Mean O-B for RapidScat data for January 2015

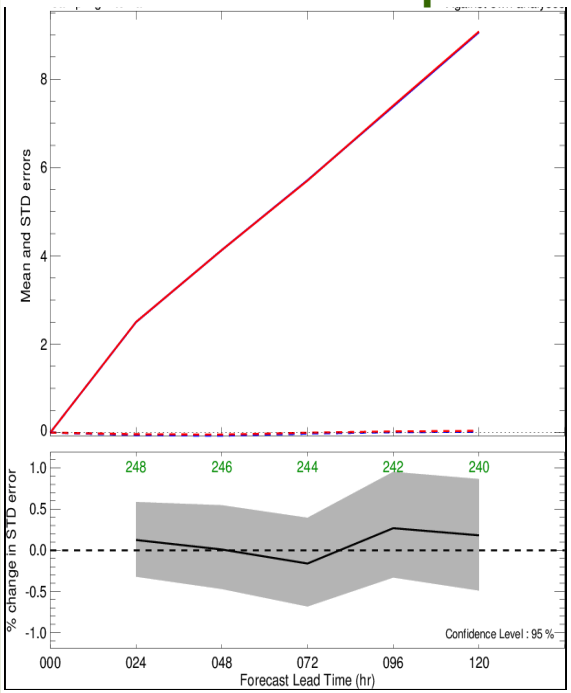
- The discrepancies between the observed and predicted ITCZ zone and over the Indian Ocean are enhanced
- Speed bias enhanced in the Southern Hemisphere mid-latitudes



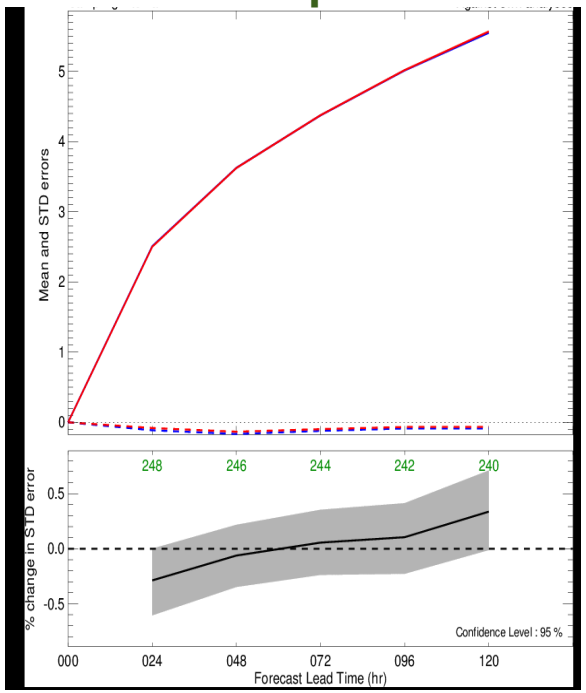
Impact of AMVs from Himawari-8, S-NPP and winds from RapidScat on GDPS

- The new set of observations represents 0.7 % of the volume of data assimilated in the GDPS
- Verification period: 28 Oct 2015 – 29 Feb 2016
- Scores for **wind speed at 250 hPa** against own analysis

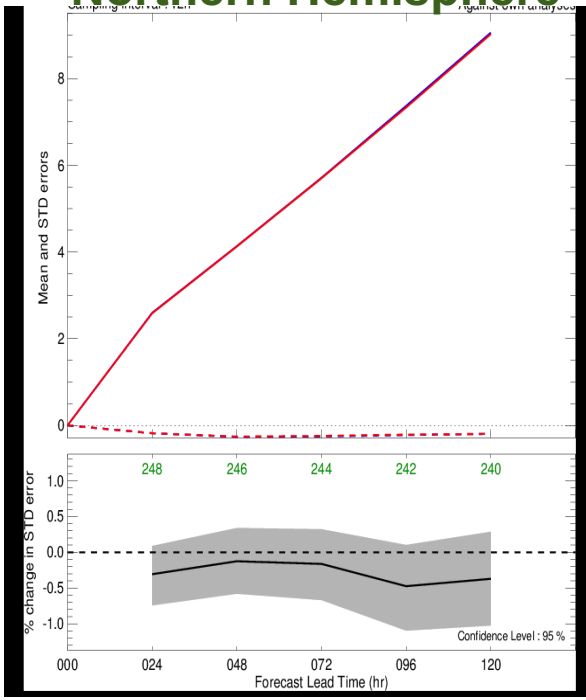
Southern Hemisphere



Tropics



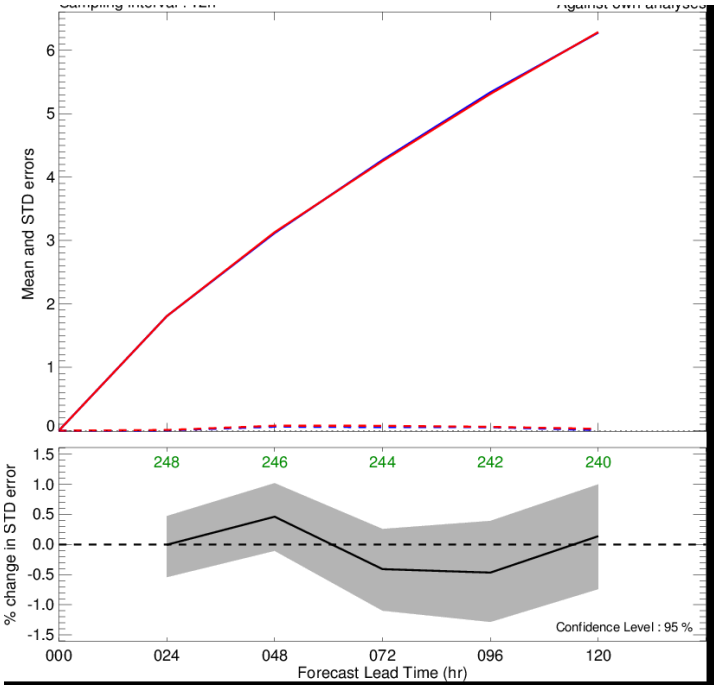
Northern Hemisphere



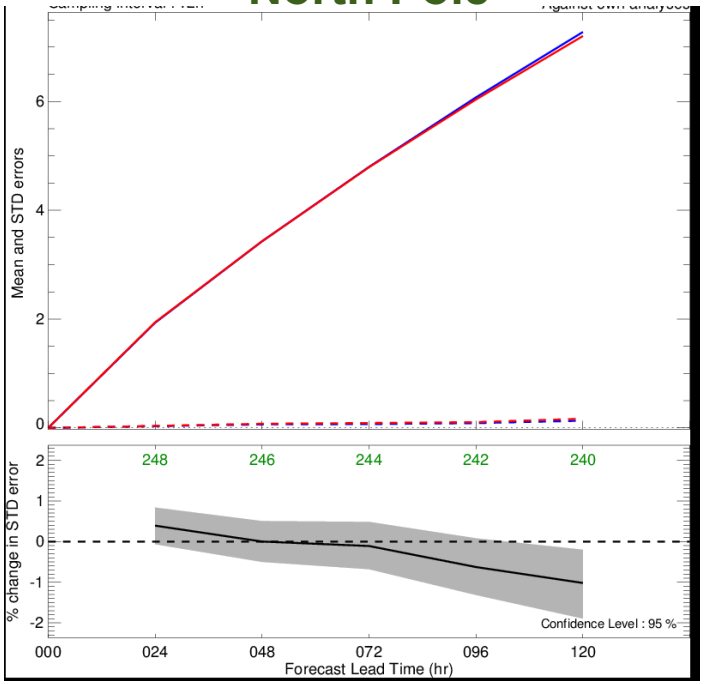
Impact of AMVs from Himawari-8, S-NPP and winds from RapidScat on GDPS

- The new set of observations represents 0.7 % of the volume of data assimilated in the GDPS
- Verification period: 28 Oct 2015 – 29 Feb 2016
- Scores for **wind speed at 500 hPa** against own analysis

South Pole



North Pole



Summary

- AMVs from Himawari-8, S-NPP and scatterometer winds from RapidScat have been operationally implemented on March 2016
- In order to get a similar number of data to MTSAT-2, only Himawari-8 AMVs with QI $\geq$ 98 are assimilated
- When RapidScat and ASCAT data are collocated, priority is given to ASCAT due to their better quality
- All these observations represent 0.7% of the total data assimilated. They overall provide a neutral to positive forecast impact, although not significant