EUMETSAT operational dual-Metop wind products

O. Hautecoeur
R. Borde
M. Doutriaux-Boucher
M. Carranza

EUMETSAT

Content

- ✓ New AMVs processor version (v2.4)

- ✓ New dual-Metop global winds product

- ✓ Dual vs Single Metop winds product over Polar Regions

EUMETSAT

EUMETSAT AVHRR/Metop winds
New processor version 2.4

Changes since v2.0:

- ✓ NWP temperature profile review :
  - • Tropopause determination → upper limit for height determination
  - • Temperature inversion identification → consider the inversion if necessary
- ✓ Wind vector computed from centres of reference and matched target windows (parallax correction applied)
- ✓ Search window size depends on the time difference, and roughly on the error expected on the speed
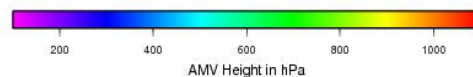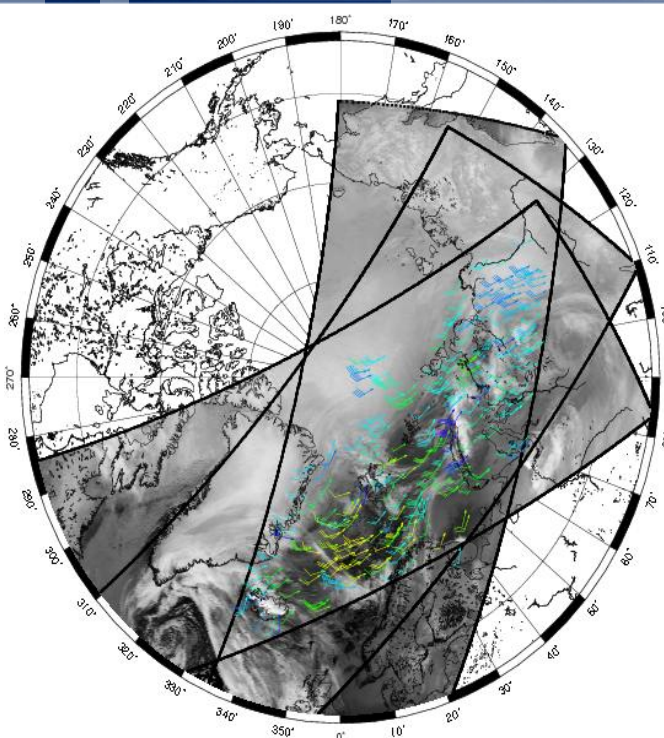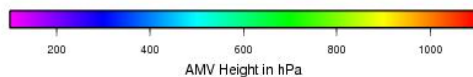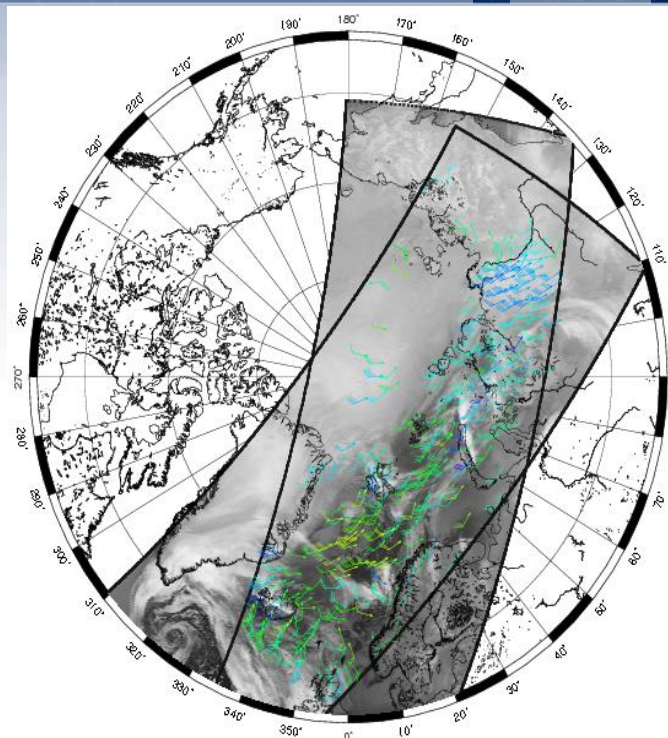- ✓ IASI data use is restricted
- ✓ Bugs fixed

EUMETSAT

EUMETSAT AVHRR/Metop winds
Operational since 2010

2 images used at EUMETSAT

~100 min

AMV Height in hPa

3 images used at CIMSS

~200 min

AMV Height in hPa

- Problems of view angles, parallax and varying pixels sizes
- Small areas to track features
- No cloudy product to set altitude (AVHRR), basic cloud mask
- Polar region specificities like ground colder to air above

EUMETSAT

EUMETSAT dual Metop winds
## The tandem Metop configuration

The tandem configuration with two satellites on the same orbital plane provides an interesting opportunity to create global AMVs from satellites with a significant overlap in imagery data

The same algorithm is used for dual Metop winds and for single Metop winds extraction.

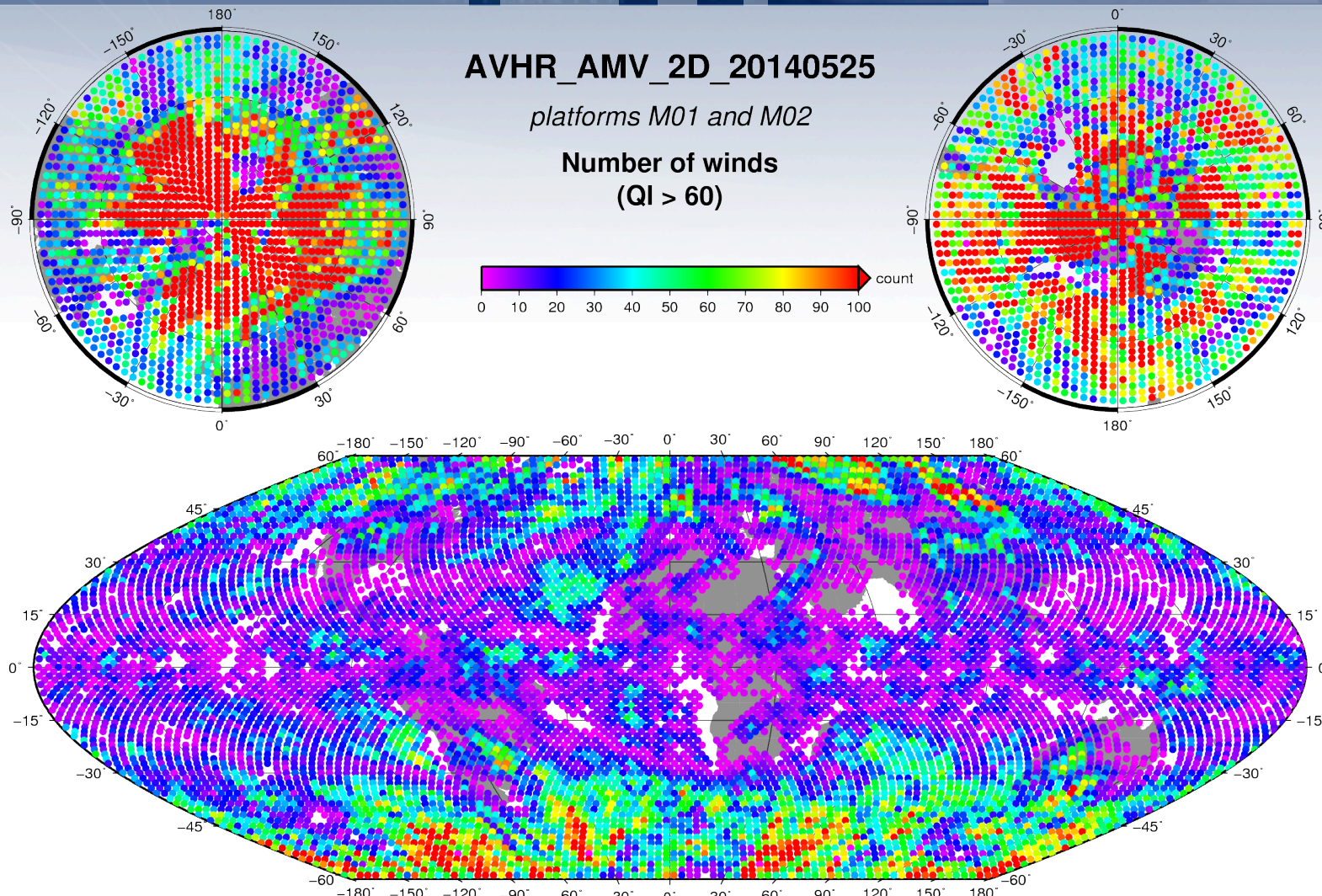It uses image pairs from the two different Metop satellites.

2 complementary products:

➢ Metop-A / Metop-B, ~46 min temporal gap
➢ Metop-B / Metop-A, ~55 min temporal gap

AMV — Pressure, 25/11/2013 at 09:49:03 — 25/11/2013 at 09:58:03
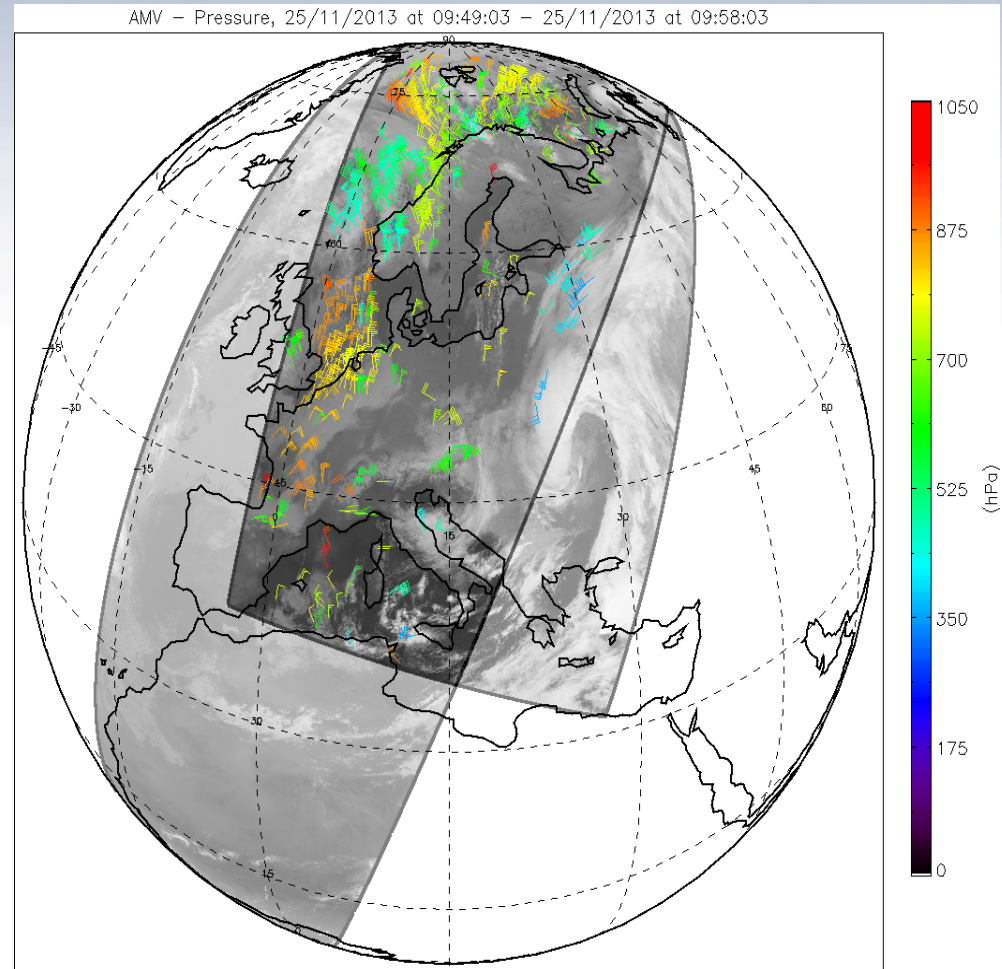
EUMETSAT

EUMETSAT dual Metop winds
Global coverage

AVHR_AMV_2D_20140525

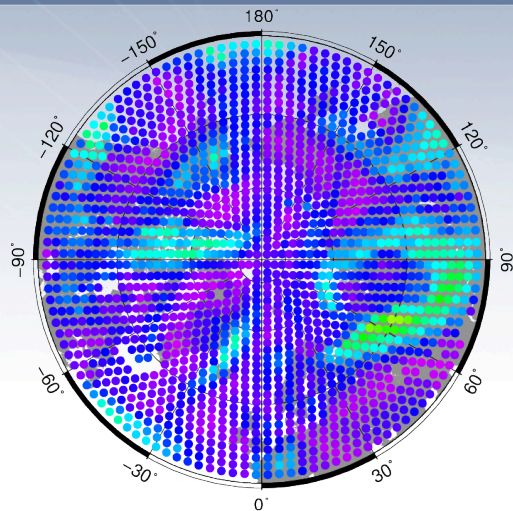*platforms M01 and M02*

Number of winds
(QI > 60)

Accumulated number of dual Metop winds, Equal Area spots (~3 square degrees)
M01/M02 and M02/M01 products

EUMETSAT

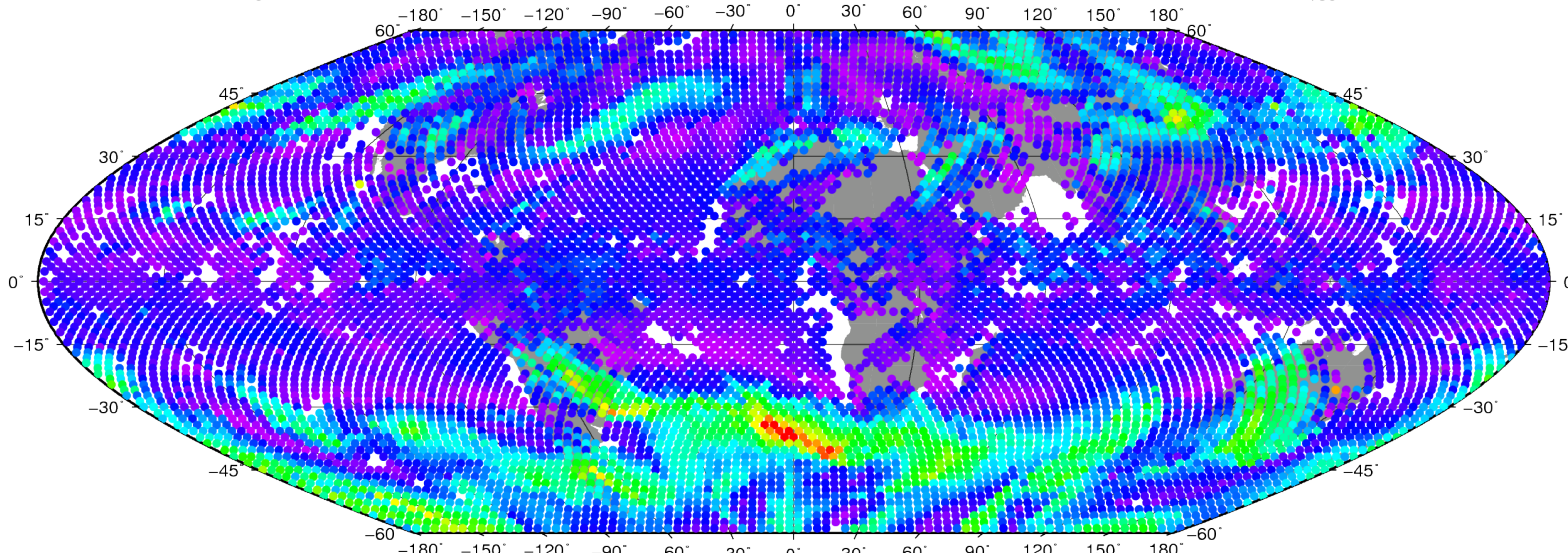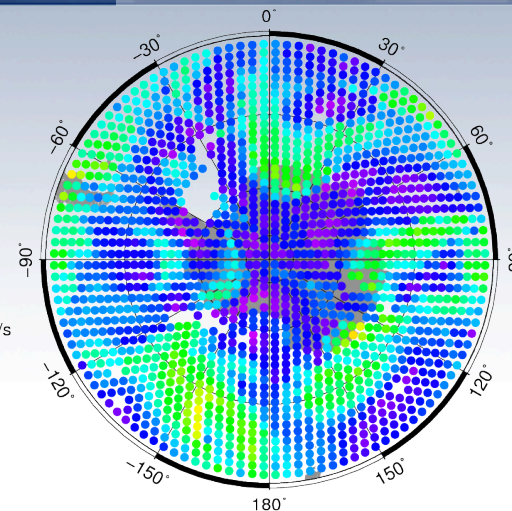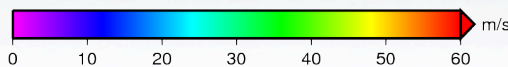# EUMETSAT dual Metop winds
Global and homogeneous product

AVHR_AMV_2D_20140525

platforms M01 and M02
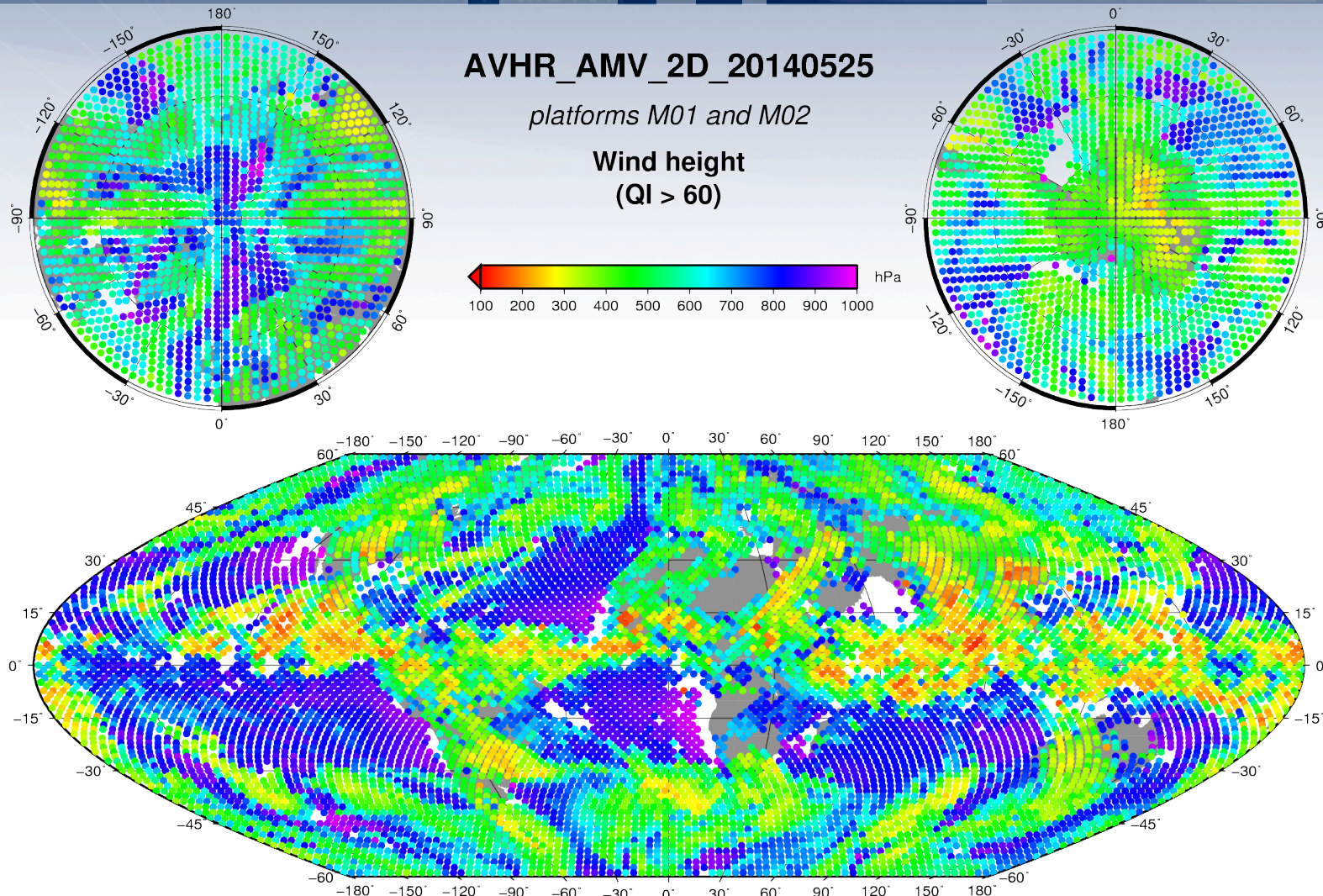
Wind speed (QI > 60)

**Averaged speed of dual Metop winds, Equal Area spots (~3 square degrees)
M01/M02 and M02/M01 products**

EUMETSAT

EUMETSAT dual Metop winds
Global and homogeneous product

AVHR_AMV_2D_20140525

platforms M01 and M02

Wind height
(QI > 60)

hPa
100 200 300 400 500 600 700 800 900 1000

Averaged pressure of dual Metop winds, Equal Area spots (~3 square degrees)
M01/M02 and M02/M01 products

EUMETSAT

EUMETSAT dual Metop winds
Comparison versus forecast (December 2013, Processor v2.3)

➤ **QI > 80, including forecast check**

Dual Metop Winds against FC	Amount	Speed (m/s)		Direction (deg)		Vector difference RMS (m/s)	Mean fc wind speed (m/s)	NRMS	NRMS (without fc)
		Bias	RMS	Bias	RMS				
All levels	801 037	0.05	4.47	-11.11	40.20	5.90	16.54	0.36	0.60
High levels	301688	-0.17	5.11	-5.68	22.31	7.09	27.04	0.26	0.39
Mid levels	408 439	0.45	4.95	-14.29	44.80	6.45	16.99	0.38	0.65
Low levels	90910	0.03	2.93	-12.94	35.23	3.88	10.18	0.38	0.76

- **General statistics look quite good but lots of disparities exist as function of the geographical areas. Large fast bias is especially found in tropics, probably due to a very poor height assignment.**

- **Statistics should be better with the last PPF v2.4**

EUMETSAT

EUMETSAT dual Metop winds
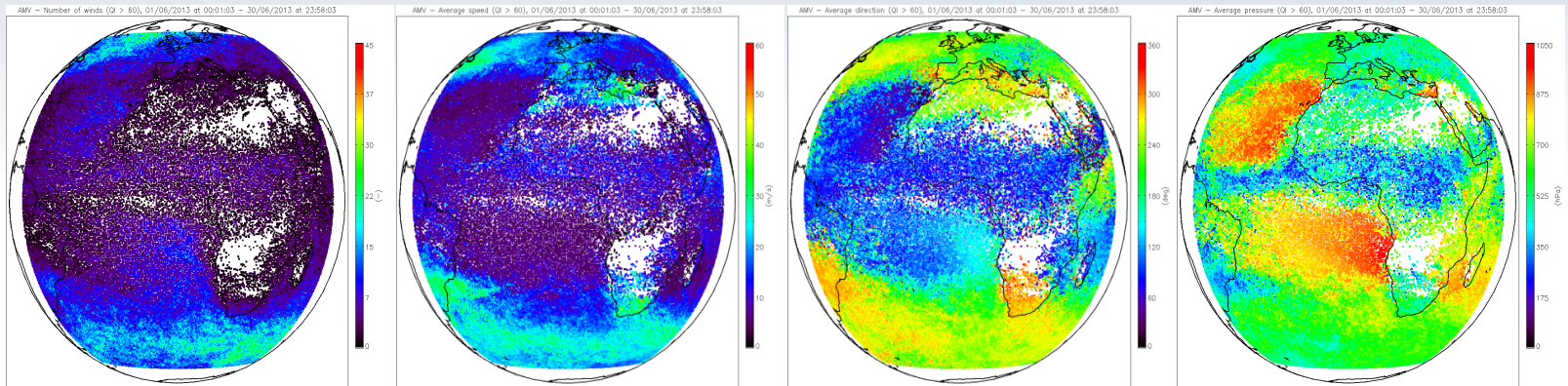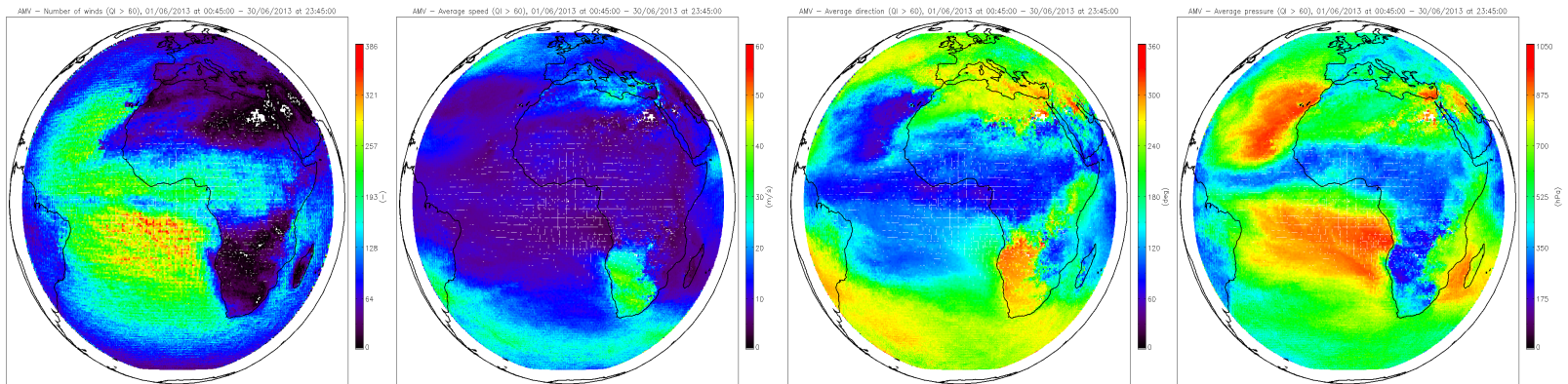## Comparison versus SEVIRI/MSG (June 2013, Processor v2.3)

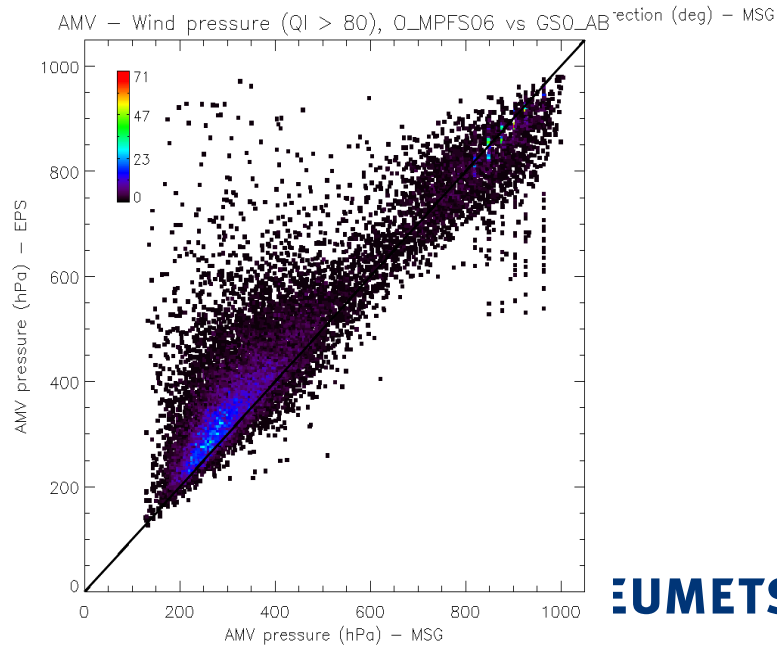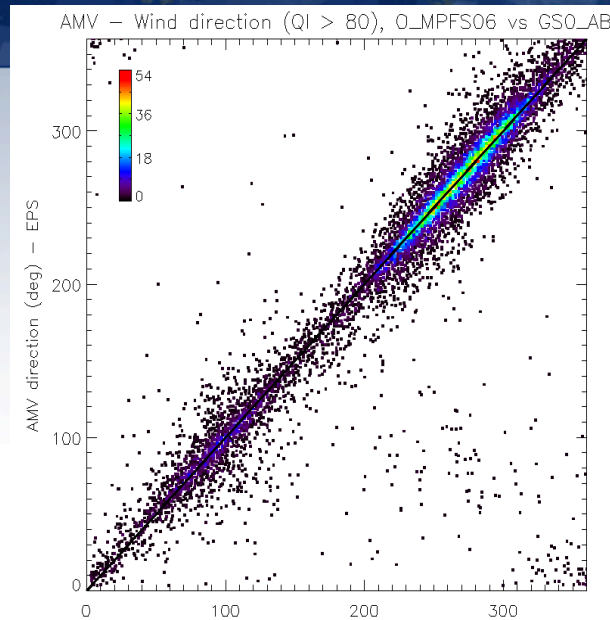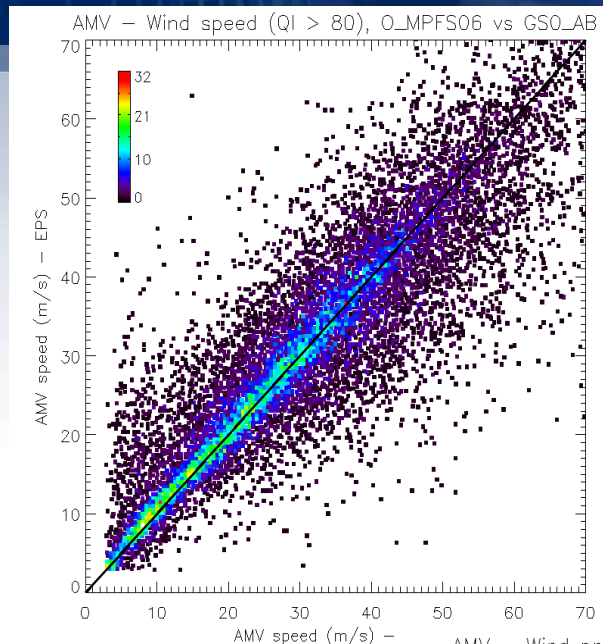Amount Speed Direction Pressure

Dual Metop QI>60

MSG QI>60

EUMETSAT

EUMETSAT dual Metop winds
Comparison versus SEVIRI/MSG (Processor v2.3)

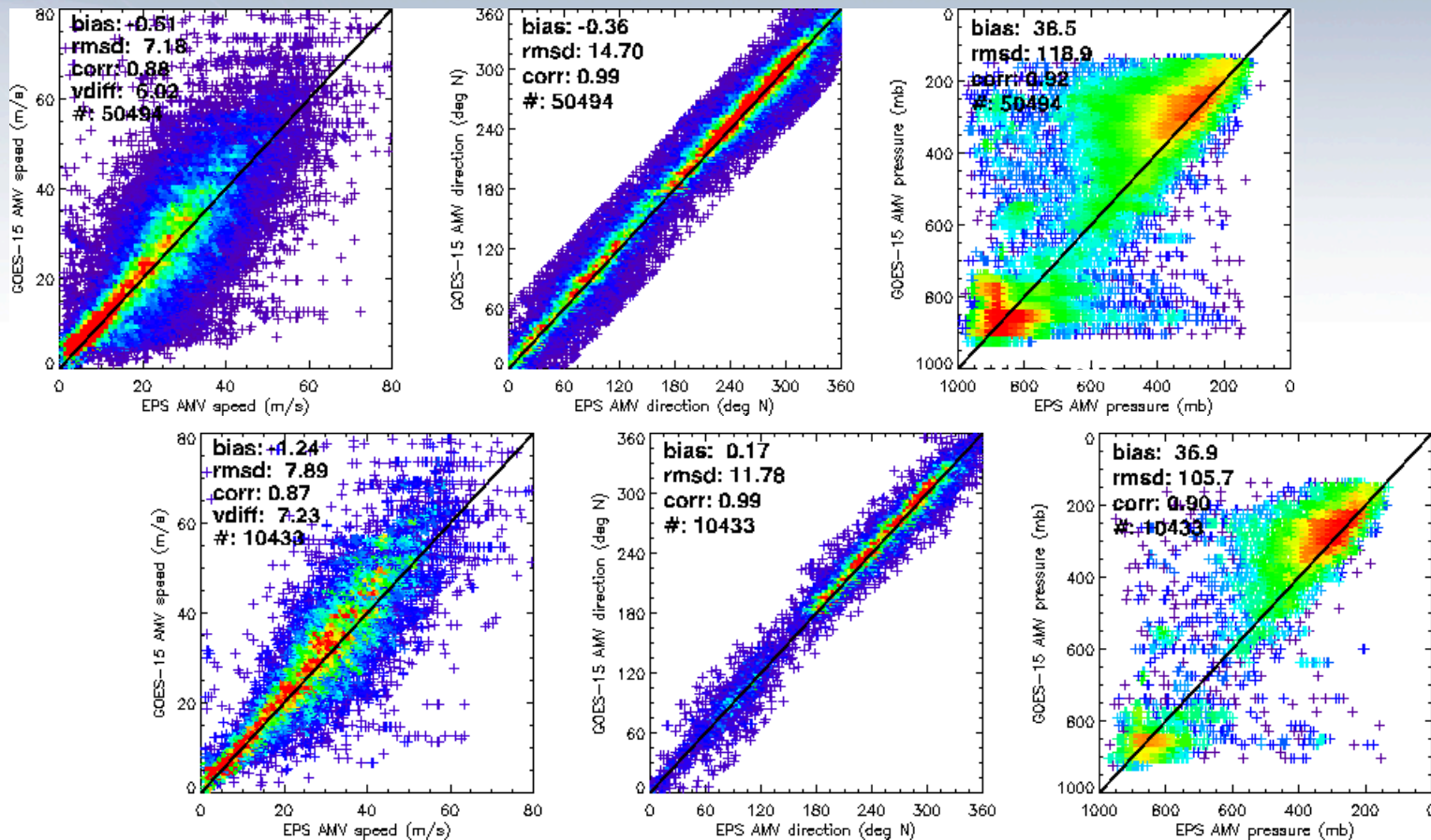**Comparison criteria:**

➤ **1st Oct 2013**
 – 31st Jan 2014

➤ **QI > 80**

➤ **45 minutes max difference**

➤ **0.25 deg lat/lon grid box**

EUMETSAT

EUMETSAT dual Metop winds
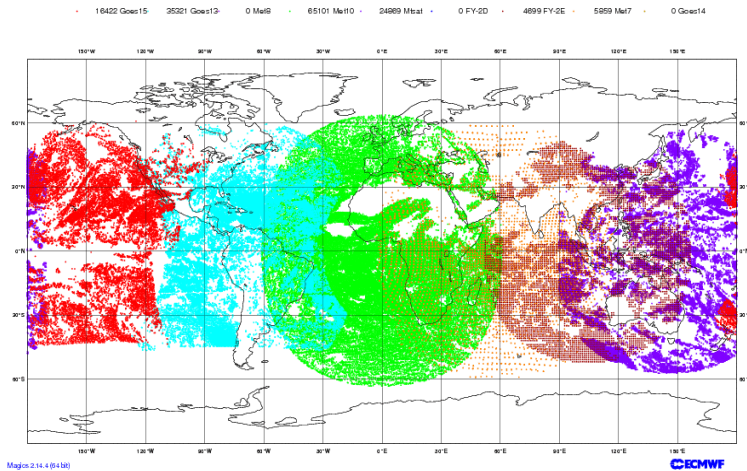## Comparison versus GOES-15 (Oct 13 – Jan 14, Processor v2.3)

...and comparison with MTSAT-2, MET07, MET10, Modis/TERRA, MISR/TERRA
➤ First externe validation study made by TROPOS

EUMETSAT

EUMETSAT dual Metop winds for Polar Regions
Why do we care?

ECMWF Data Coverage (All obs DA) - AMV IR
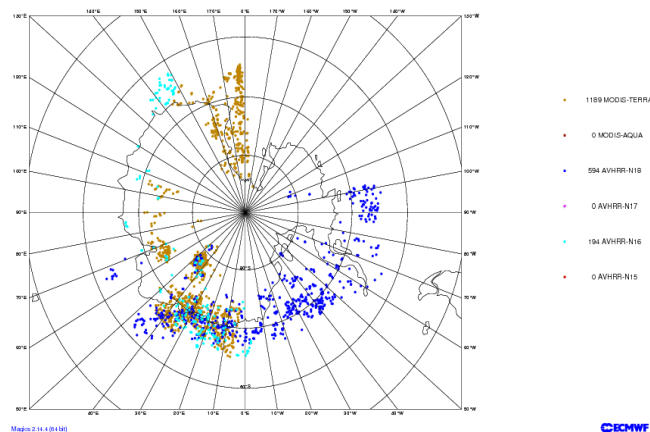05/Feb/2014; 00 UTC
Total number of obs = 152271

✓**For best results, NWP models require information on both the mass field and the wind field.**

✓**AMVs are the only observation type to provide good coverage of upper tropospheric wind data over oceans and at high latitudes.**
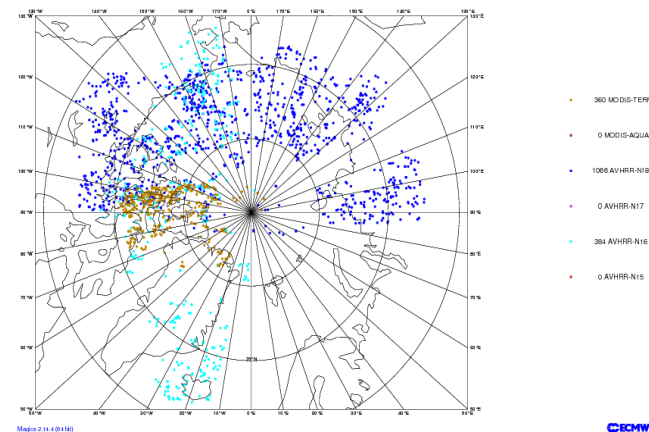
✓**Different AMV extraction schemes are used, no homogeneous product**

✓ **Polar winds are extracted, but it remains a lack of observations between 50 to 70 deg latitude**

ECMWF Data Coverage (All obs DA) - AMV POLAR IR
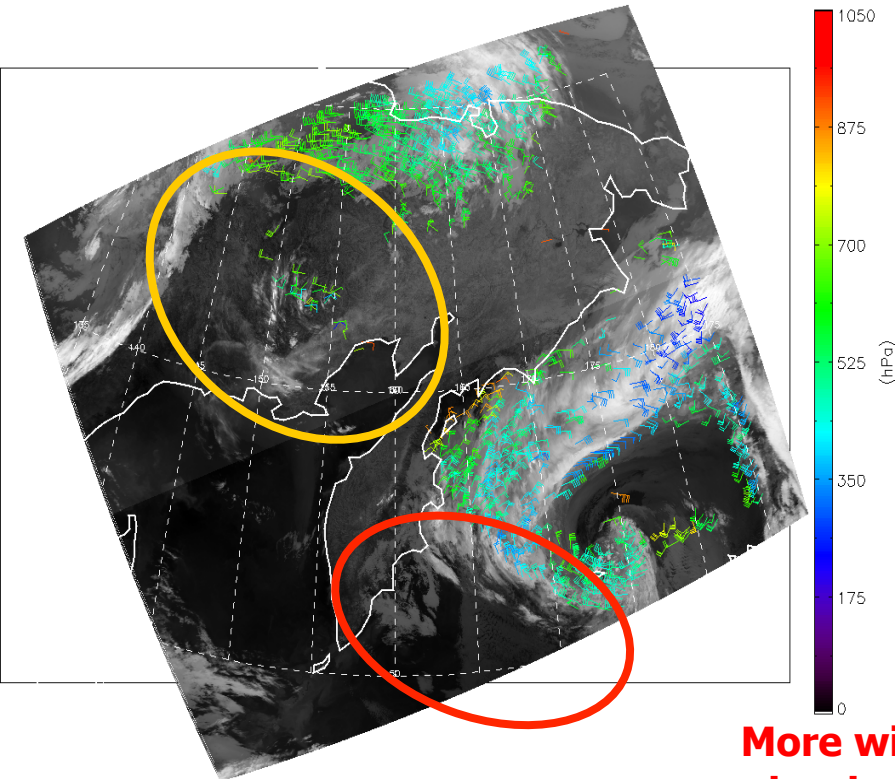05/Feb/2014; 00 UTC
Total number of obs = 1977

ECMWF Data Coverage (All obs DA) - AMV POLAR IR
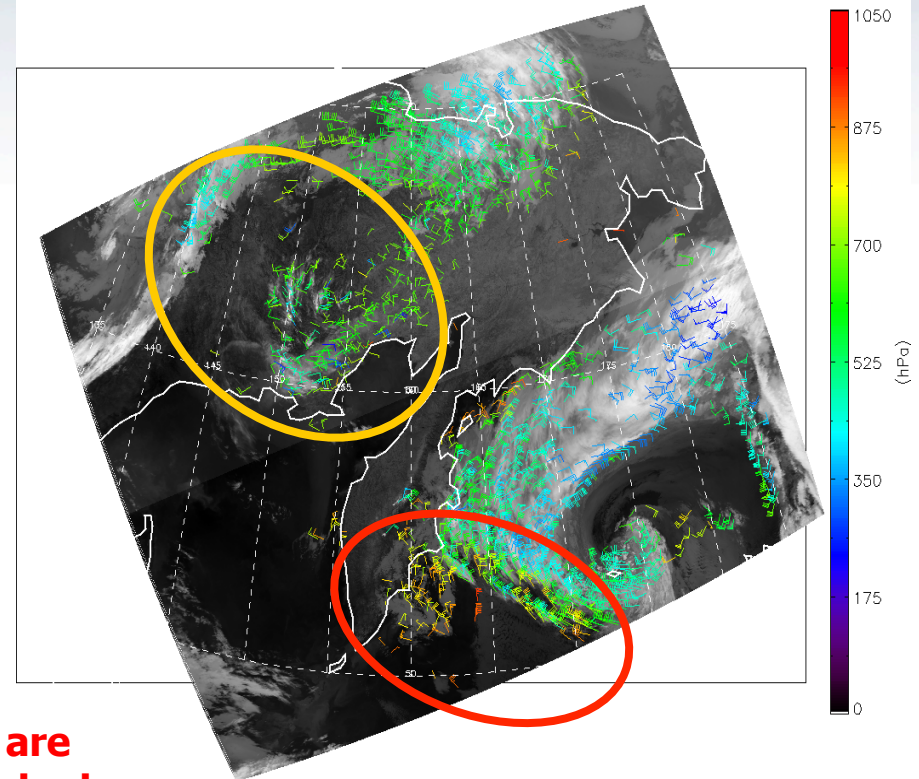05/Feb/2014; 00 UTC
Total number of obs = 1810

EUMETSAT

EUMETSAT AVHRR/Metop winds
Increase the coverage on Polar Regions & Reduce the temporal gap

Single Metop; all winds
(~100 min gap)

More winds are extracted by dual Metop algo.

Dual Metop; all winds
(~50 min gap)

EUMETSAT

EUMETSAT AVHRR/Metop winds
Comparison single vs dual over South Pole, 22 Jan – 5 Feb 2014
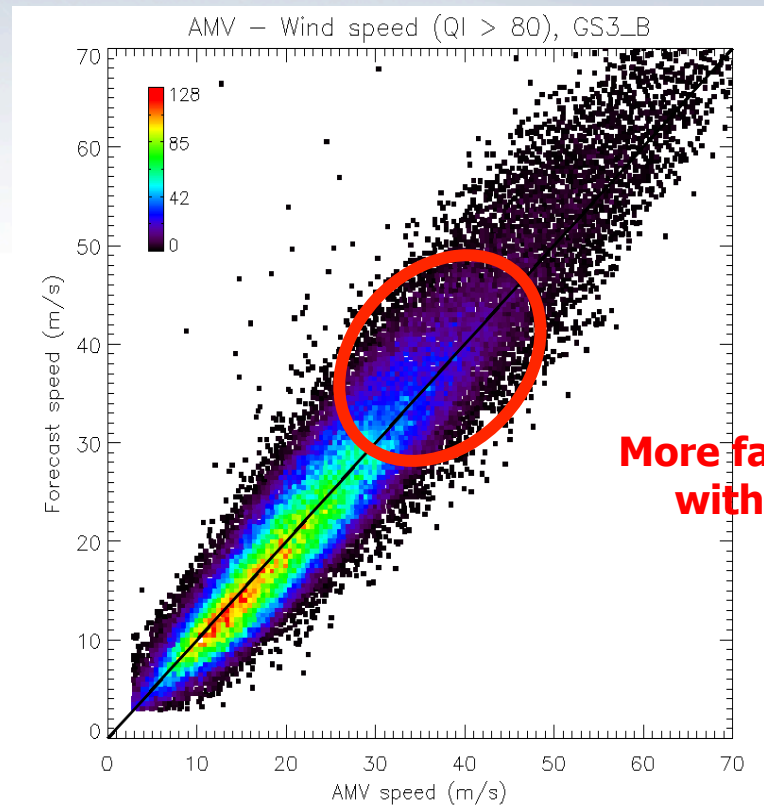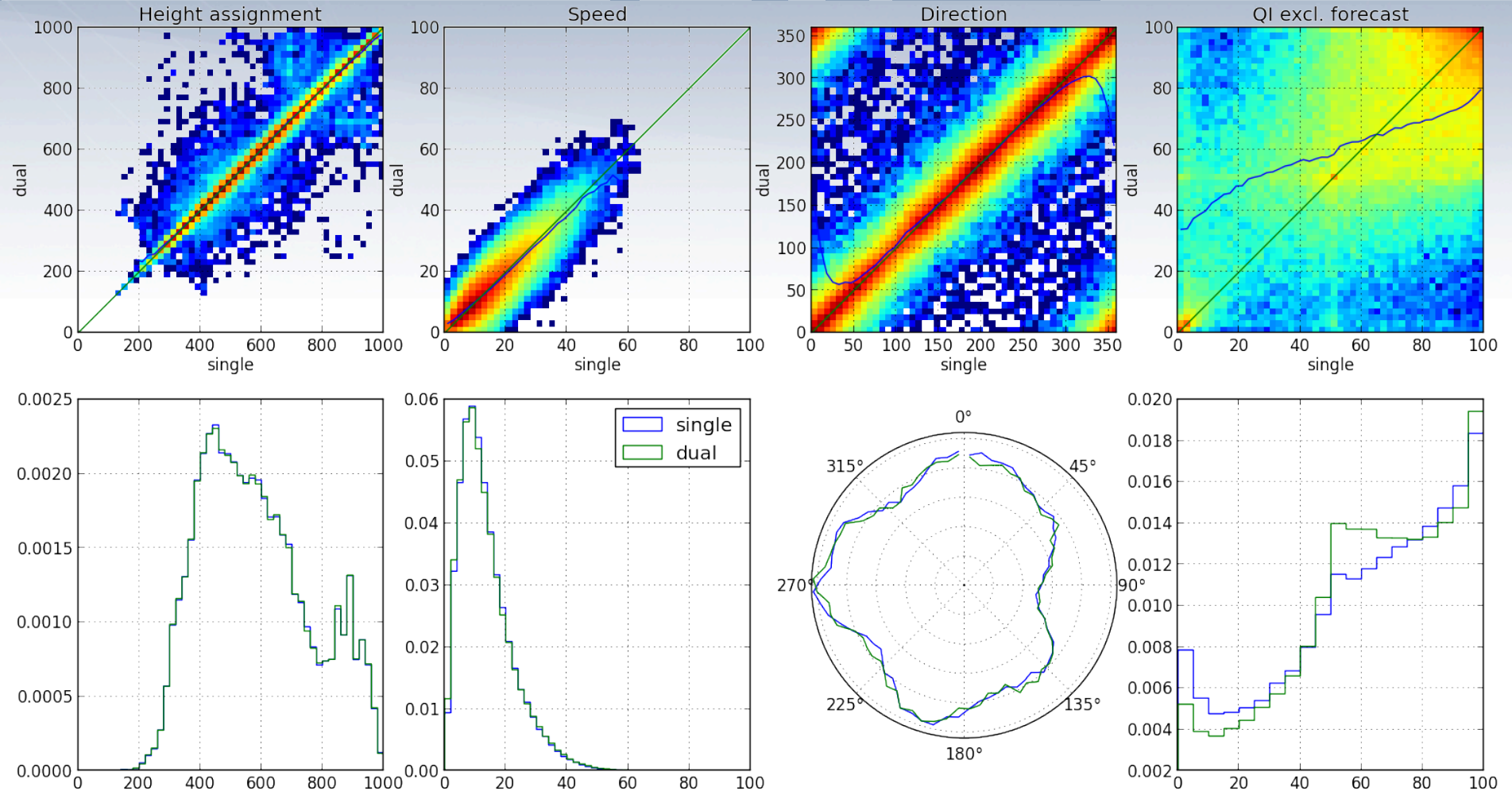

Single Metop; QI>80
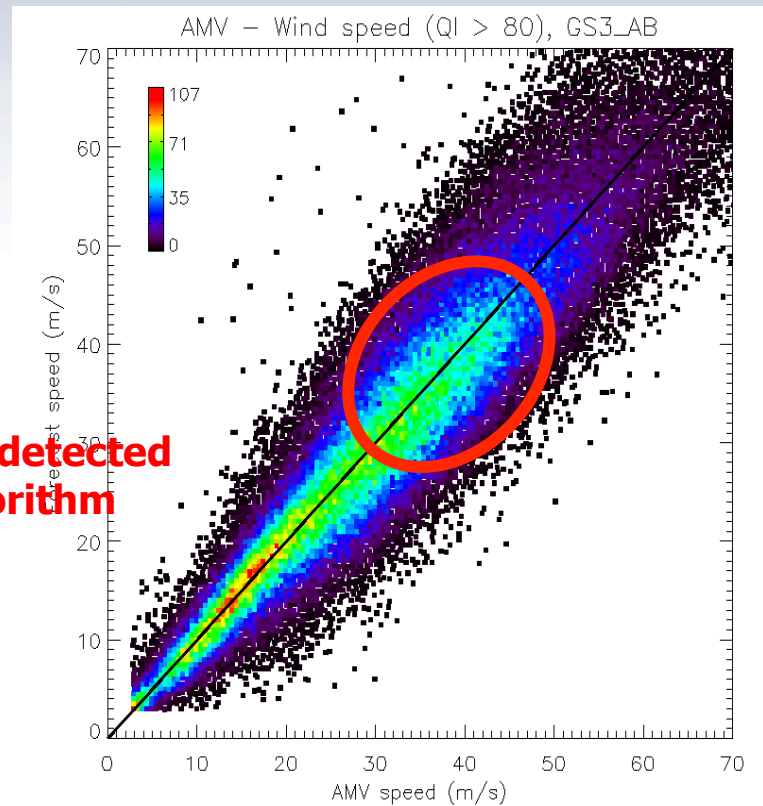
Dual Metop; QI>80

More fast winds detected with dual algorithm

EUMETSAT

EUMETSAT single vs. dual Metop winds
Collocated AMVs (version 2.4)

Collocated single and dual AMVs M01 on 20140525
Filter = QIx >0

EUMETSAT

EUMETSAT single vs. dual Metop winds
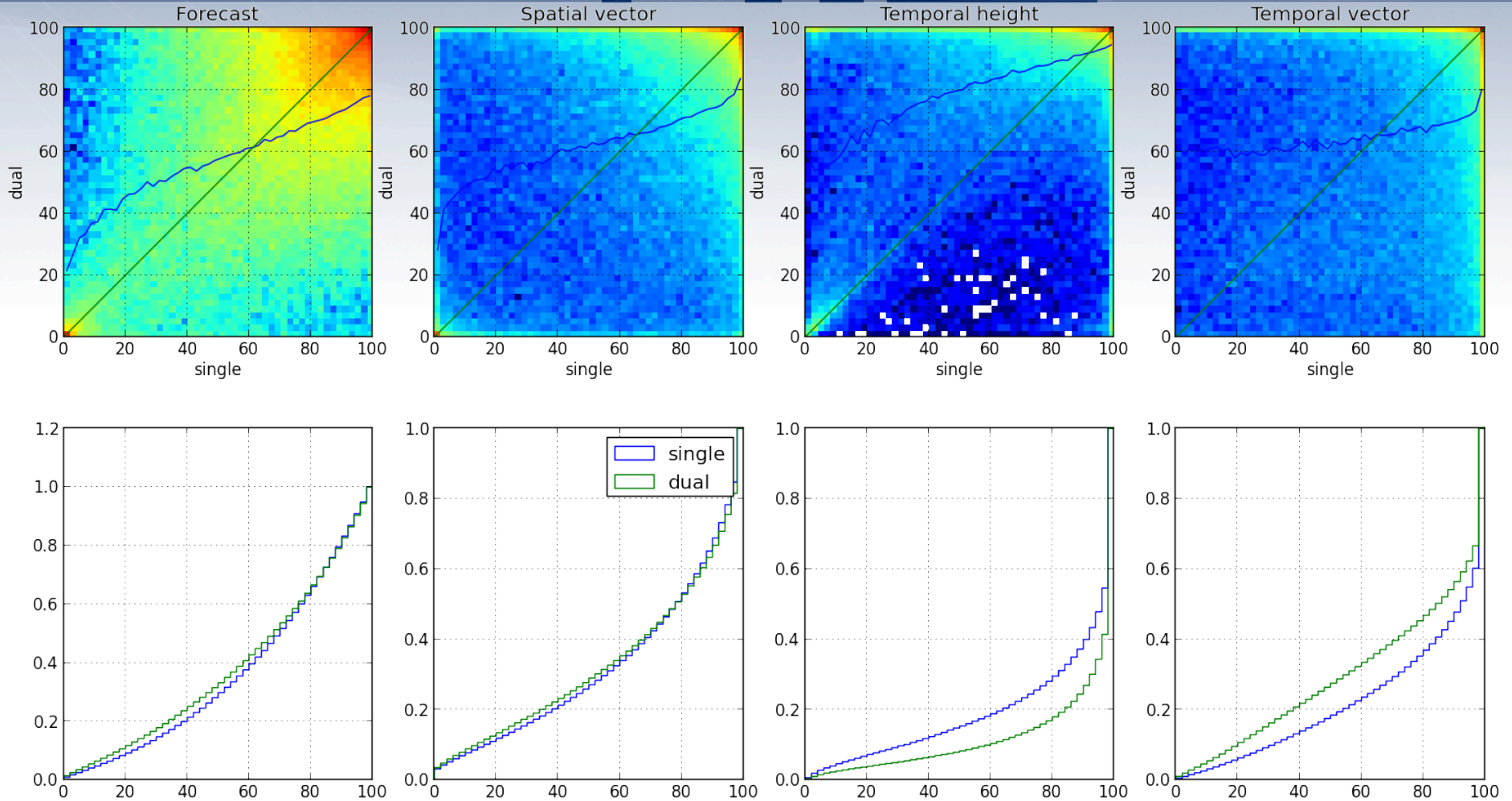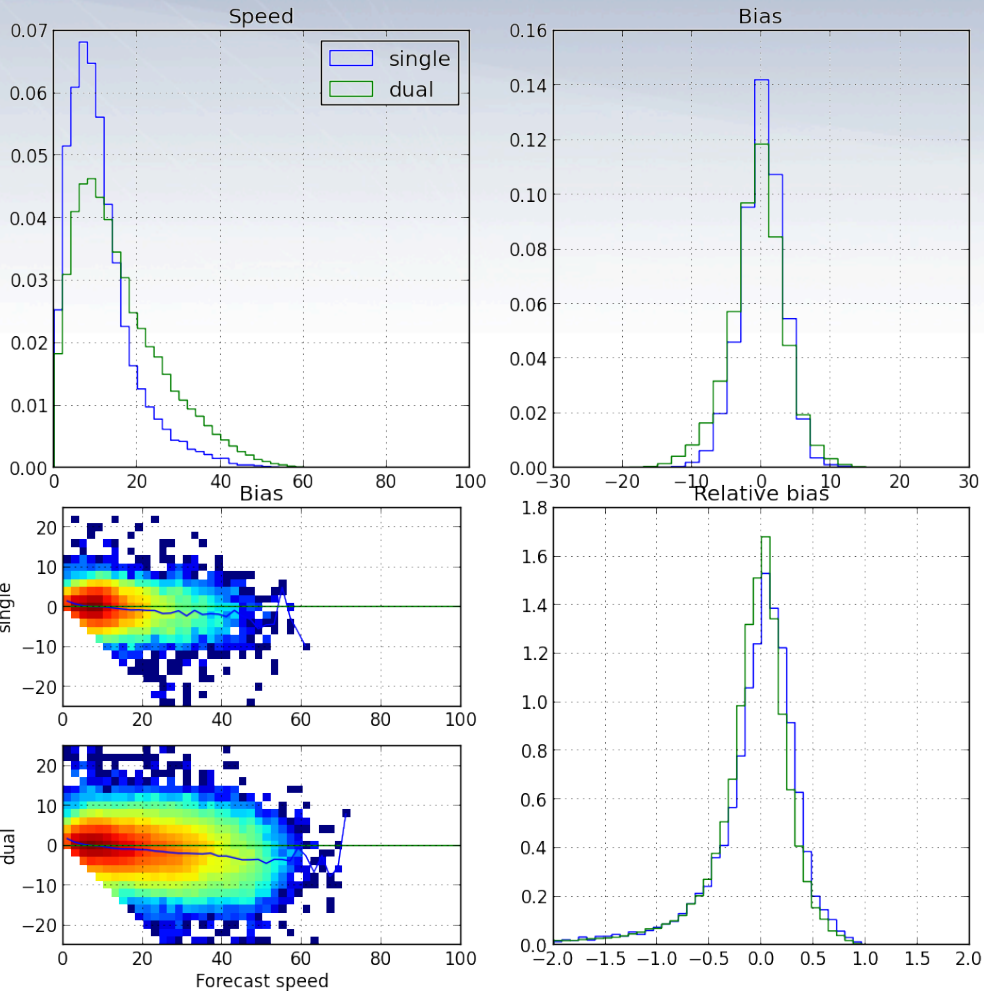## Collocated AMVs (version 2.4)

Collocated single and dual AMVs M01 on 20140525
Filter = QIx >0

EUMETSAT

EUMETSAT single vs. dual Metop winds
Collocated AMVs (version 2.4)

AMV count	Single	Dual
Single	19526	146580
Dual	146580	90416

- **Comparison based on the same set of PDUs processed:**
  - **166106** *single* **winds**
  - **236996** *dual* **winds**
  - ➢ **Count +40%**

- **Possibility too track faster winds**

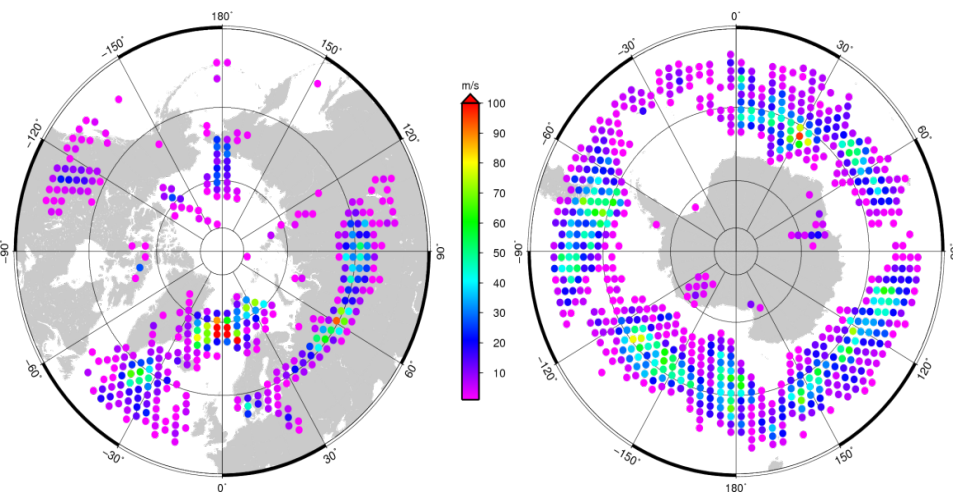**EUMETSAT**

EUMETSAT AVHRR/Metop winds
Better detection of Polar jets

The fast winds extracted with dual Metop algorithm are located in the polar jets.
They are also extracted at lower latitudes

AVHR_AMV_02_20140325
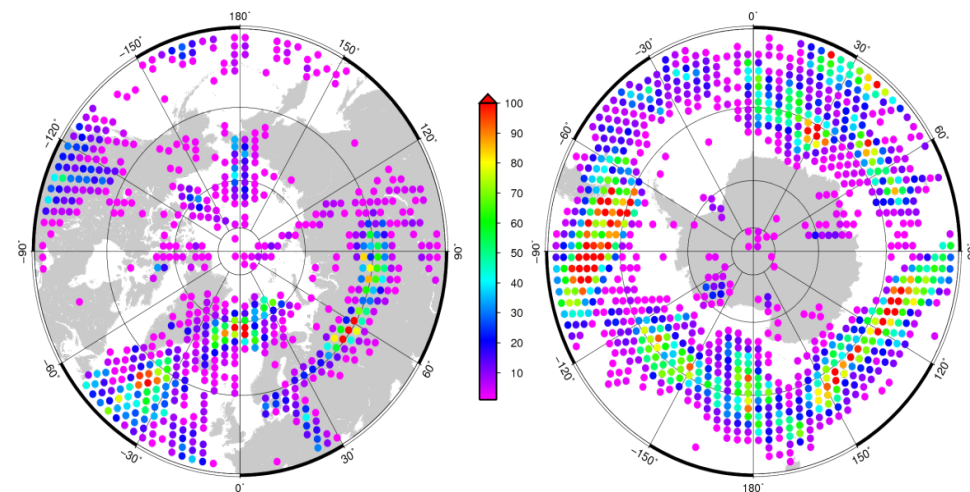*platforms M01 and M02*
Number of AMvs
(speed>30) and (QI > 60)

AVHR_AMV_2D_20140325
platforms M01 and M02
Number of AMVs
(speed > 30 m/s) and (QI > 60)

Single Metop; QI>60
Speed > 30 m/s

Dual Metop; QI>60
Speed > 30 m/s

EUMETSAT

EUMETSAT dual Metop winds
Summary

✓ Global coverage homogeneous product, allow comparison against geo AMVs

✓ Validation study (external study, TROPOS, Leipzig) based on test data (v2.3)
  - ✓ Comparisons against geo AMVs (GOES, Meteosat and MTSAT), MODIS winds and MISR winds

✓ Larger coverage over polar areas, reduction of the temporal gap

✓ Help to filling the 50-70 deg latitude gap, better detection of polar jets

✓ Operationally processed on Eumetsat ground segment (v2.4 since end of May)
  - ✓ Trial dissemination comming soon

EUMETSAT

One month of data over Polar Regions

AVHR_AMV_2D May 2014

platforms M01 and M02

Wind speed
(QI > 60)

EUMETSAT
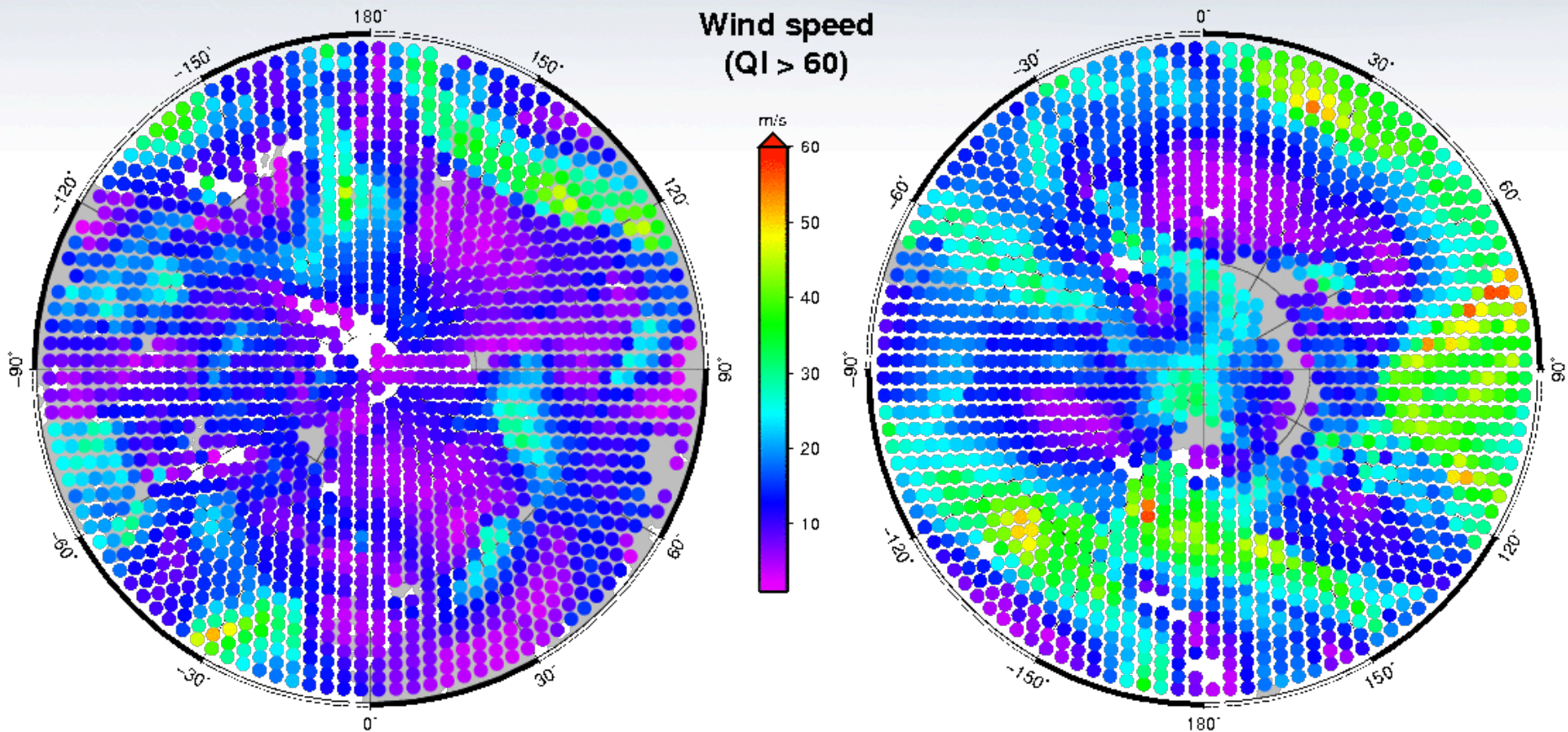
Coming next…

✓ Further validation / characterisation of actual products

✓ Version 3

  ➢ Projection of all data on a grid

    ➢ All pixels same size

    ➢ Allows to track features outside of the reference image

  ➢ Review of the tracking algorithm

  ➢ Reconsider how to use IASI data

  ➢ Revise the quality assessment process

  ➢ Introduce the triplet mode

➢ New BUFR wind sequence

EUMETSAT

THANKS

Olivier.Hautecoeur@eumetsat.int
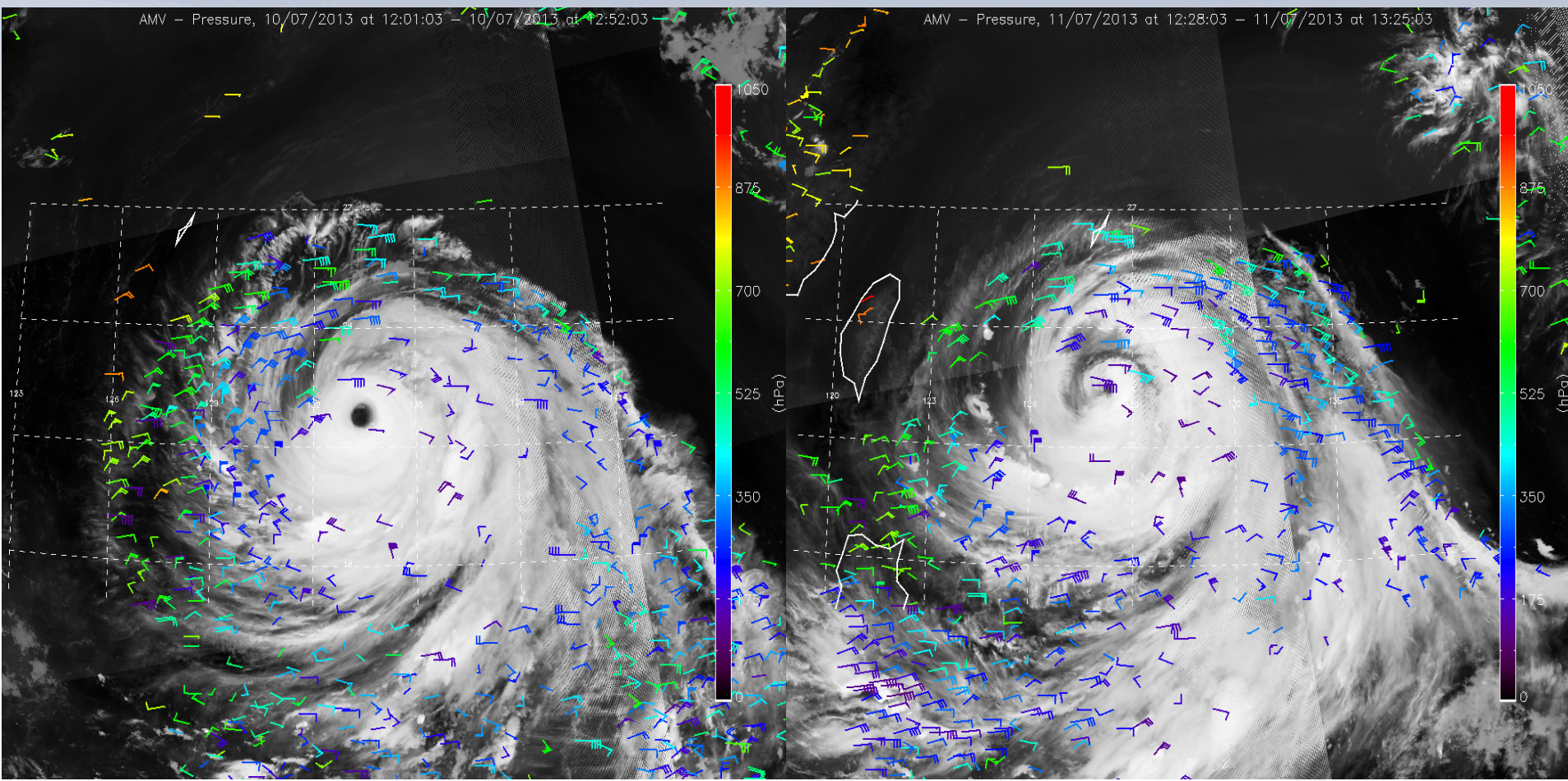
Dual Metop, Typhoon Soulik/Huaning over the Pacific, 10th and 11th July 2013

EUMETSAT