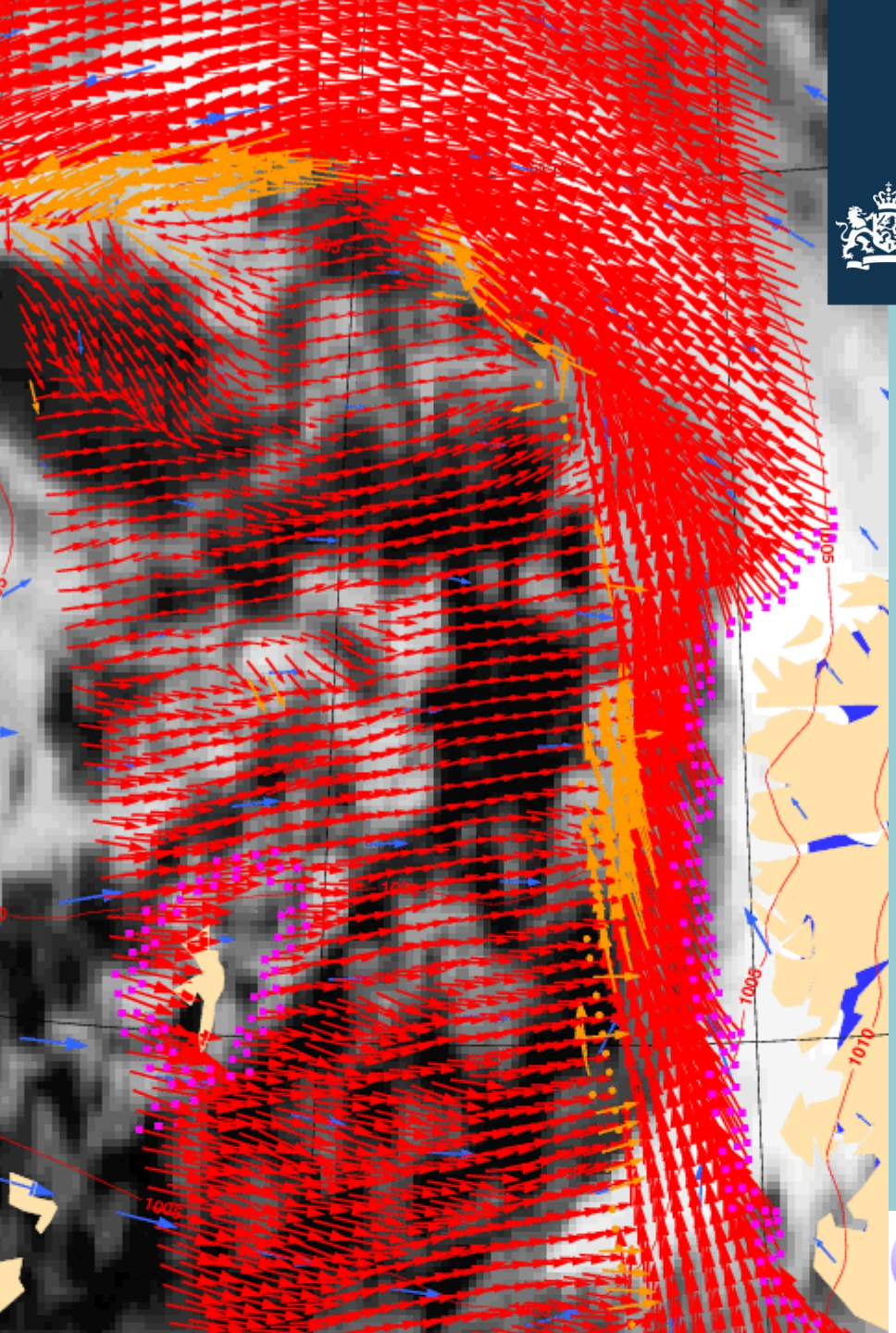


Royal Netherlands Meteorological Institute
Ministry of Infrastructure and the Environment

European Commission

Tandem ASCAT winds and climatologies

Ad Stoffelen

Anton Verhoef, Jeroen Verspeek, Jur Vogelzang, Tilly Driesenaar, Gerd-Jan van Zadelhoff, Marcos Portabella, Wenming Lin

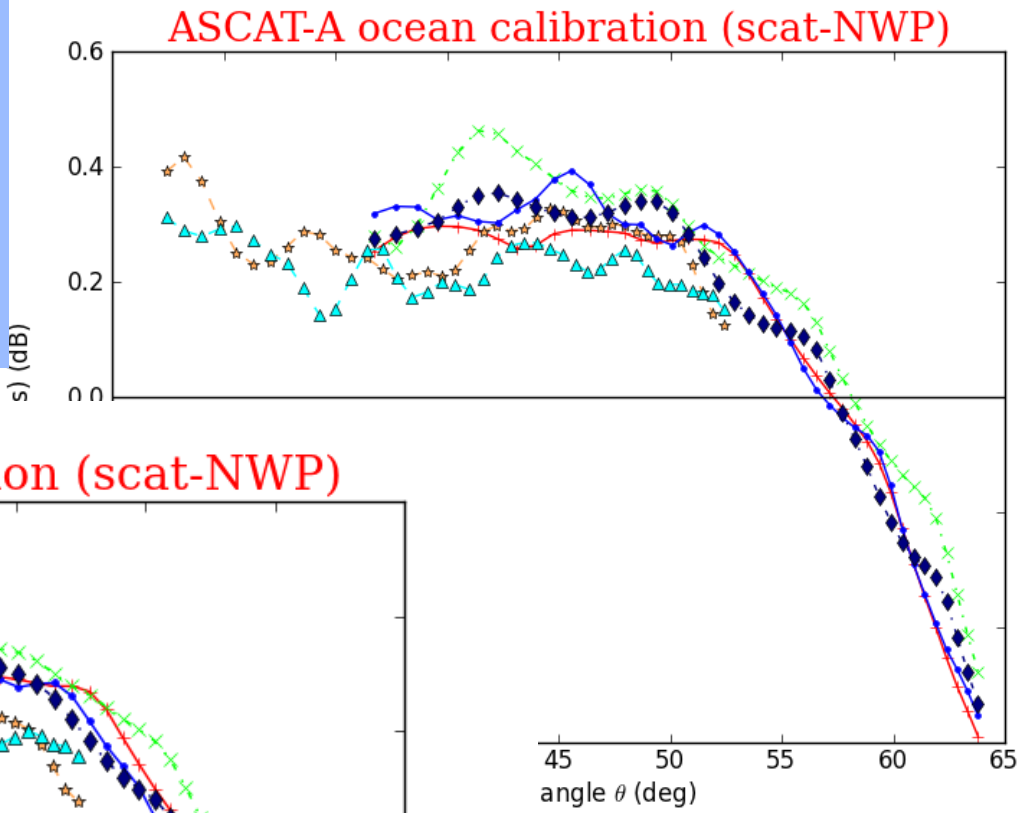
KNMI Scatterometer Team

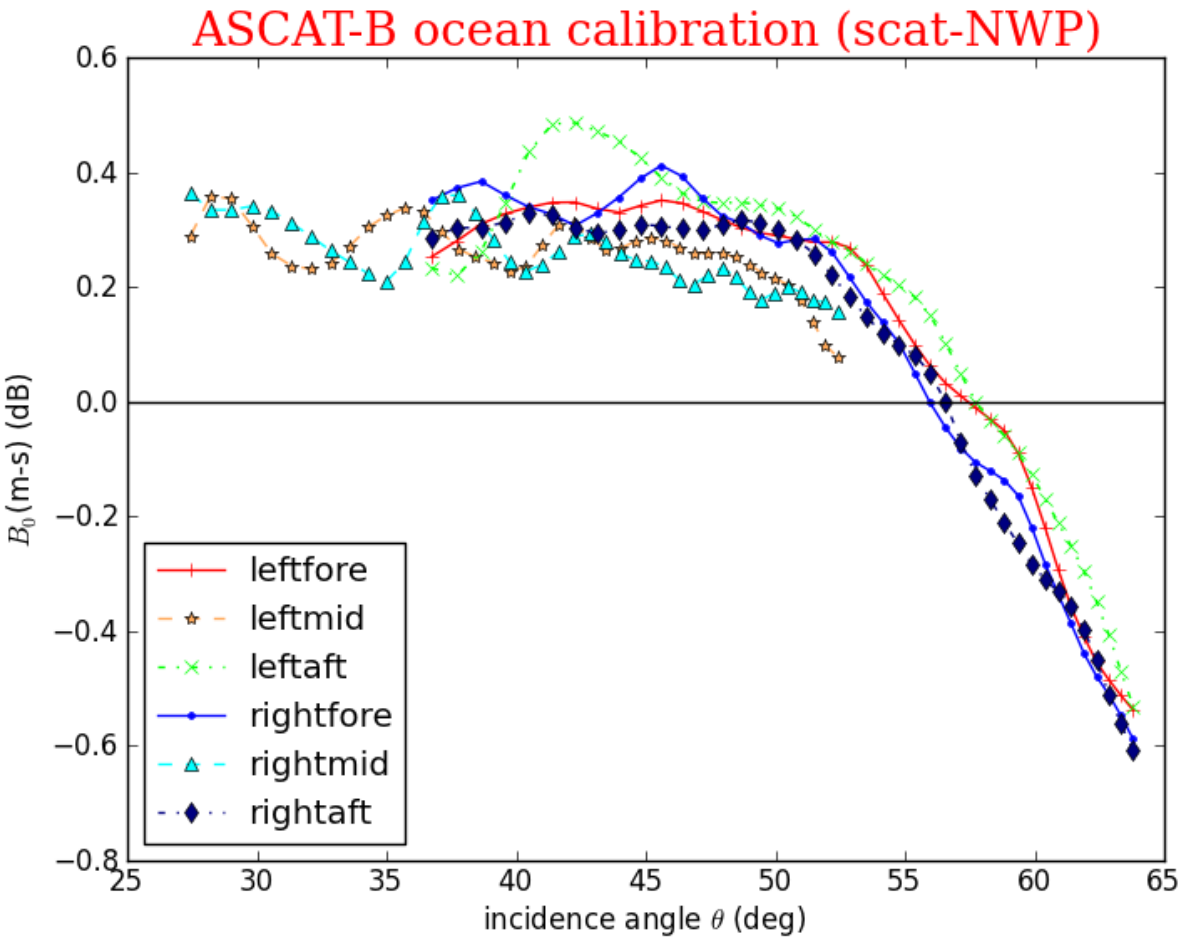
EUMETSAT OSI SAF, NWP SAF, EU MyOcean, EU NORSEWInD

NWP SAF
Numerical Weather Prediction

OSI SAF
Ocean and Sea Ice

NWP Ocean Calibration A versus B

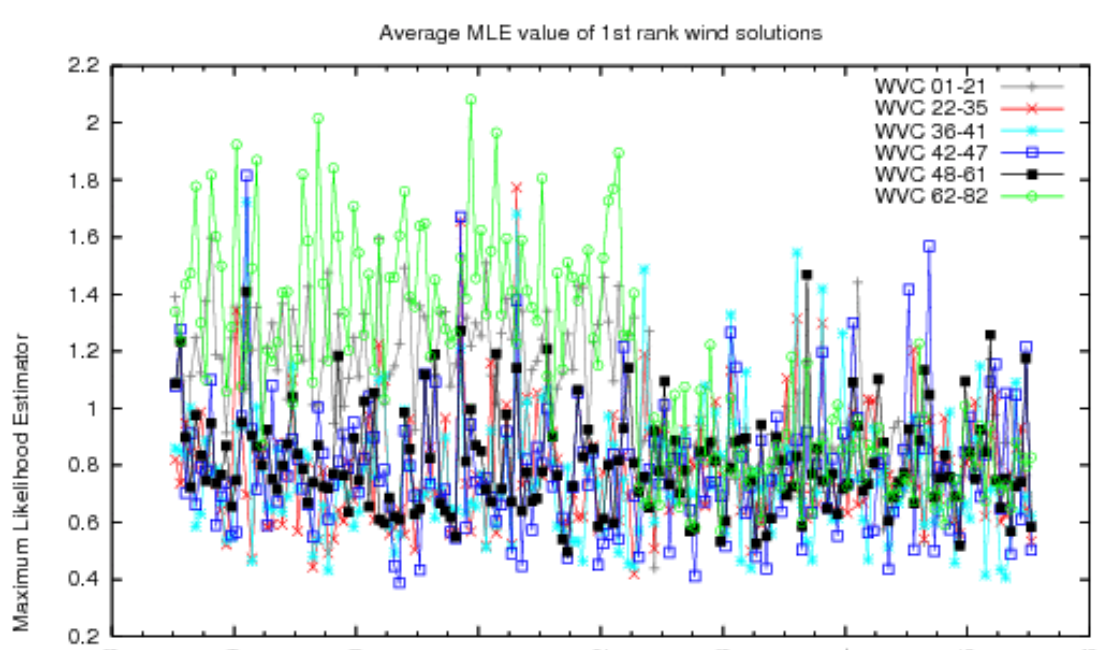


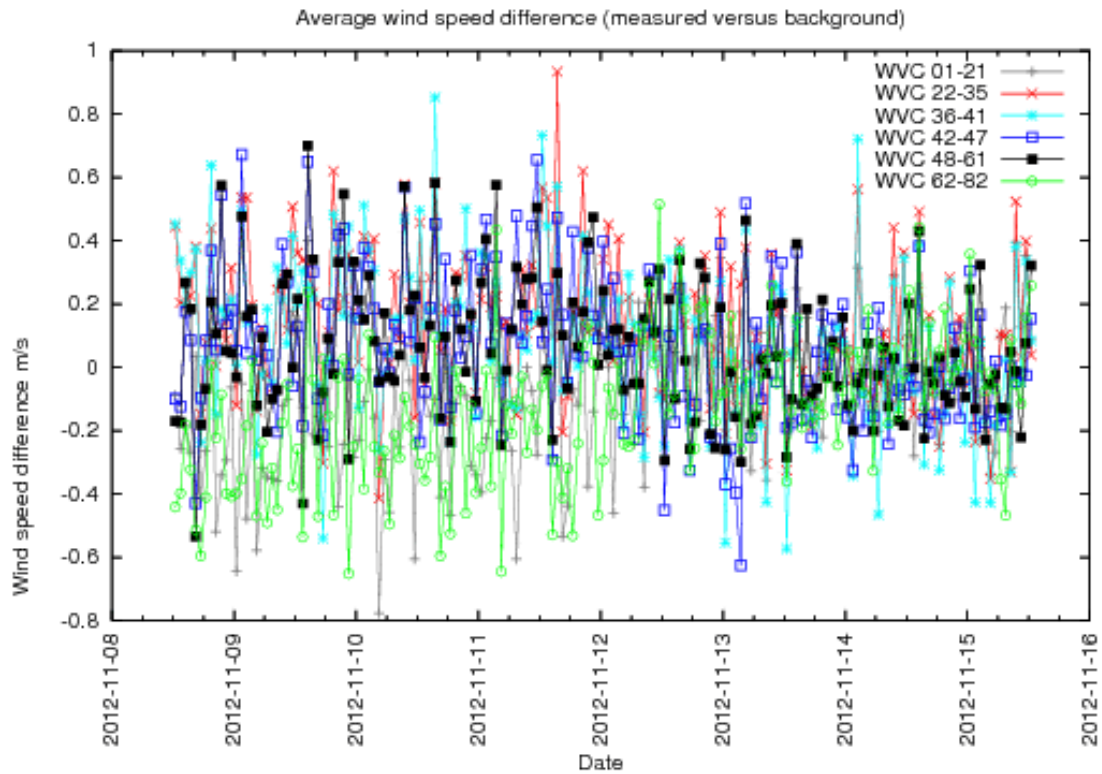


- Similar biases
- Similar general θ dependence
- Similar wiggles by beam

➢ After NOC-A and NOC-B correction all differences for ASCAT-A and B are in a band of 0.2 dB

AWDP-B





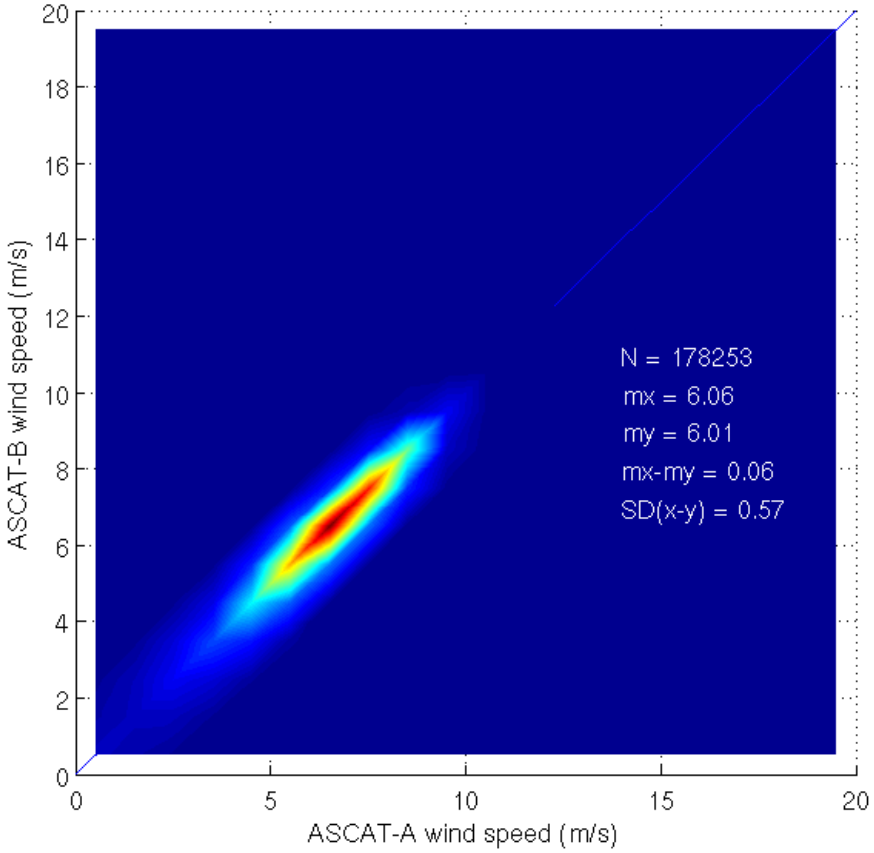
www.knmi.nl/scatterometer

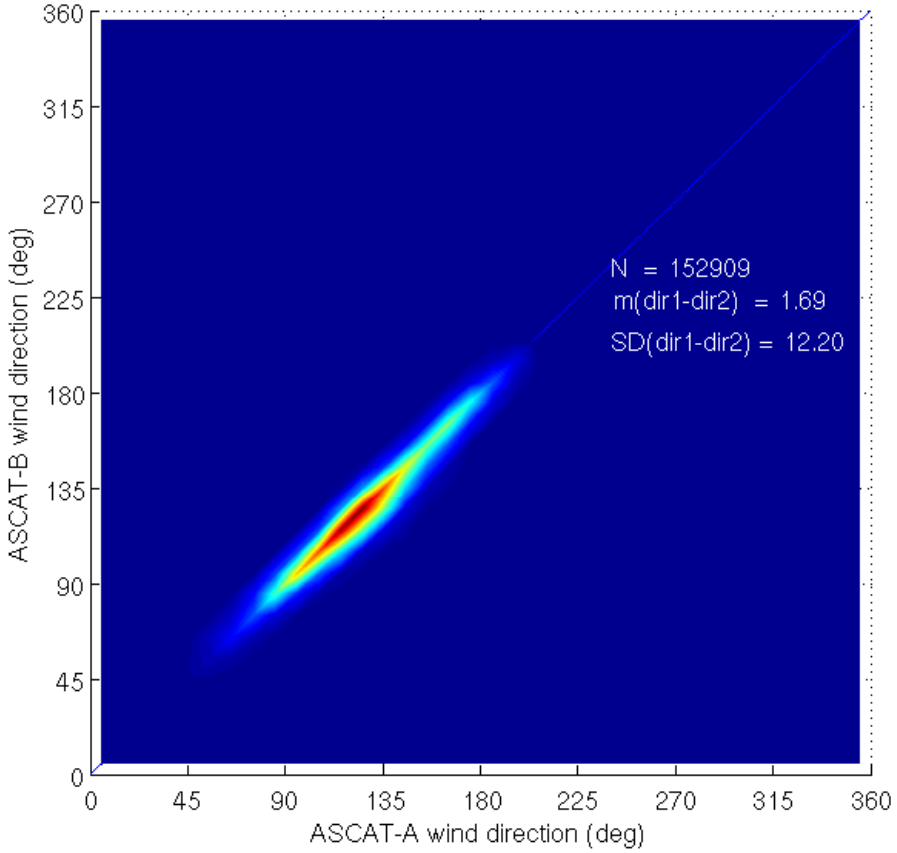
- AWDP-B on 12/11/'12
- AWDP-B for MetOp-B very similar to AWDP-A for MetOp-A
- AWDP without correction for ASCAT-B shows enhanced MLE residual and speed bias

➢ NOC provides improved cone positions and more uniform quality winds

A versus B

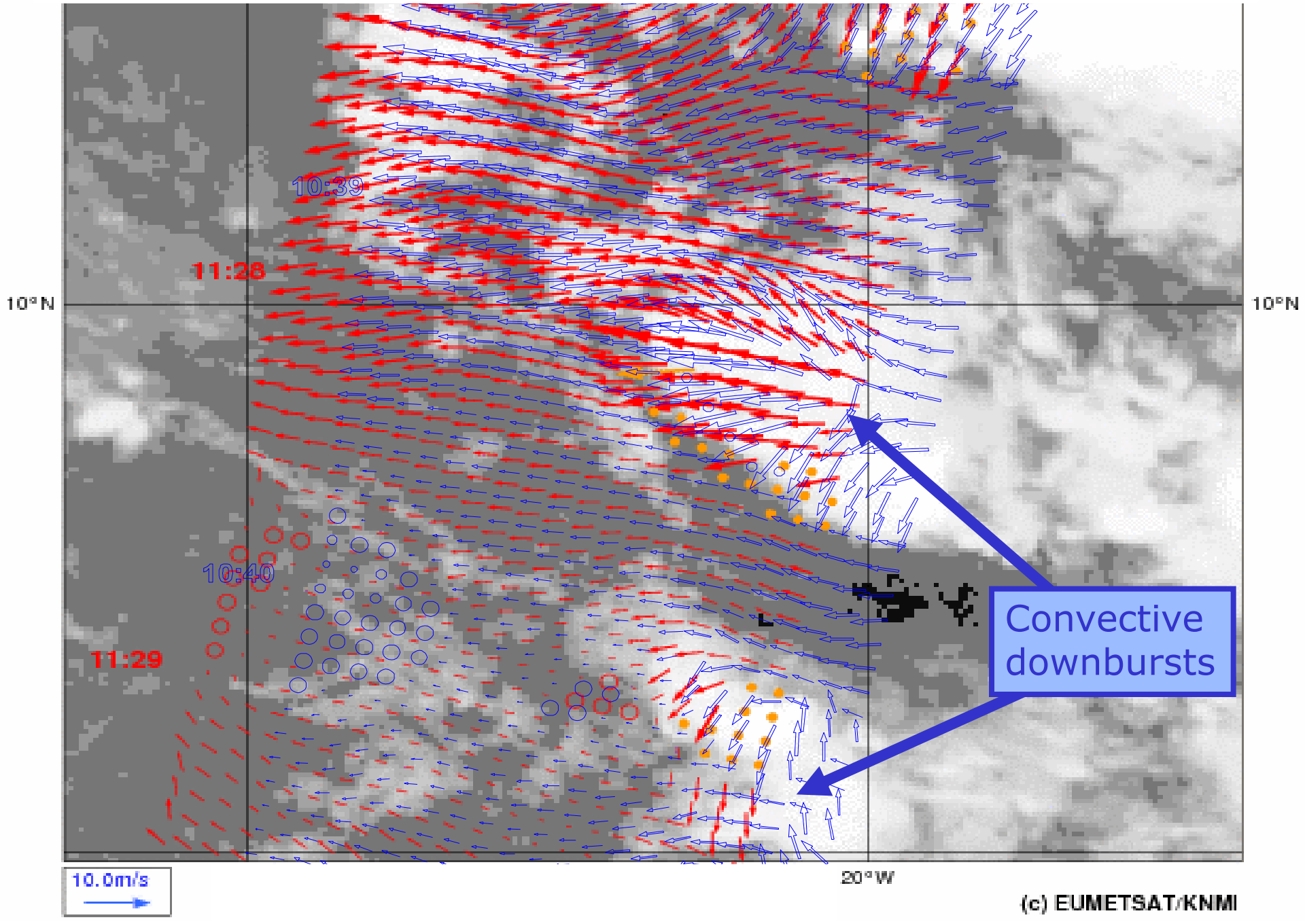
Comparison of ASCAT A/B winds over Atlantic tropical ocean





PDF of ASCAT A/B collocations for wind speed (left panel) and wind direction (right panel) respectively. Low latitude, i.e., -10°<lat<10°

ASCAT-A and ASCAT-B come together



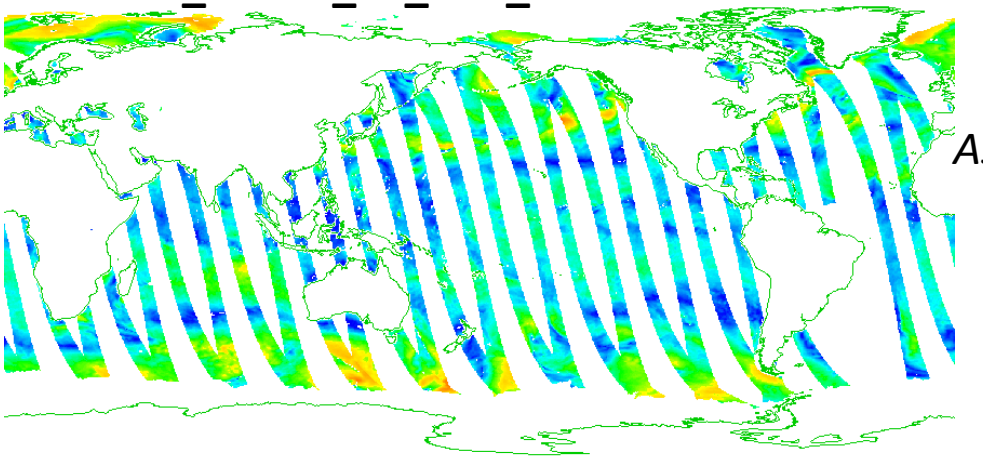
Summary on B

- Very grateful for ASCAT-B
- AWDP-B switched on and made available soon after commissiong
- NWP Ocean Calibration helps (as for A)
- Verification against ECMWF, buoys, and flags and MLE statistics very similar indeed to AWDP-A for ASCAT-A
- 25-minute orbital separation would deliver more tropical coverage

➢ Explore extended space and time coverage
➢ You may support more coverage

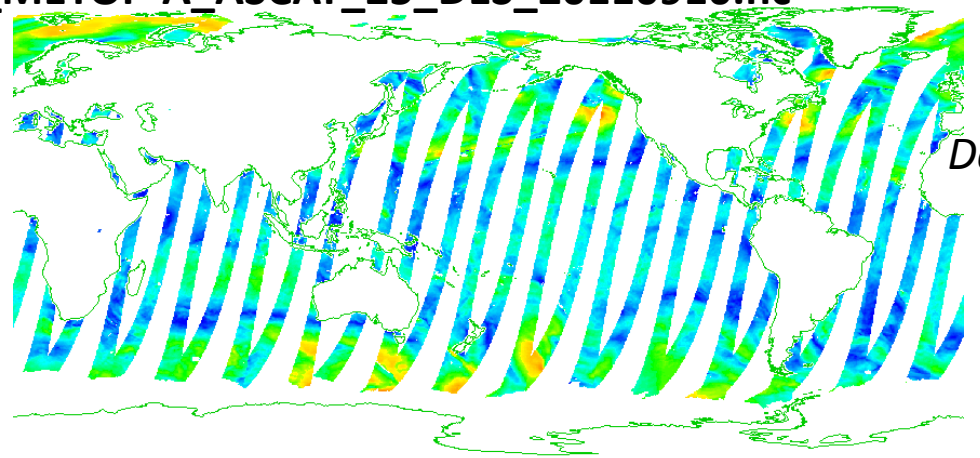
L3 Wind product example

GLO-WIND_L3-OBS_METOP-A_ASCAT_25_ASC_20110910.nc



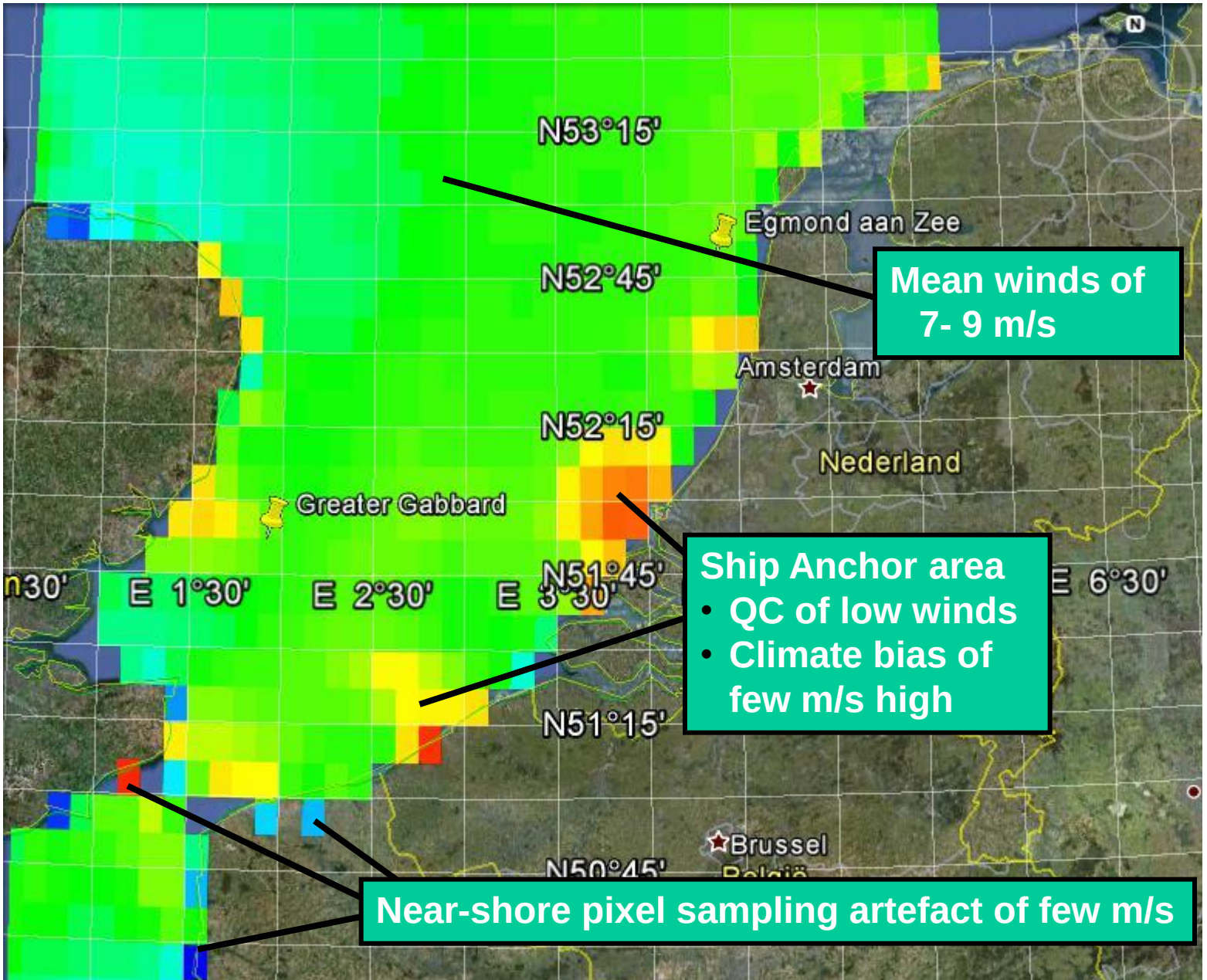
Ascending passes

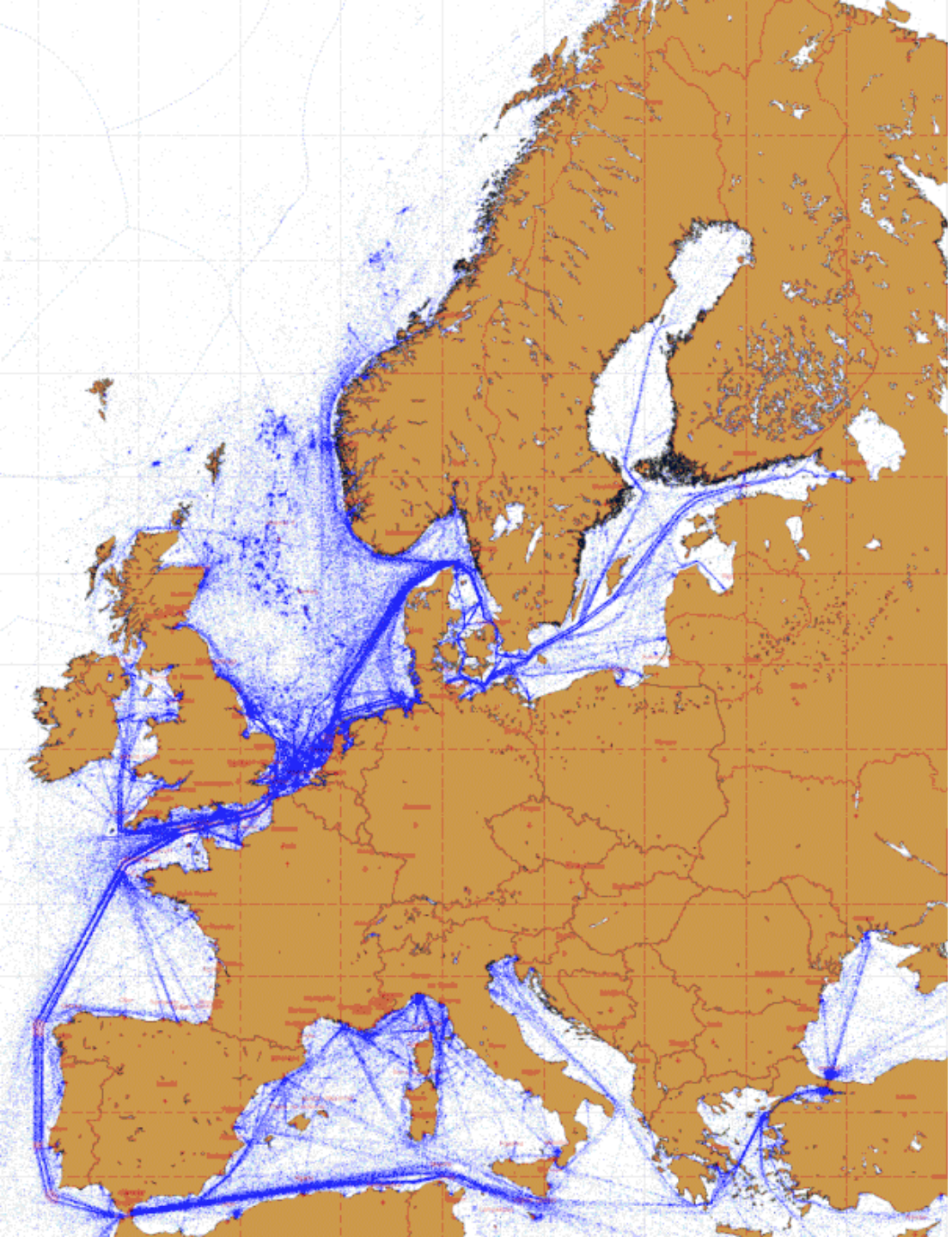
GLO-WIND_L3-OBS_METOP-A_ASCAT_25_DES_20110910.nc



Descending passes

Wind atlas based on ASCAT L3



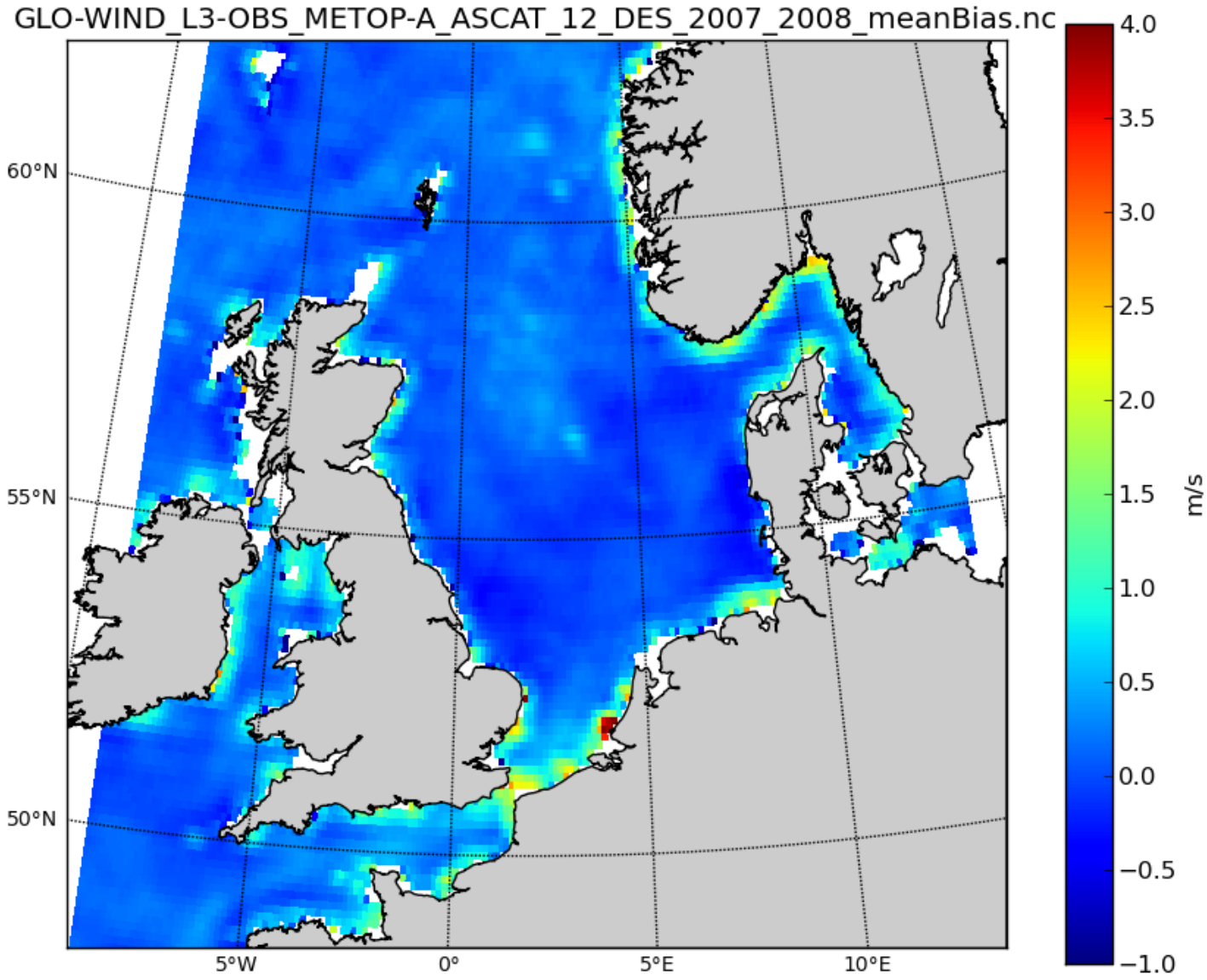


Ship traffic

- Rotterdam anchorage
- Shipping lanes appear in wind climate too at low winds
- As well as platforms

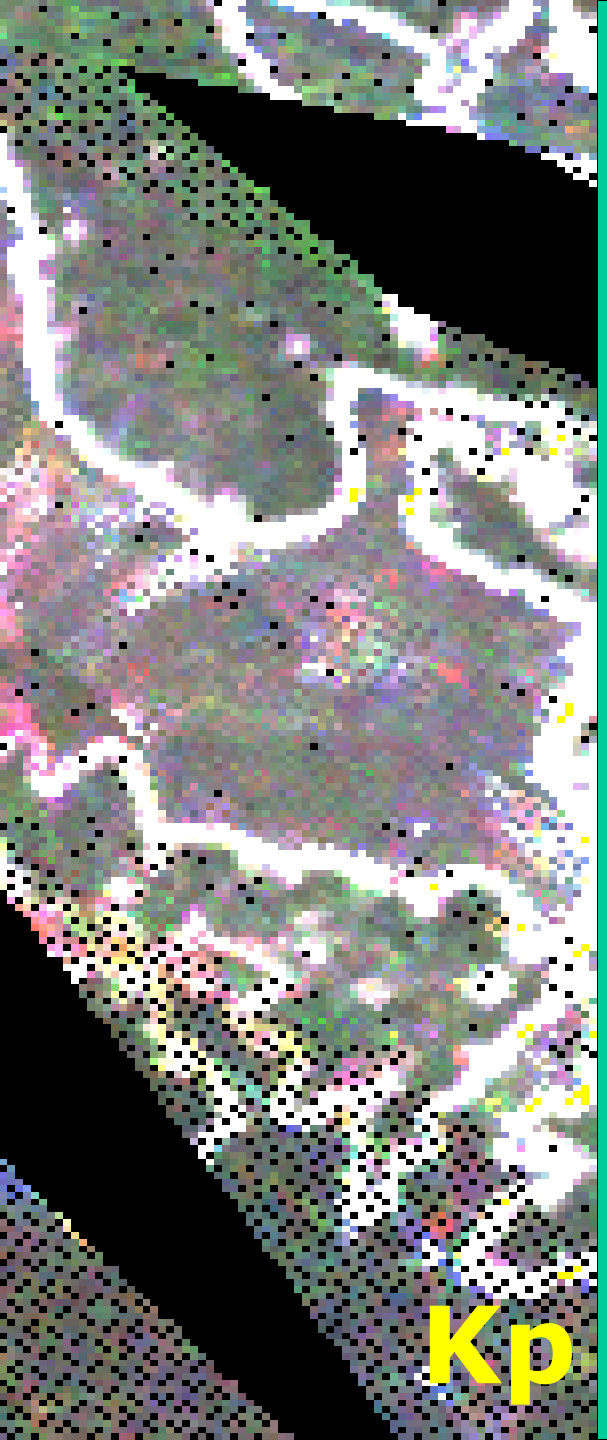
➢ R&D needed

Wind climate affected by structures



- Effect can be very large
- Unlikely only C band
- QC helps

➢ But full resolution needed



North Sea Kp

Structures near harbour and in Channel?

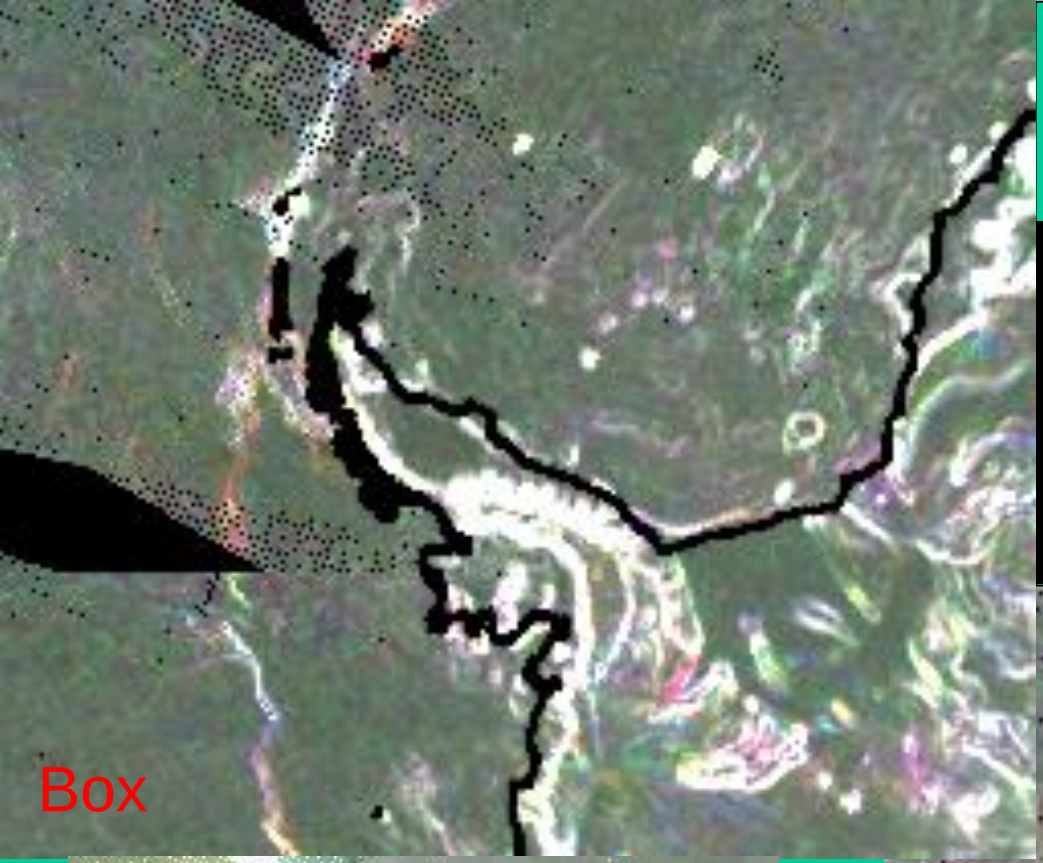
Cities over land clearly visible

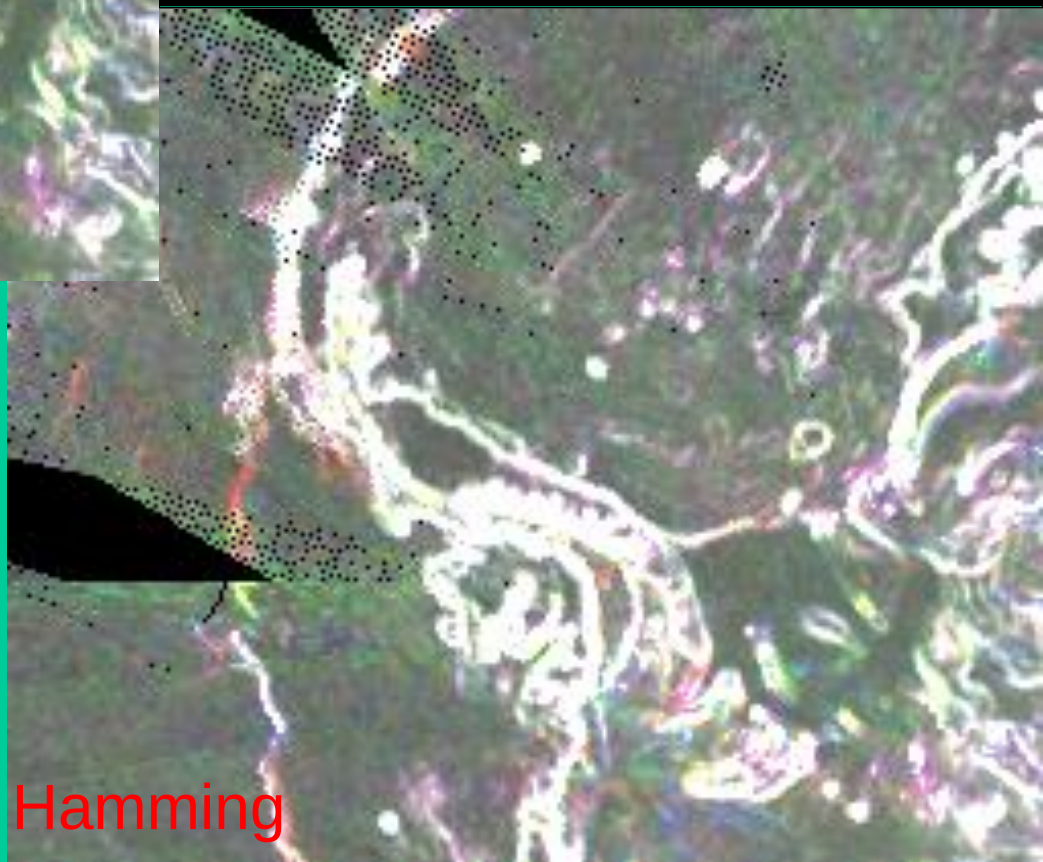
Summary

- MetOp-B operational
- Released AWDP-B
- Use full resolution product for 6.25-km product and QC: rain, structures at sea …
- Further exploit Kp, MLE
- L3 products will be extended
- Climate maps will account for sampling deficits due to QC (rain, structures at sea)
  - Replace by NWP
  - Reference to NWP

Kp “noise”

Sea ice edge
leads?
Ice bergs?





ASCAT plans

- Converge to one 25-km product and one coastal 12.5-km product for both ASCAT-A and ASCAT-B (merge EARS)
- 6.25-km product
- ASCAT-B (prime) production parallel to ASCAT-A
- Update coastal 12.5-km product to new EUMETSAT full resolution product and Kp formulation
- Validation of coastal product with SAR backscatter and Doppler (Marivi Tello)
- Investigate ASCAT performance in rain (Wenming LIN; Marcos Portabella, David Weissman)
- CMOD6; CMOD5na + MLE optimization (Gerd-Jan van Zadelhoff)
- Update visualization on web with overlapping earth-fixed frames
- ASCAT, (and QSCAT, ERS) reprocessing
- Extend ASCAT L3 to OSCAT and stress derivatives in EU MyOcean2
- Training
- EU MyWave, OWI
- ESA eSurge

Strengths / Limitations
Scatterometer / Passive

Excellent precision, mature algorithms, complete coverage

Small scales (25 km), order better than NWP

Since 1991 vector winds

Intercalibration, accuracy assessment speed scale

Calibration above 30 m/s (truth ?)

Rain (bias) for Ku band and passive systems

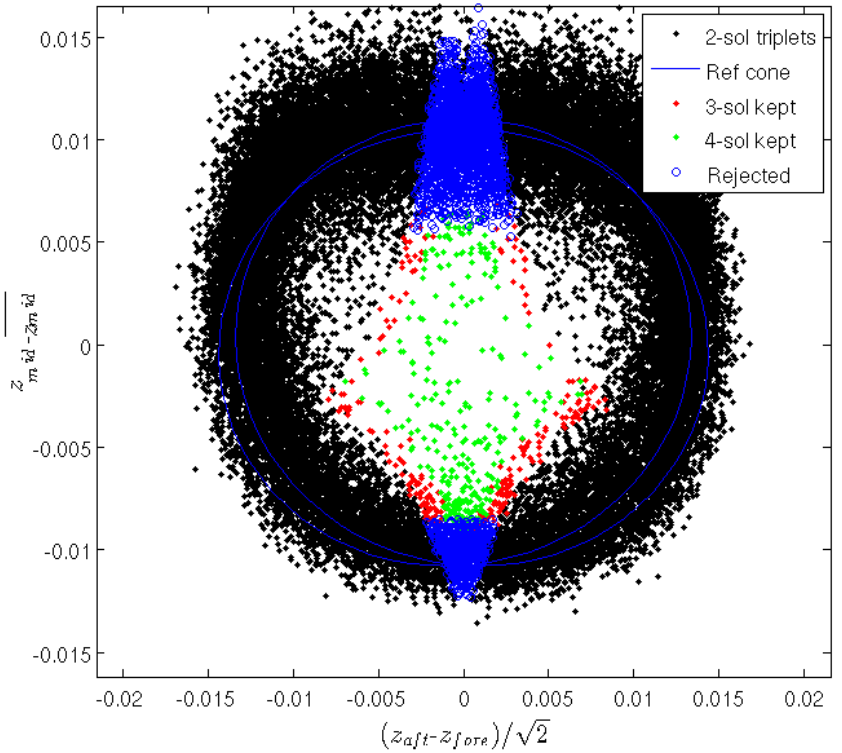
Temporal coverage does not match scales (yet)

Low spatial resolution (physical processes)

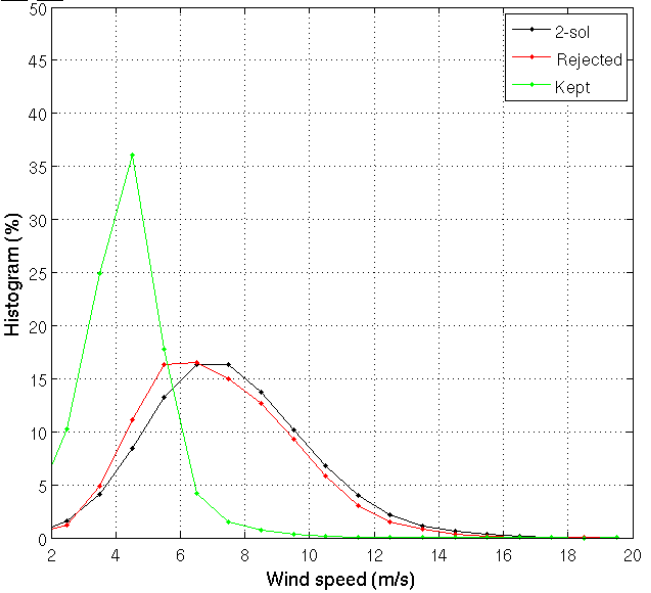
Ambiguous direction retrieval

Structures/signals at sea

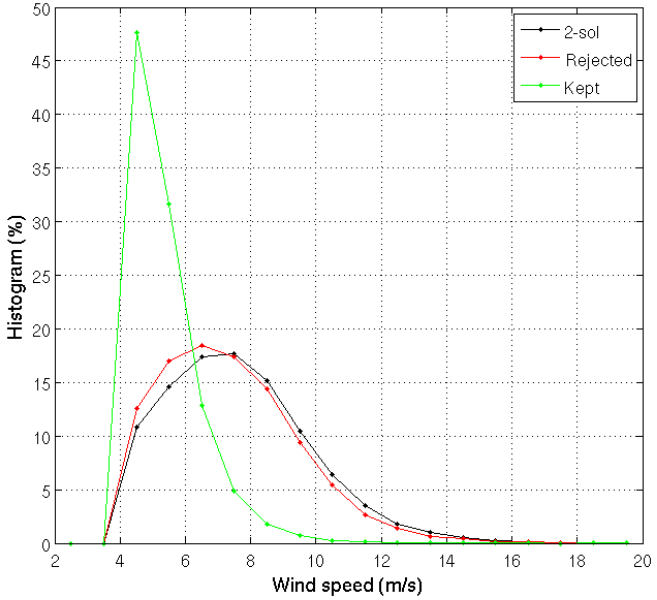
Spurious high-ranks outer swath



Intersection of the cone for an outer swath WVC, corresponding approximately to a speed of 6 m/s



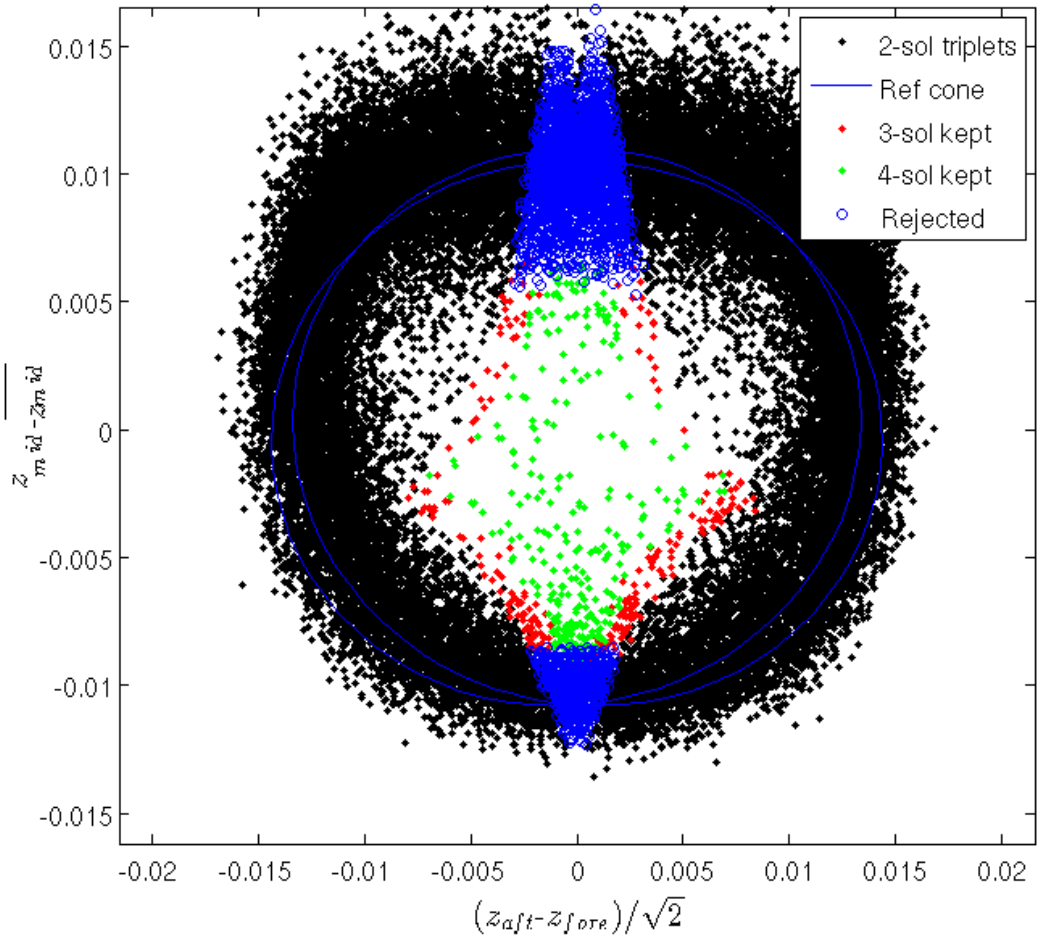
Wind speed histogram, ***ASCAT*** *selected solutions*



Wind speed histogram, ***ECMWF***

Wenming Lin & Marcos Portabella

CMOD6

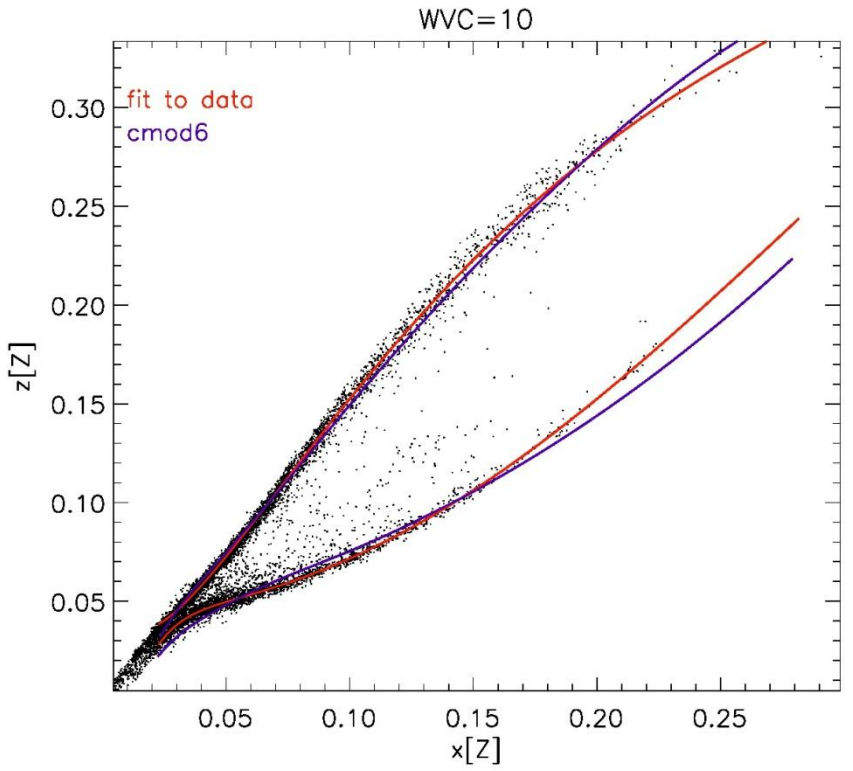


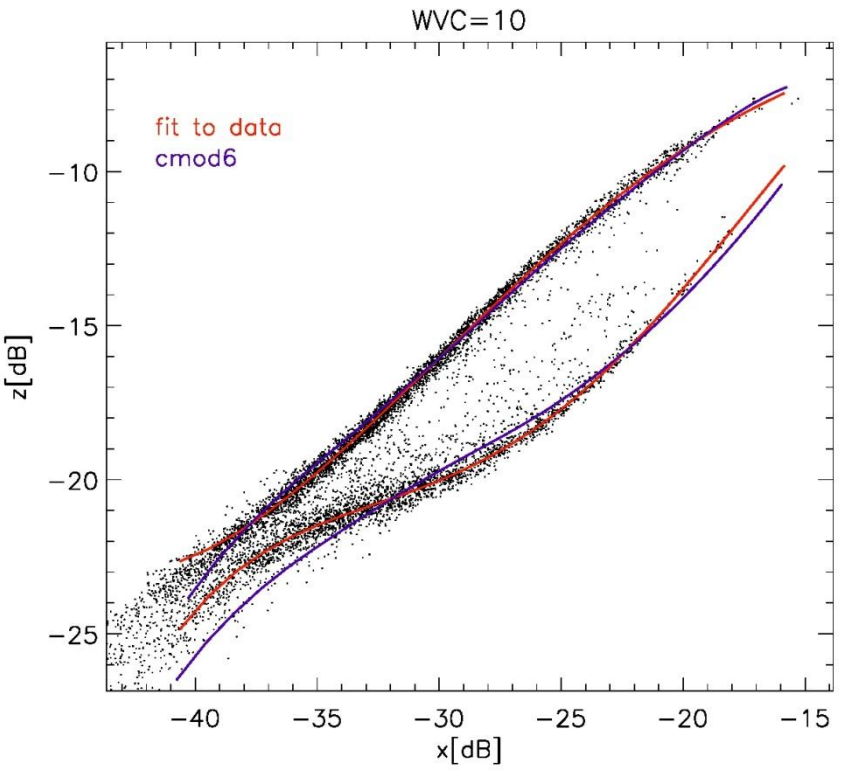
- Craig's diagnostic
- MLE
- Simulate cone based on known noise contributions

Improving the wind cone

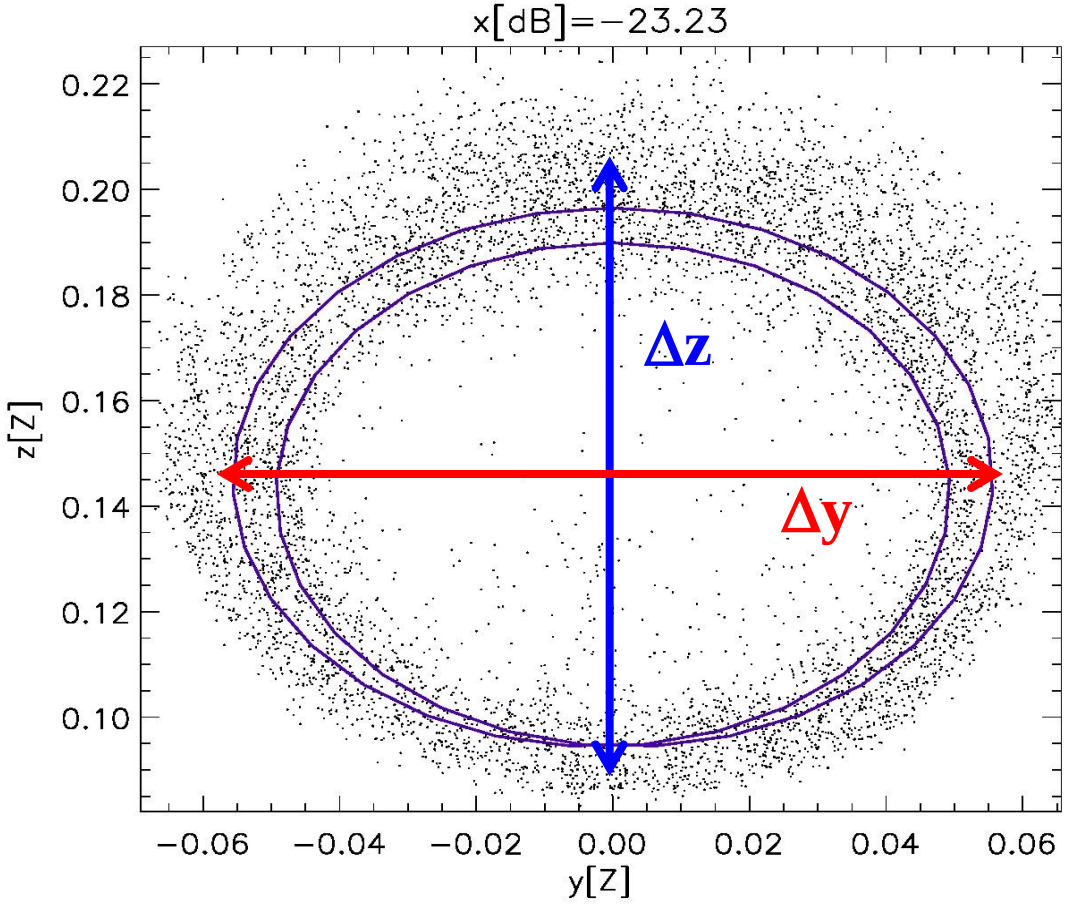
GJ van Zadelhoff, A Stoffelen, & C. Anderson

- cmod5.n/6 retrieve accurate winds speeds for nearly all winds
- Low wind speeds show the largest errors.
- 6 months of Atlantic ocean data from ASCAT are used to look into this issue.



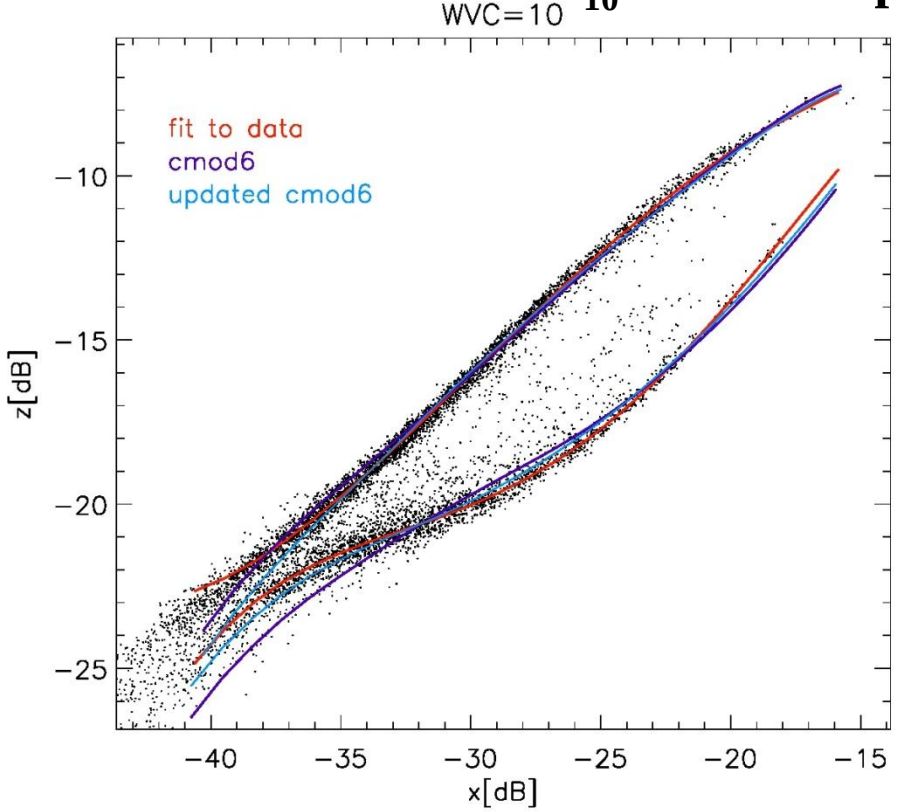


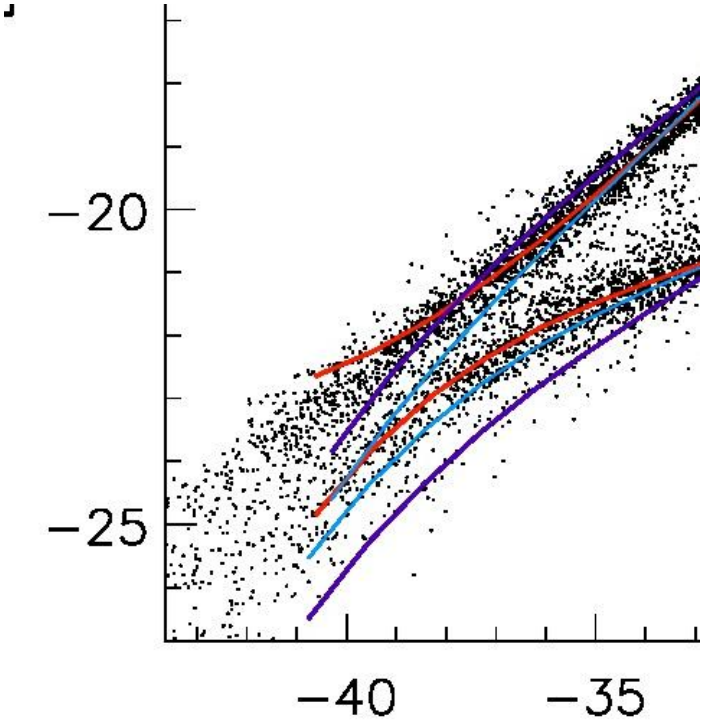
The problem is divided into a number of steps.
First the observed width in Δz(fore-cross) and Δy is compared to cmod6 in both incidence angle and x



$$x = \frac{s_{fwd}[Z] + s_{aft}[Z]}{\sqrt{2}}$$

- **Width of the cone improves, especially for small wind speeds**
- **The absolute value (Z) of the new cone for small x is still too small (work in progress)**
- **Wind speed and wind direction information has to be included to fix the measurements to u_{10} relationship.**

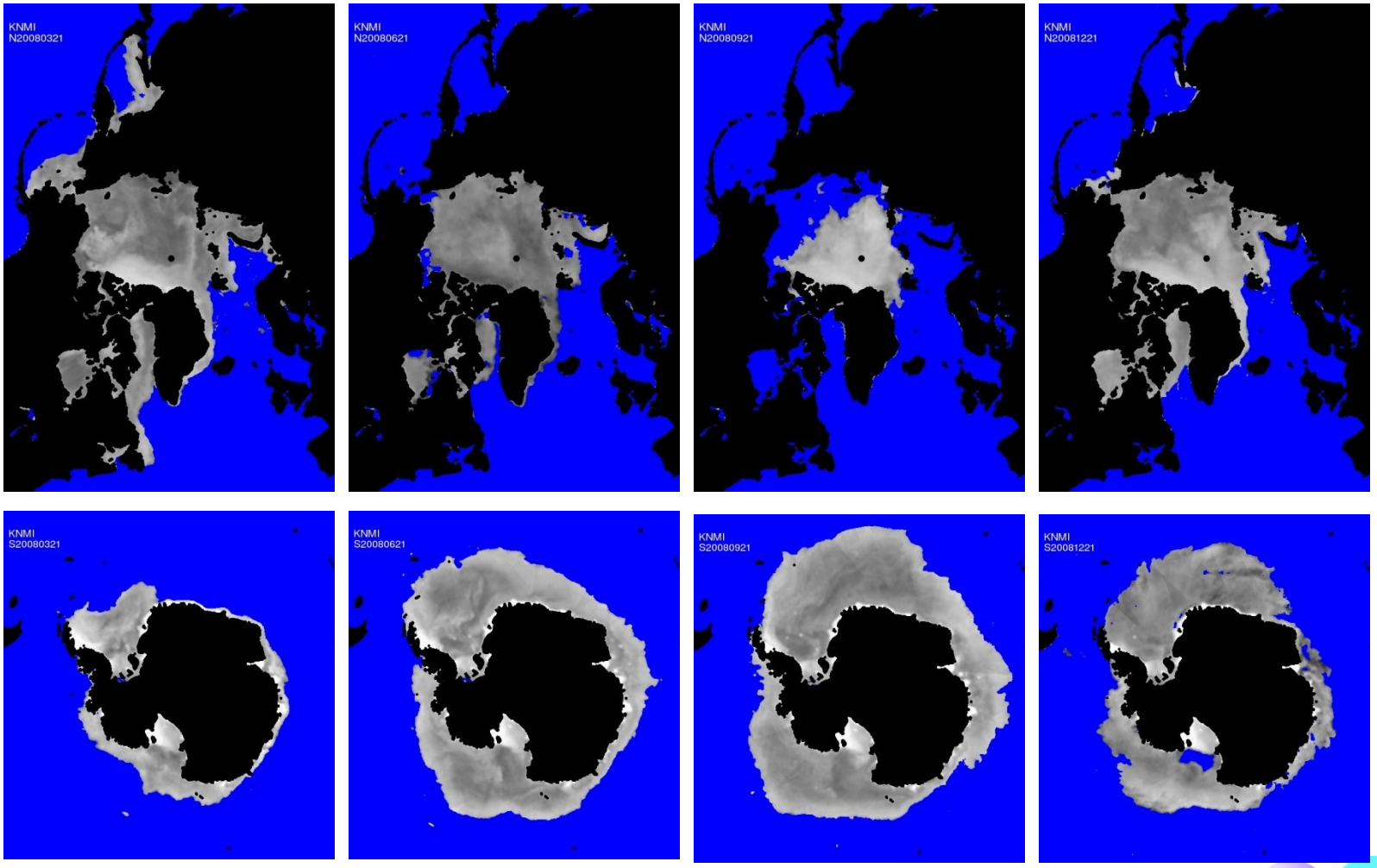




ASCAT ice age

ASCAT

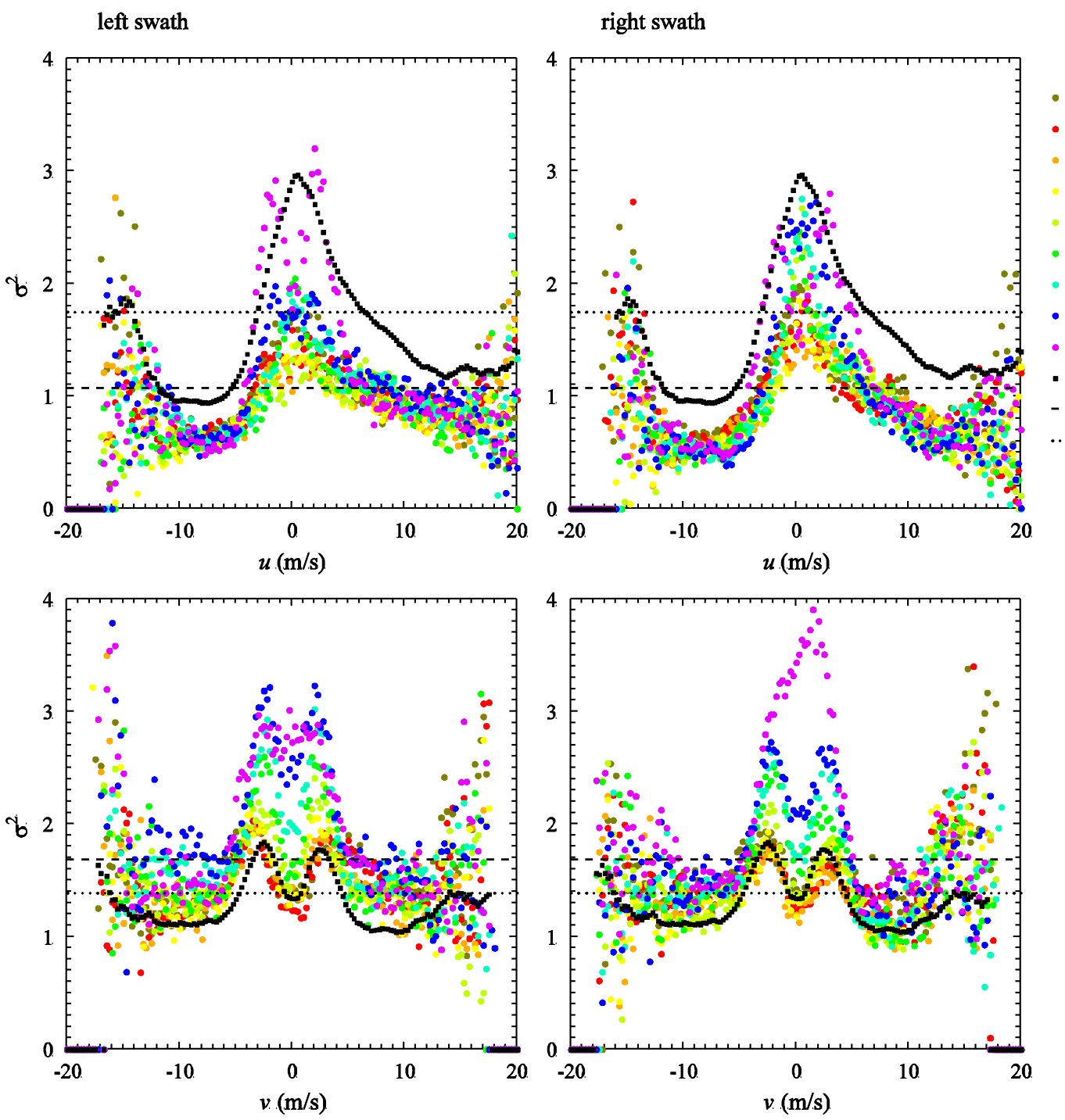
March 21st | June 21st | September 21st | December 21st



ASCAT sea ice age 2008

WVC intercalibration

ASCAT-12.5 Jan



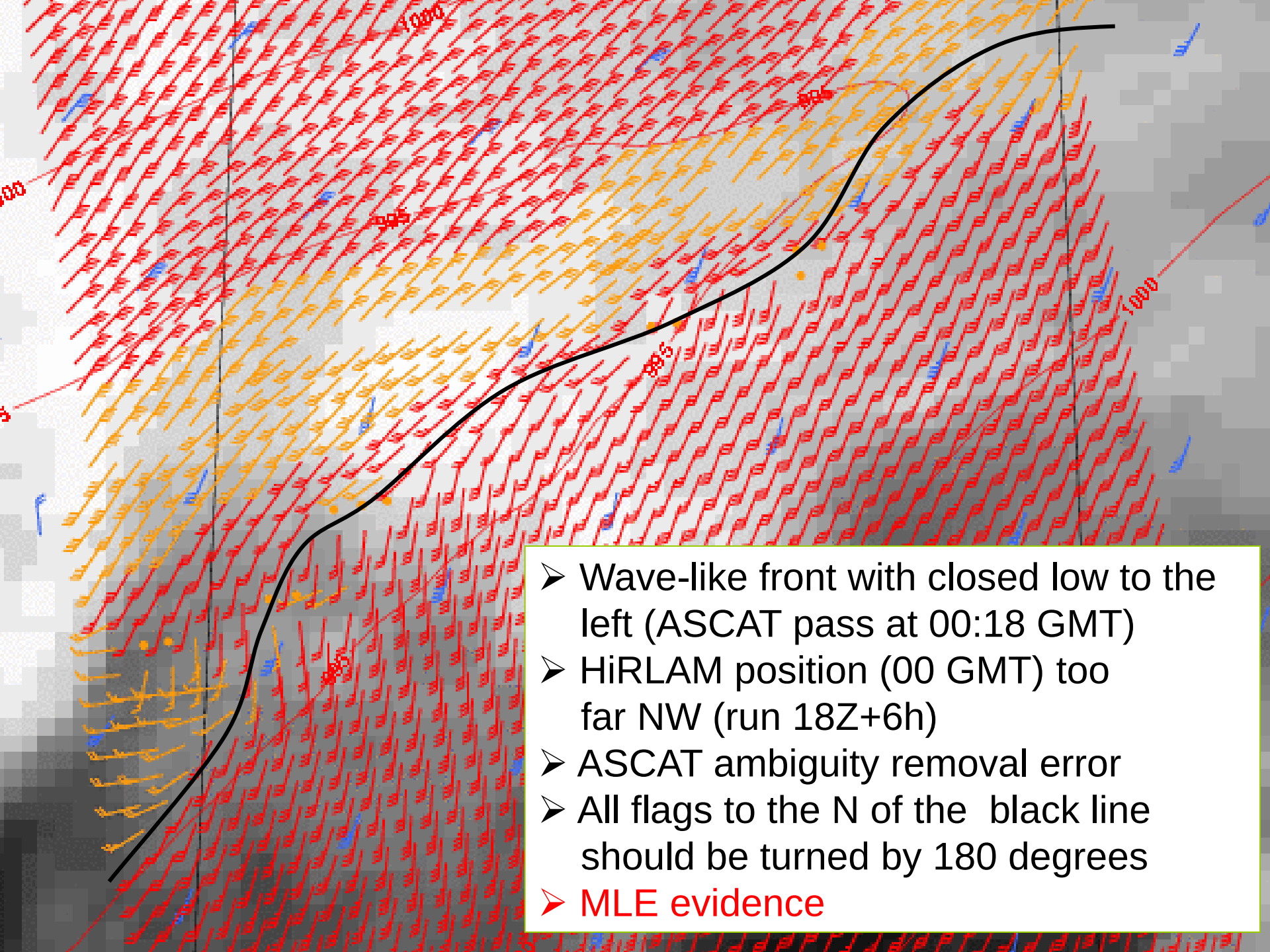
from TC

u (upper panels)
v (lower panels)
left swath, right swath

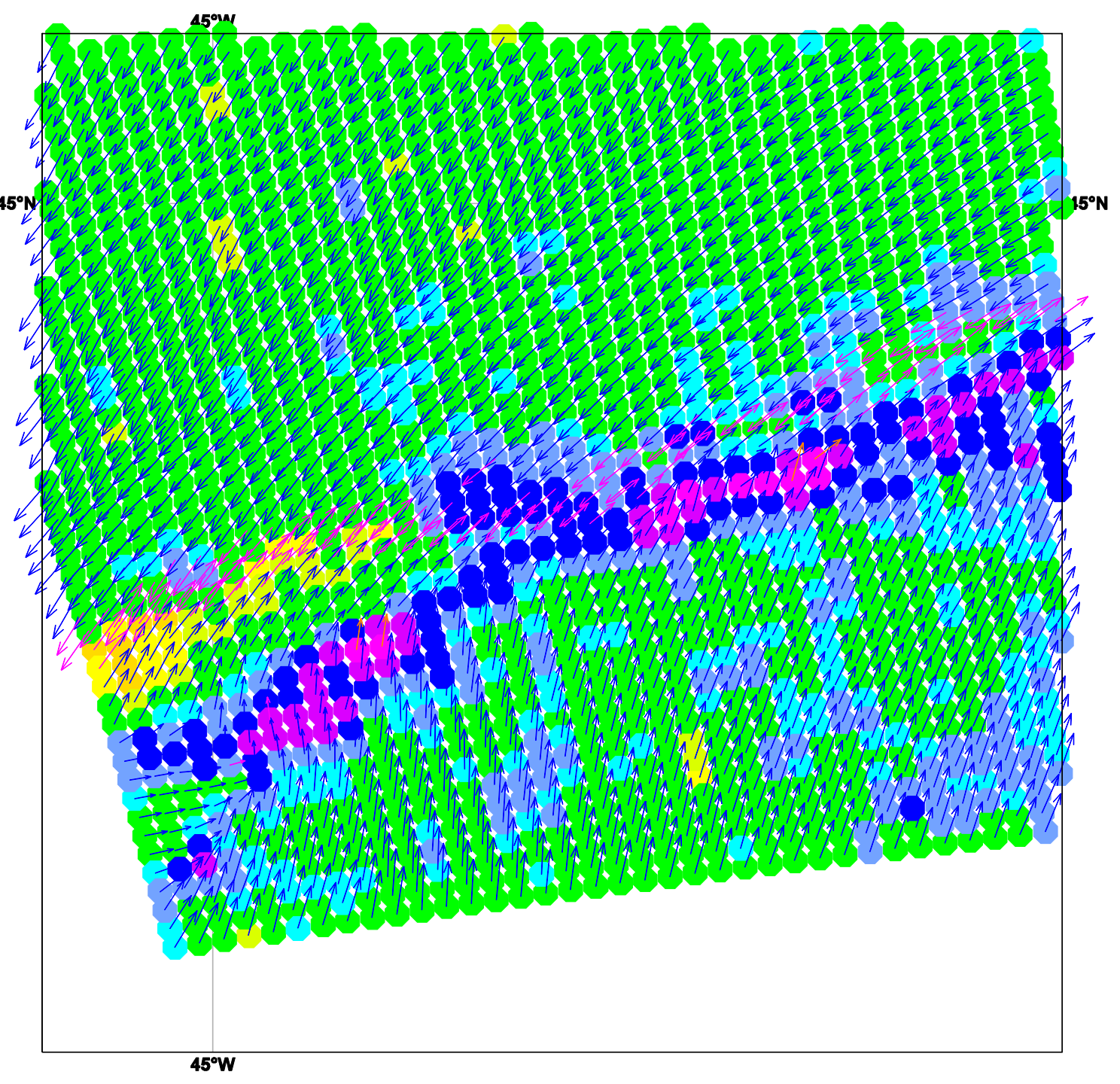
WVC intercalibration

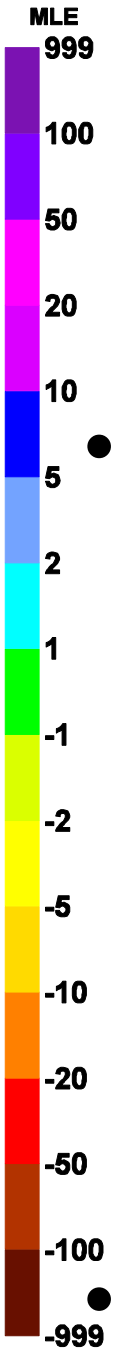
- Triple collocation using all ASCAT-12.5 collocations from Oct 2008 to March 2012
- Error standard deviations in m/s w.r.t. scatterometer scales

[m/s]	Buoy		ASCAT		ECMWF	
	σ_u	σ_v	σ_u	σ_v	σ_u	σ_v
Old	1.178	1.211	0.656	0.798	1.484	1.502
New	1.170	1.203	0.647	0.764	1.482	1.503



- Wave-like front with closed low to the left (ASCAT pass at 00:18 GMT)
- HiRLAM position (00 GMT) too far NW (run 18Z+6h)
- ASCAT ambiguity removal error
- All flags to the N of the black line should be turned by 180 degrees
- MLE evidence



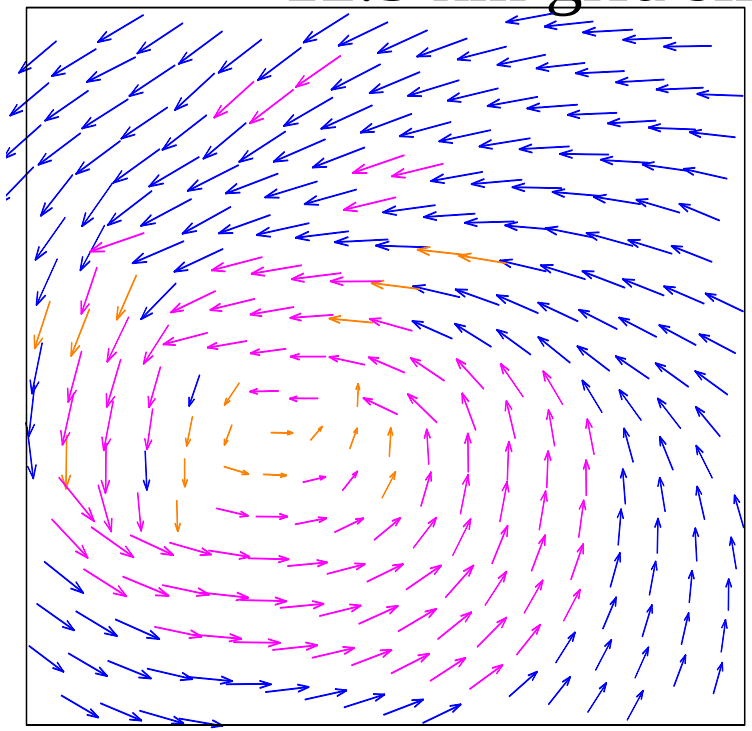


MLE

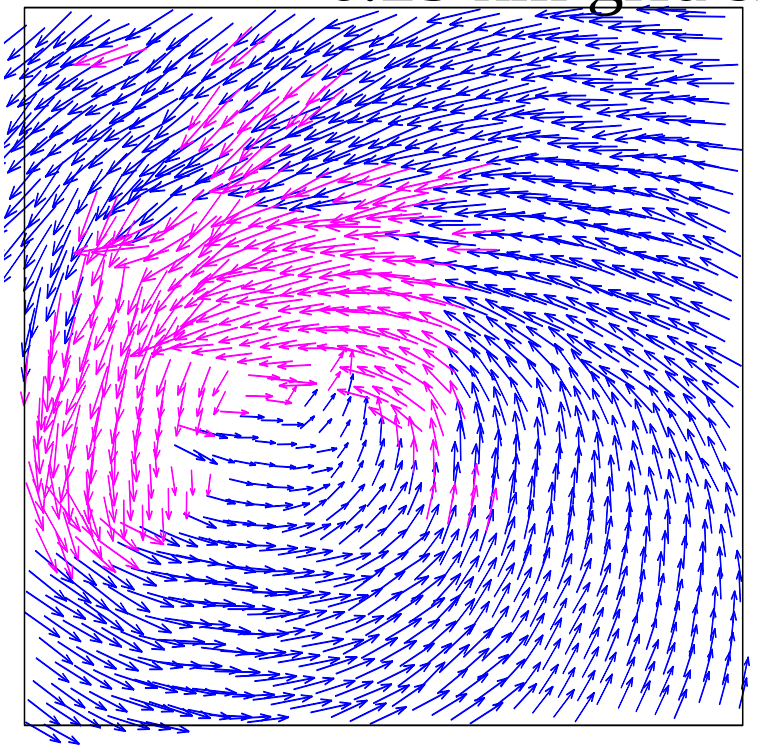
- +ve MLE related to wind variation, e.g., front
- -ve MLE

6.25 km σ^0 grid

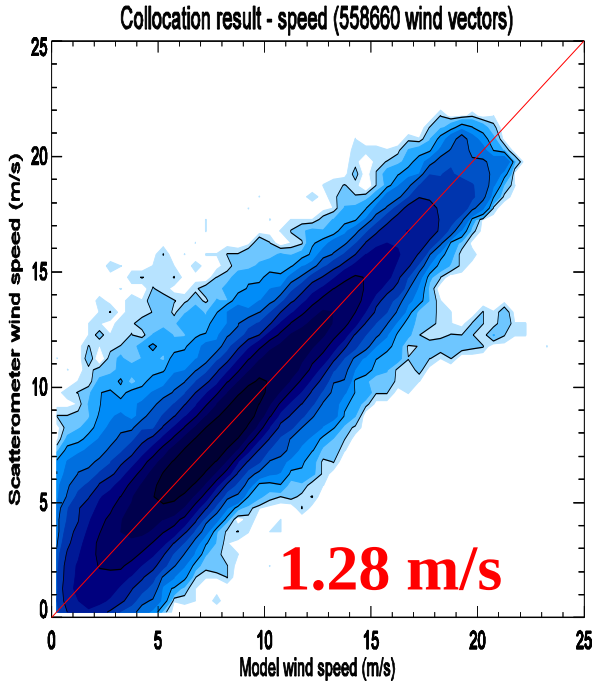
- 12.5 km grid size

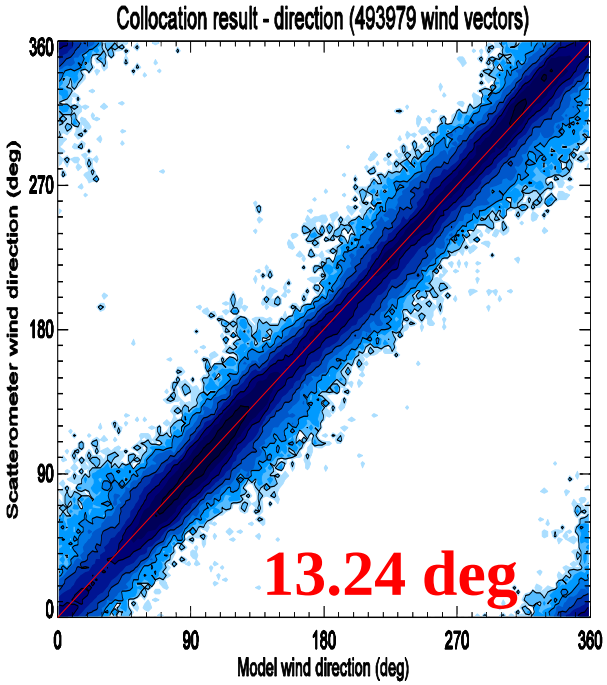


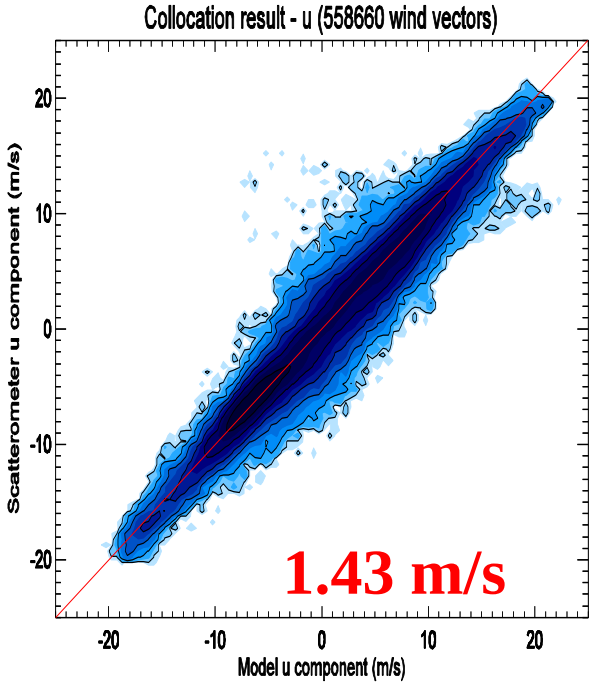
6.25 km grid size

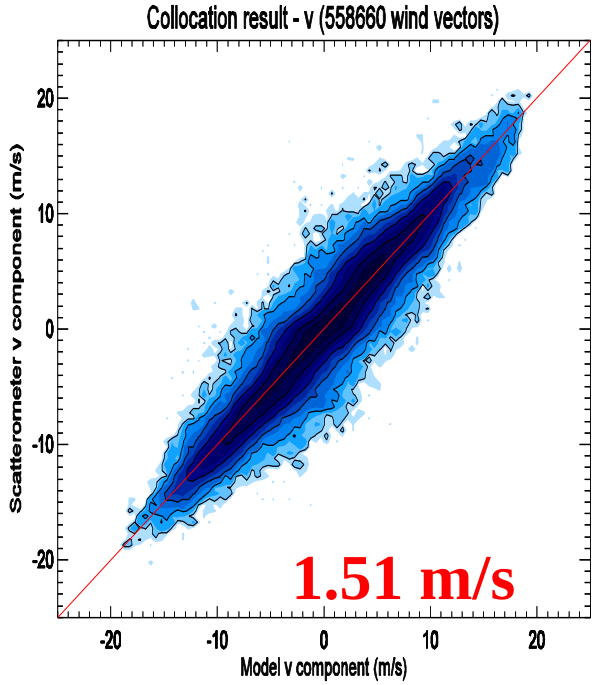


A vs ECMWF





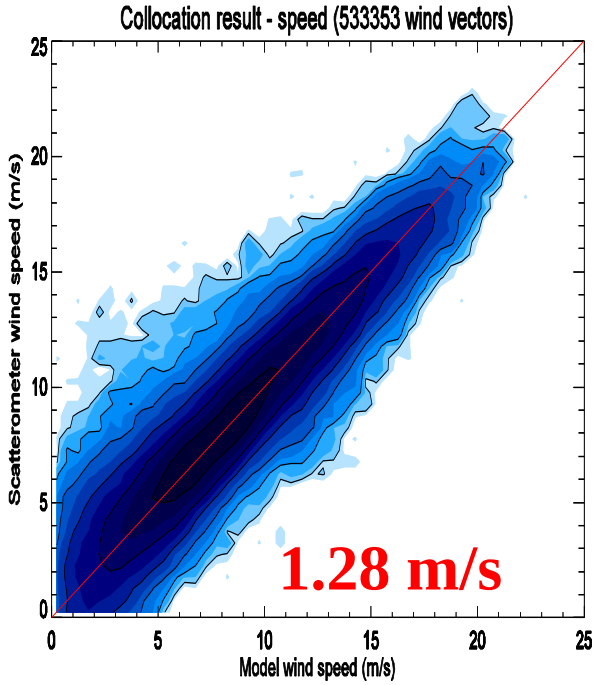


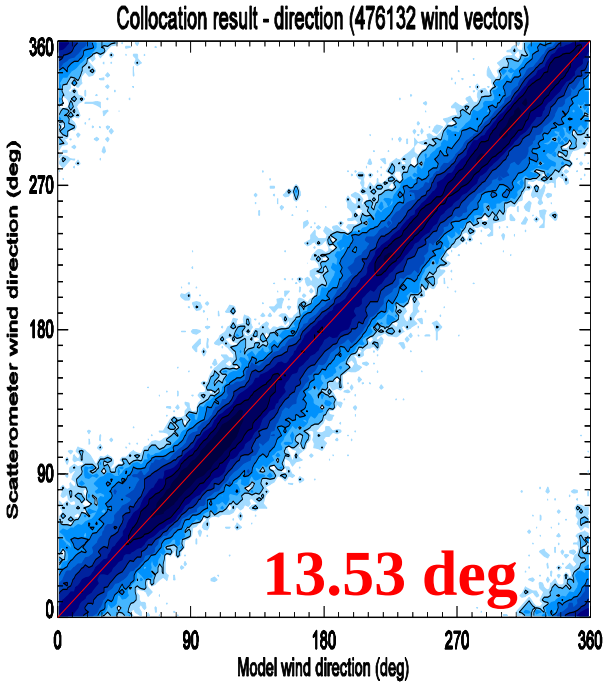


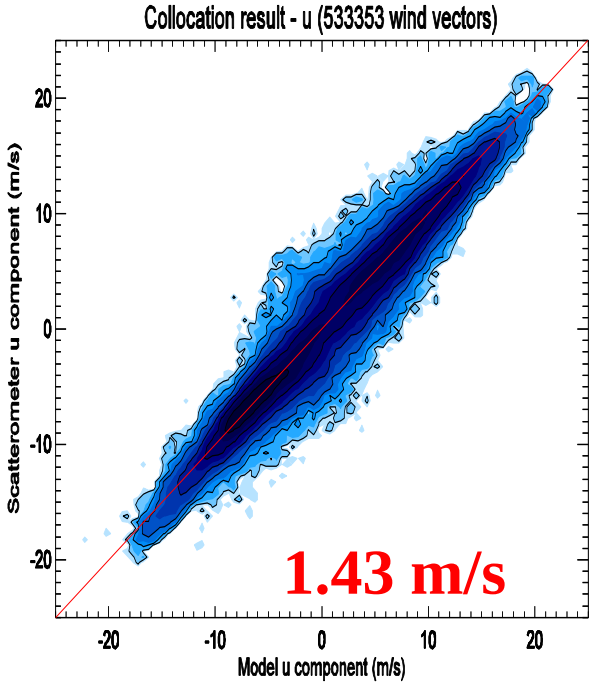
- Orbits 31193-31208
- SDs given
- AWDP-A

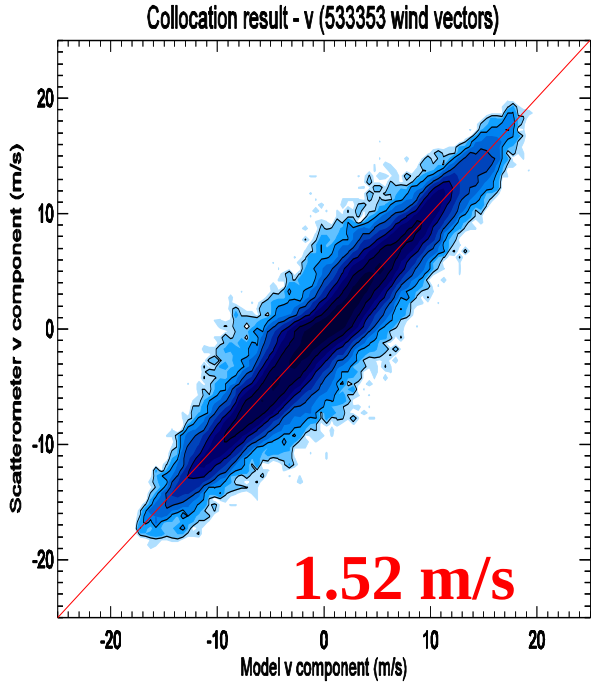
➢ Excellent quality

ASCAT B vs ECMWF







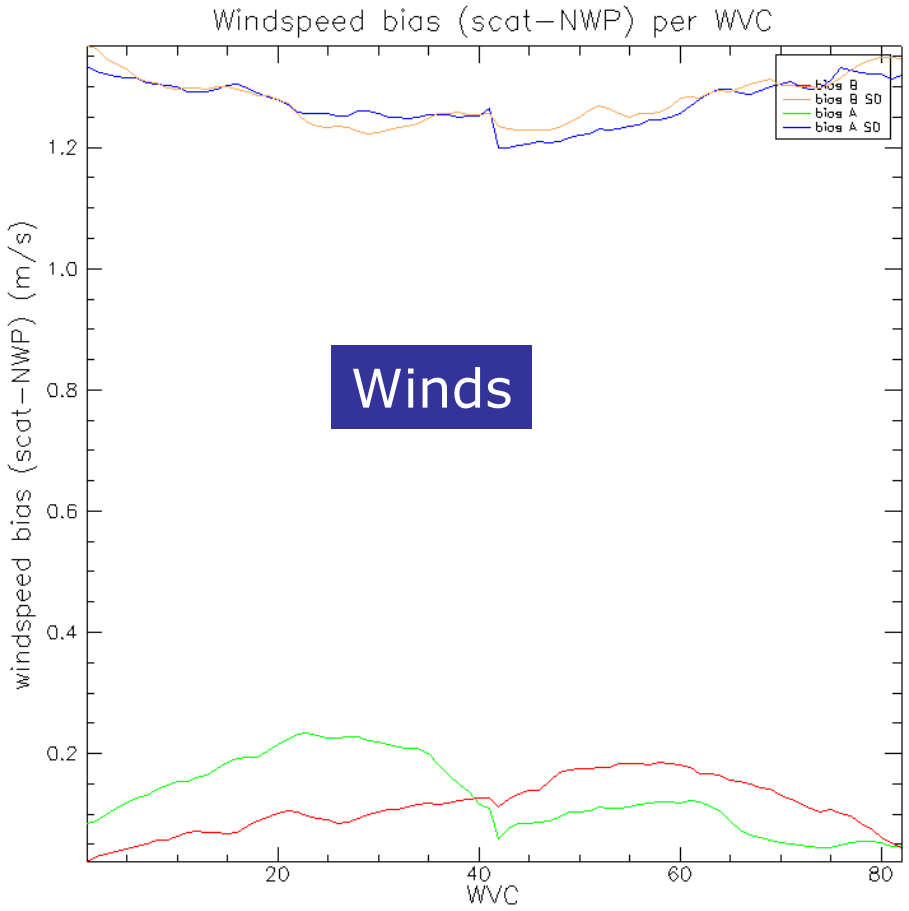


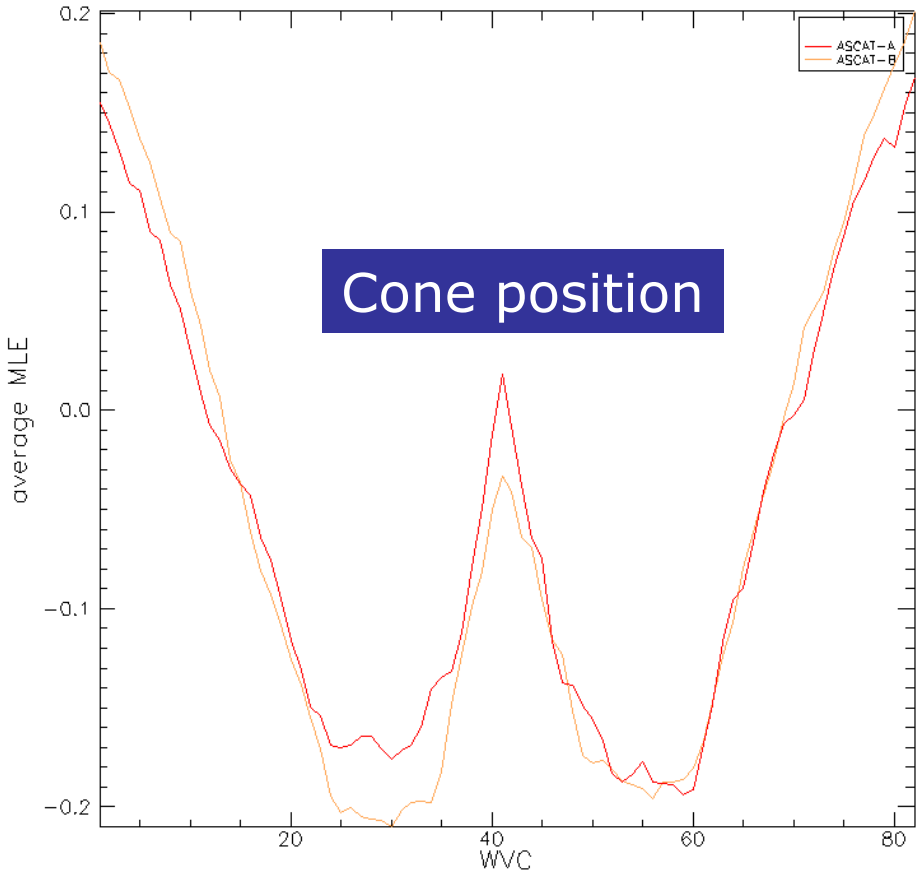
- Orbits 507 – 522
- Same day as A
- AWDP-A (no corrections)

▷Very

AWDP runs

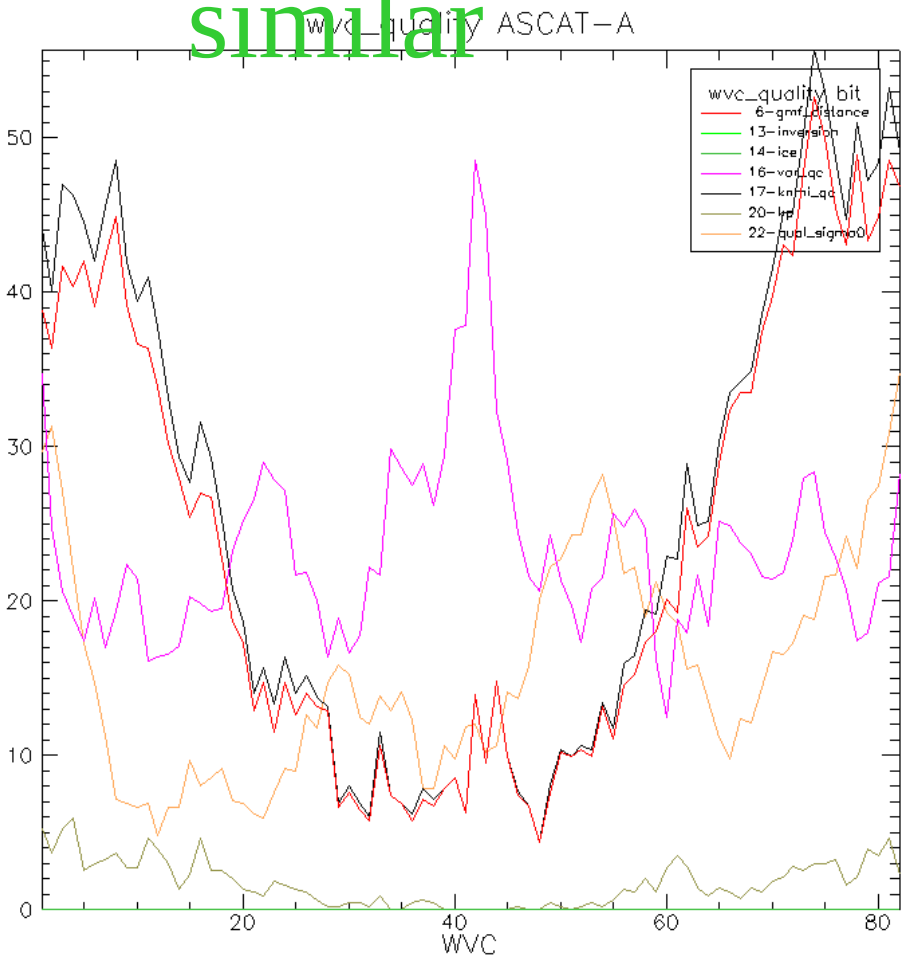
- Ocean data from 20121112 12:00 to 201214

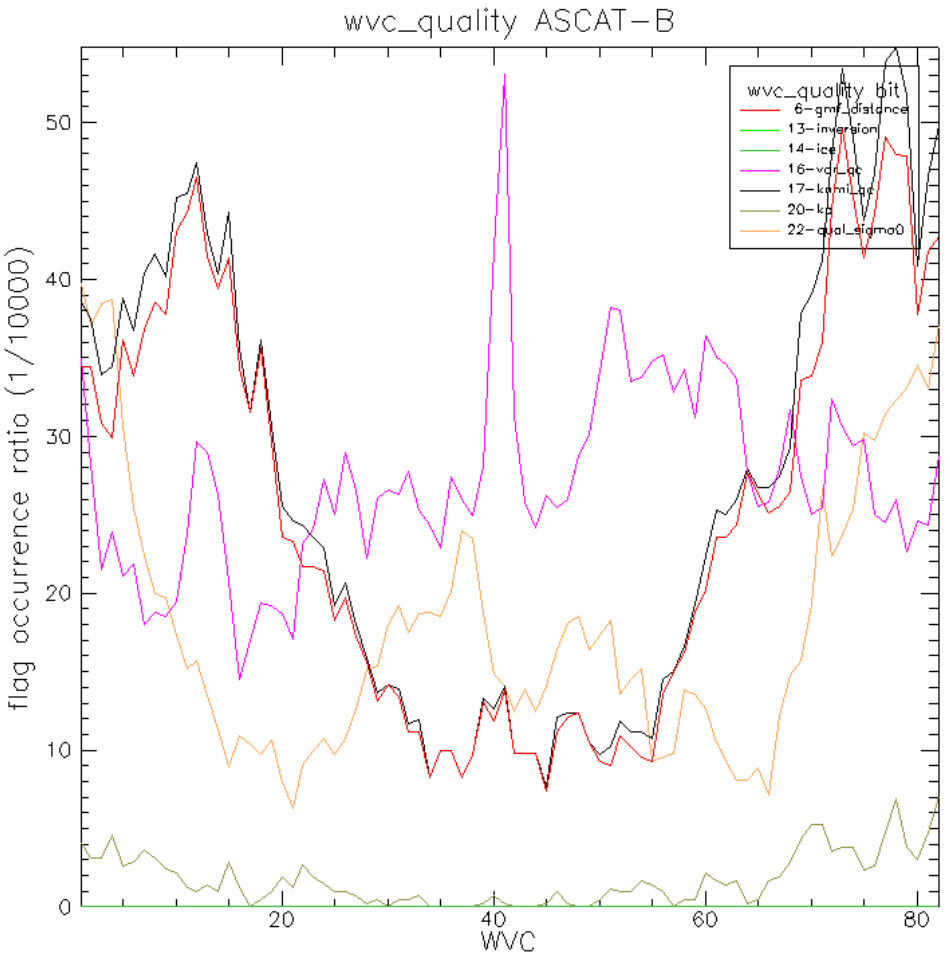




AWDP QC

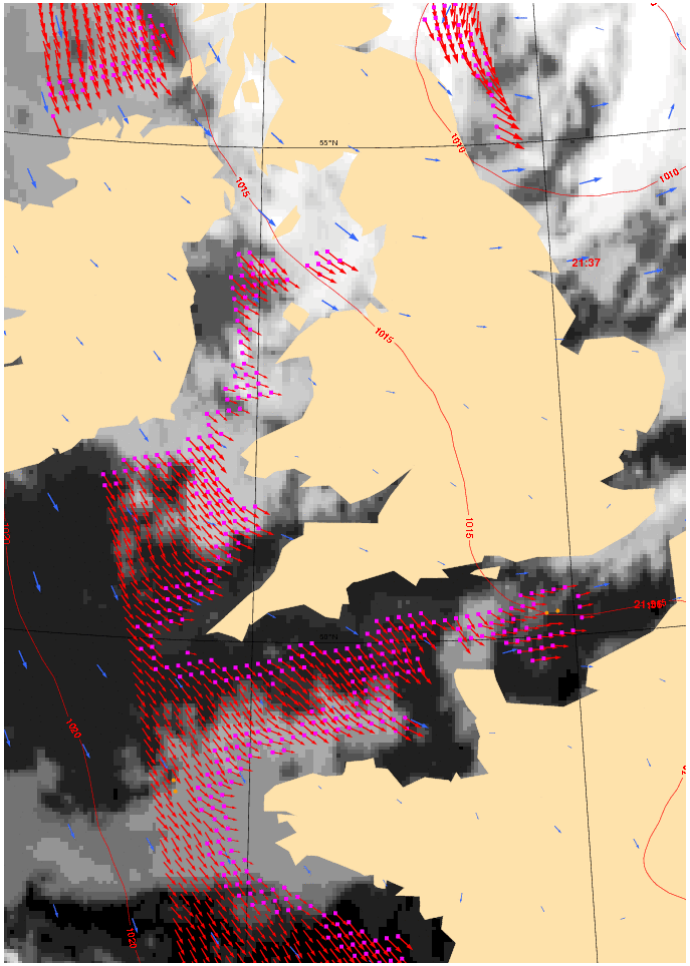
- General QC characteristics very similar

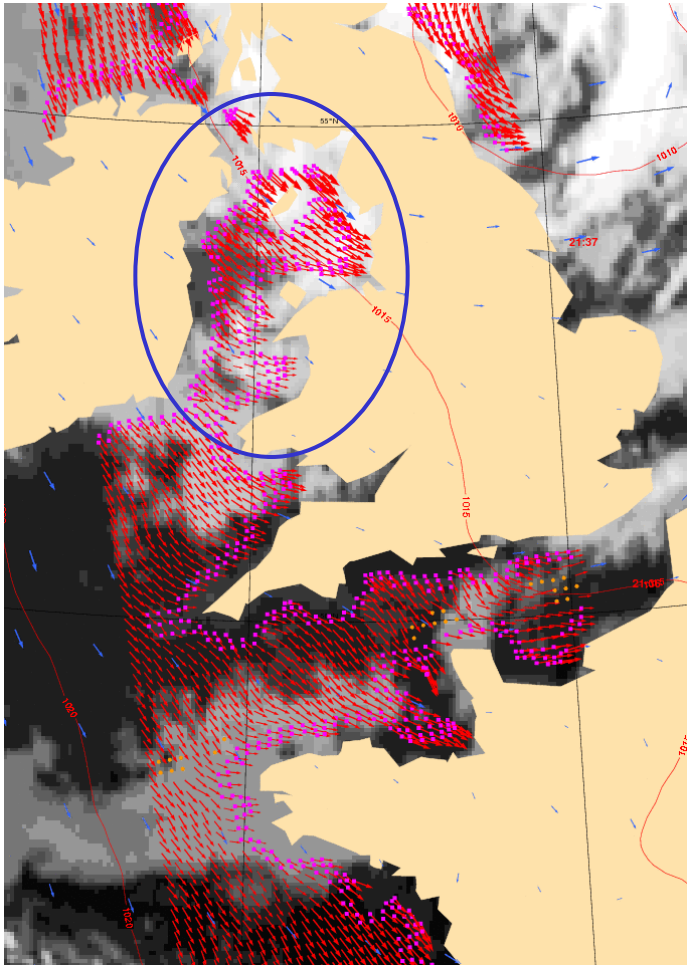




Current products

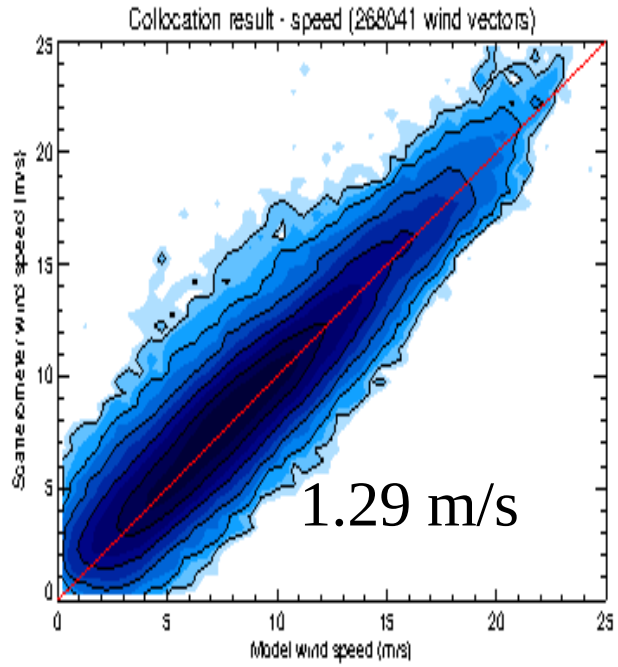
- ASCAT 25 km
  - A operational
  - B operational
- 12.5 km coastal
  - A operational
  - B operational
- ASCAT 12.5 km
  - A operational
  - no B demo
- ASCAT EARS 2x
  - A operational
  - B operational
- OSCAT 50 km operational
- OSCAT 25 km demo
- HY-2A 25 km R&D

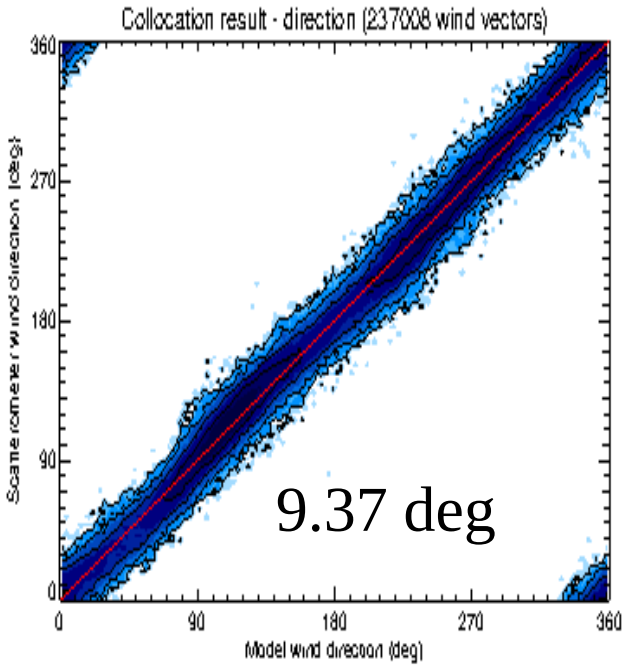


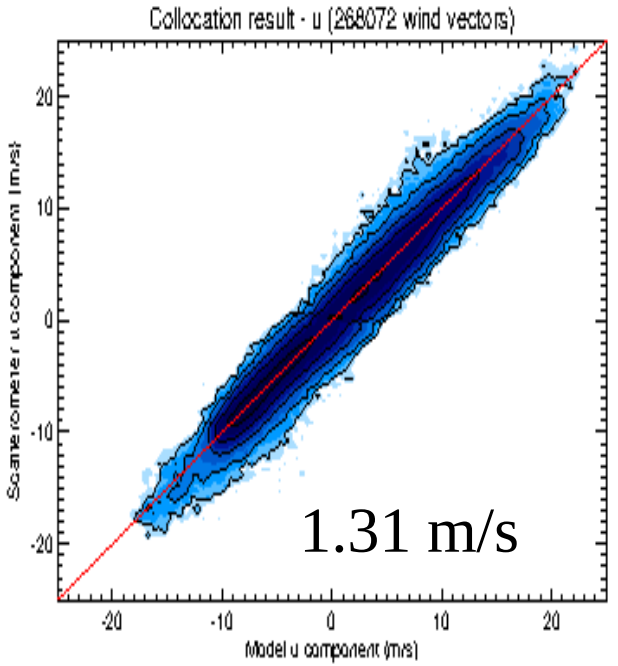


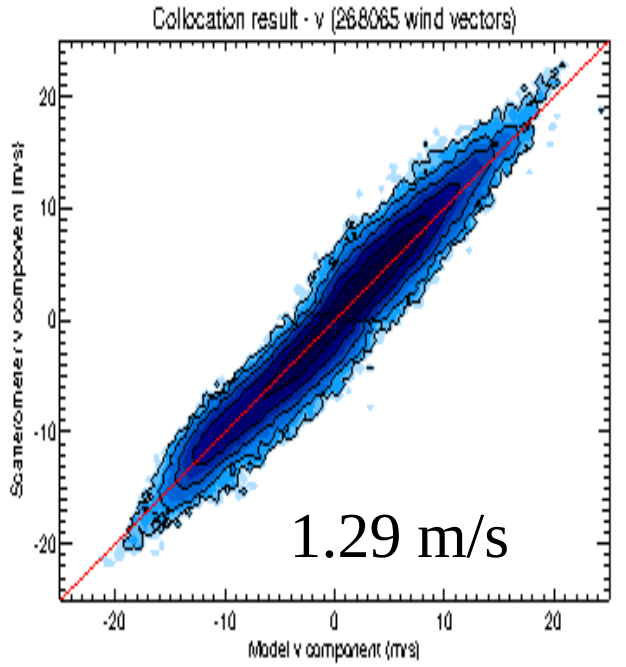
➢ **Recommend simplification, e.g., no added value in ASCAT 12.5 km winds**

OSCAT OWDPv1.3 vs ECMWF





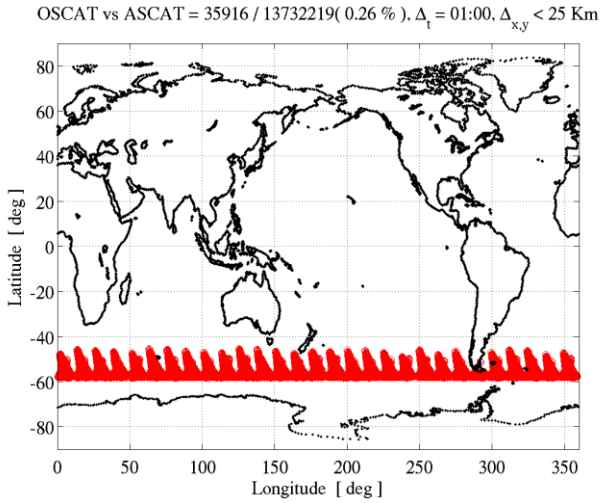


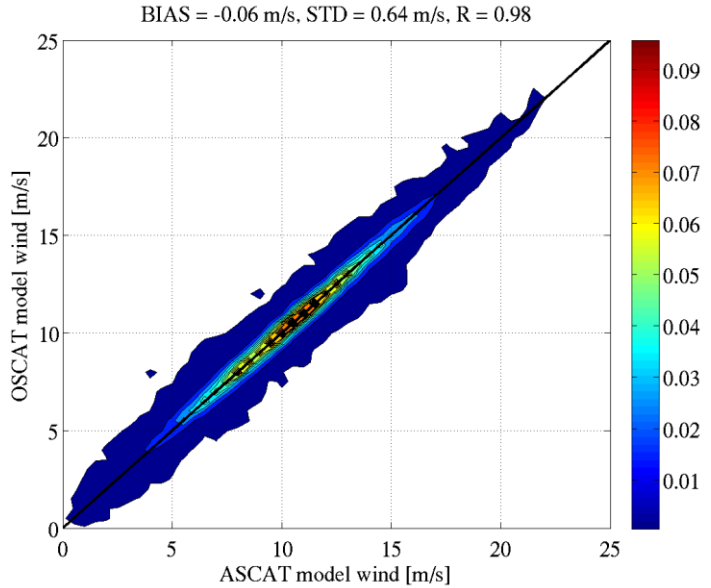


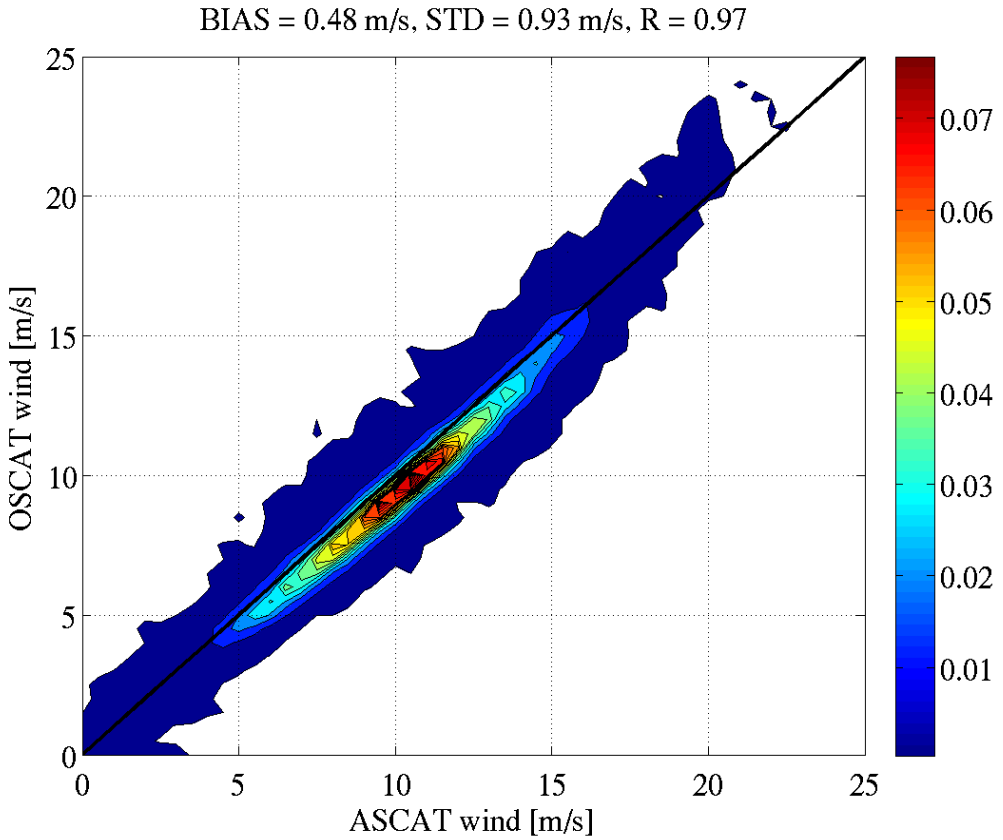
- SDs given
- All 50-km WVCs
- With σ^0 corrections
- Range correction
- NSCAT3

- Better than without NSCAT3 and corrections
- Some less extreme winds > 15 m/s
- Direction error at 90 degrees decreased

Collocation 1h, 25km, Jan-Mar 2012





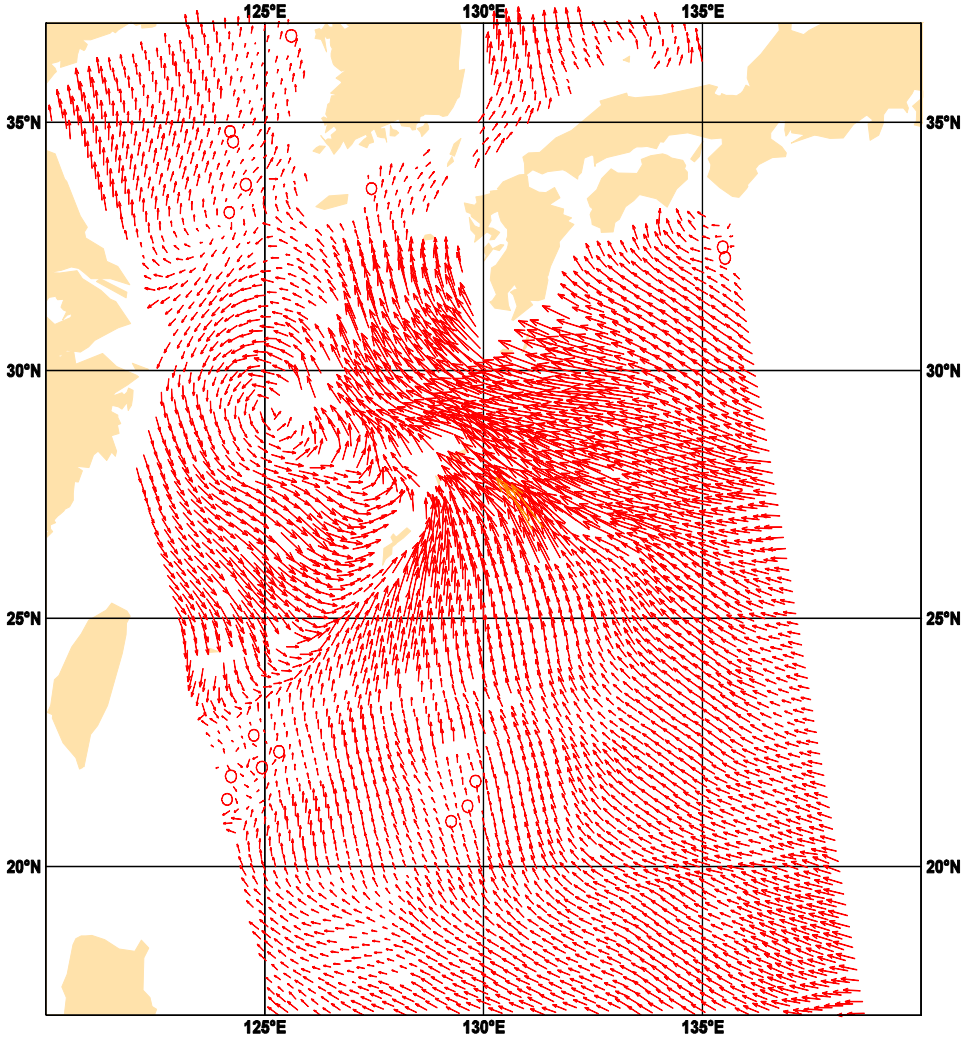


- STD collocation error ~ STD observation error !
- Bias; now corrected at KNMI

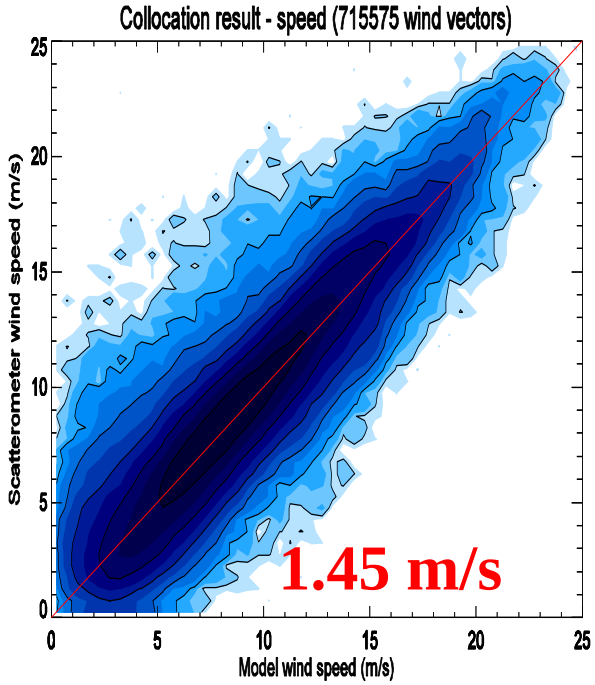
S. Guimbard et al., 2012

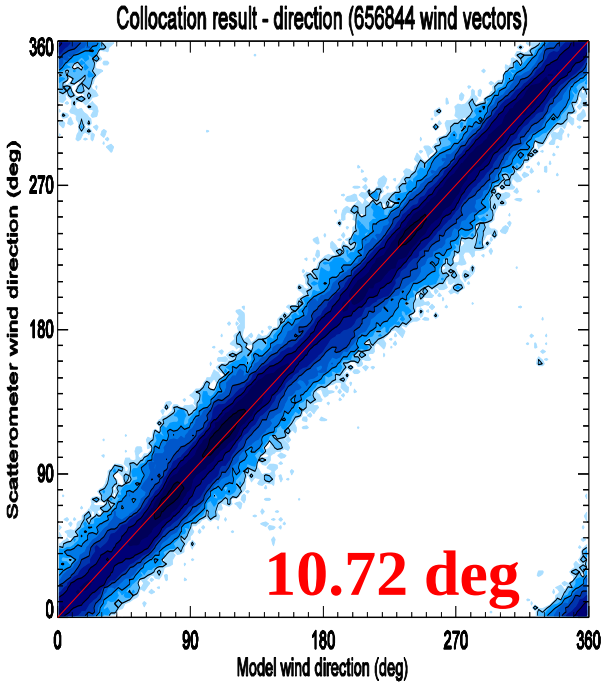
OSCAT 25-km grid

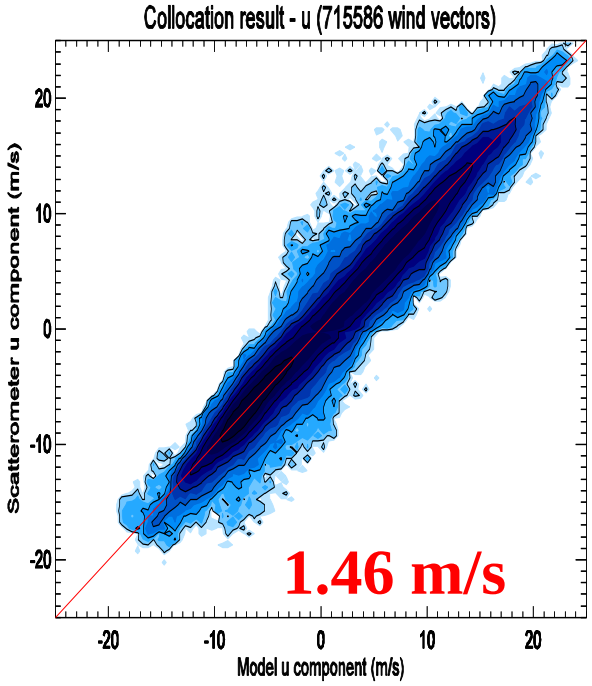
- Development of 25 km product based on Level 1B from ISRO (cooperation with NOAA) or ISRO L2A
- Await further ISRO analysis
- Improvement of backscatter calibration (NOC) and QC
- Improvement of sea ice screening model
- Coastal ?
- Release of OWDP software in the NWP SAF
- Access to operational NRT wind is arranged on high level in a coordinated way (ISRO, EUM, NOAA, NASA, …)

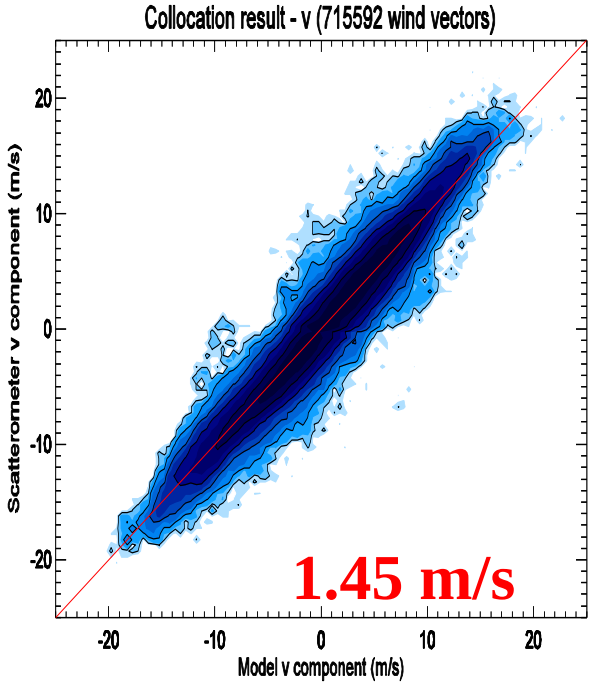


HY-2A KNMI L2B vs ECMWF



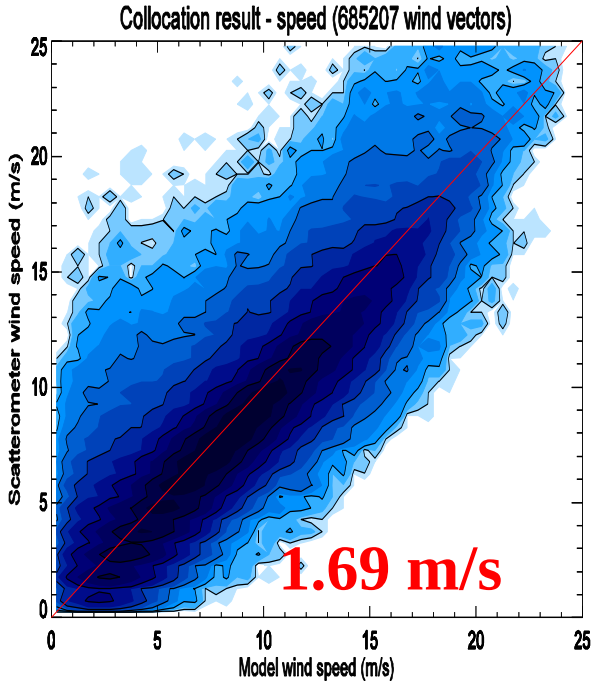


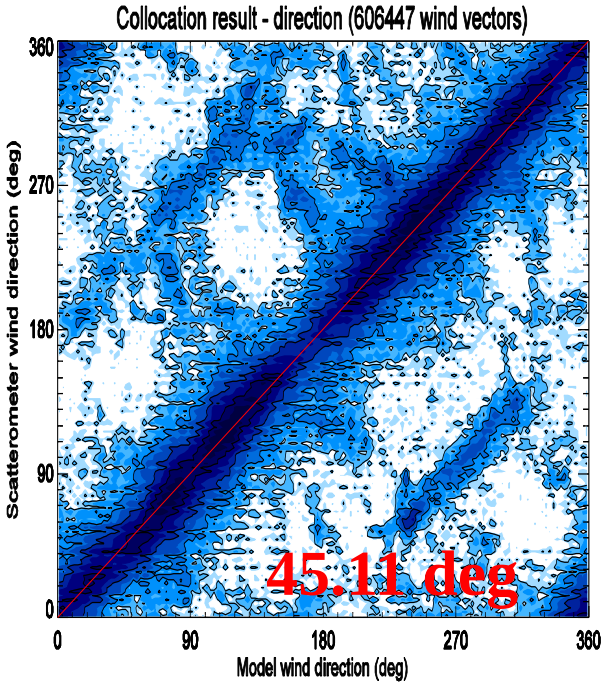


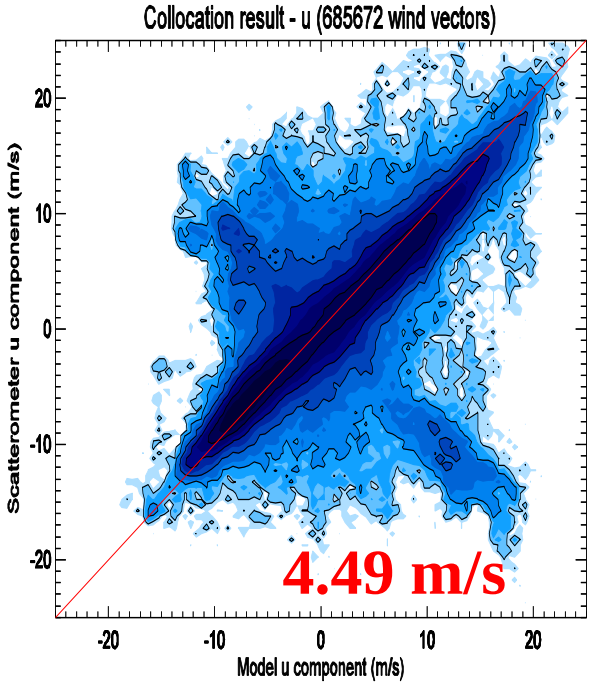


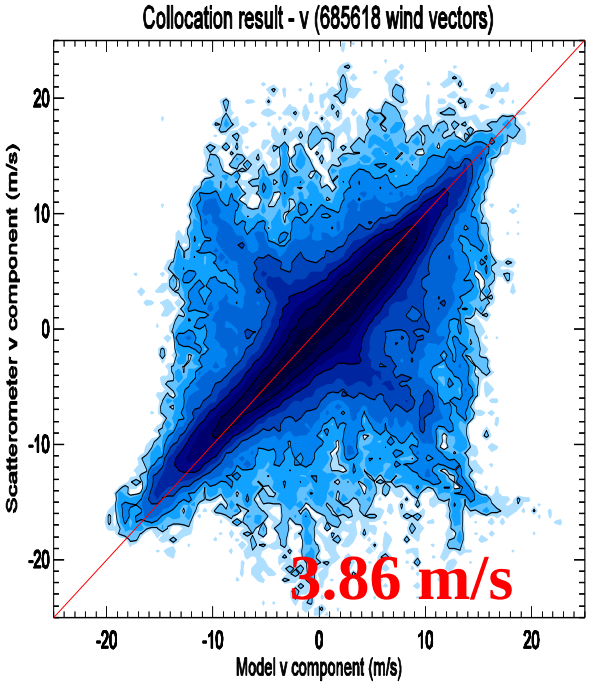
- OWDP as used for QSCAT and OSCAT
- -1.7 dB σ^0 corrections
- -0.0001 linear outer beam correction
- All WVCs
- SDs given

- ➢ No speed bias
- ➢ Rain issue reduced
- ➢ Scores similar to QScat and OSCAT









NSOAS L2B vs ECMWF

- SD of difference given in each panel
- All WVCs
- No land, no sea ice

- ➢ Rain effect visible
- ➢ Ambiguity removal issues
- ➢ Many flag bits zero

Overview ECMWF comparisons

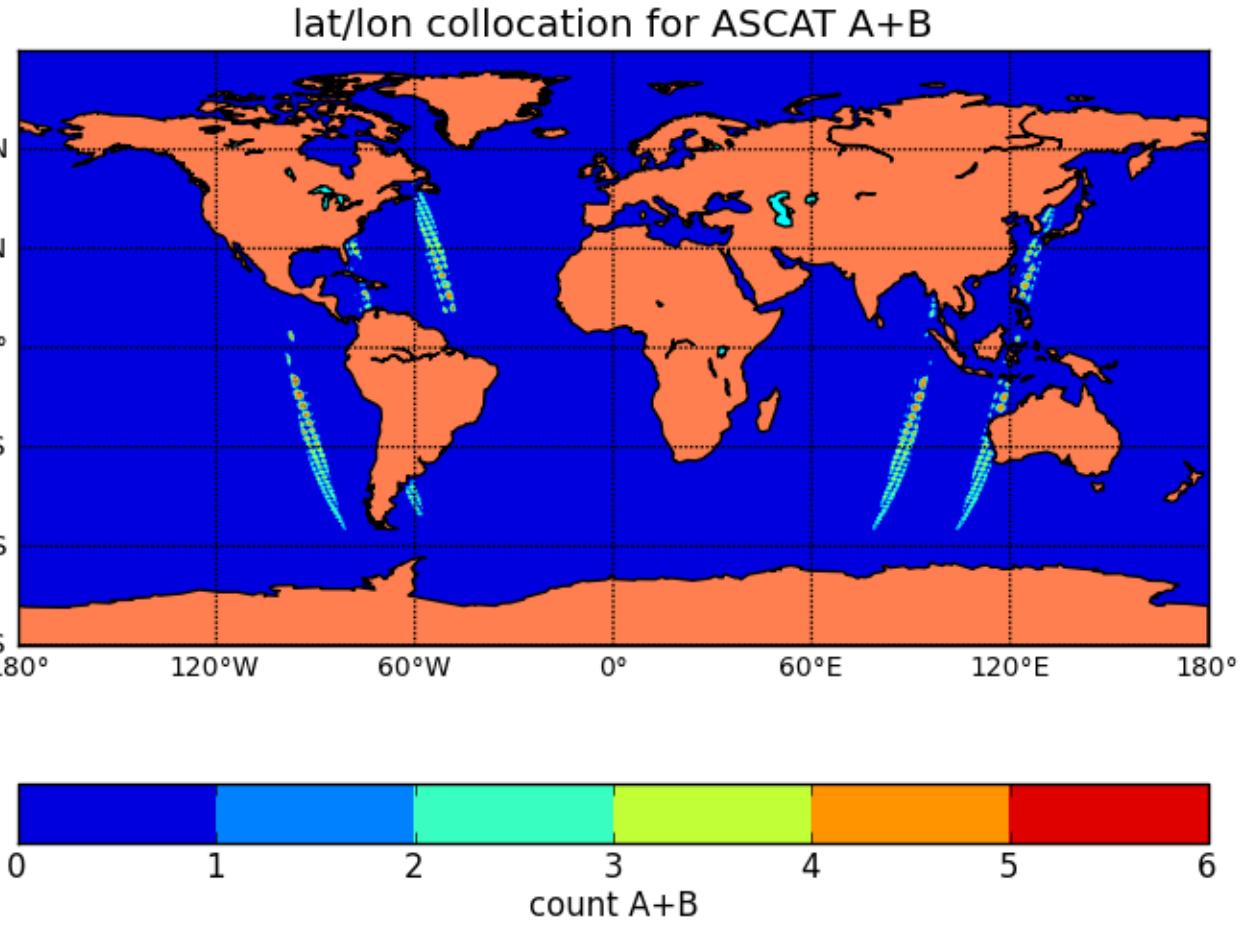
	NSOAS	OWDP all	OWDP no outer	OWDP* no outer	OWDP OSCAT
Number	685672	715592	559557	520554	284703
Bias (m/s)	-0.35	0.17	0.21	1.81	0.19
SD speed (m/s)	1.69	1.45	1.48	1.58	1.38
SD dir. (deg.)	45.11	10.72	10.58	10.80	9.78
SD u (m/s)	4.49	1.46	1.44	1.64	1.37
SD v (m/s)	3.86	1.45	1.44	1.67	1.35

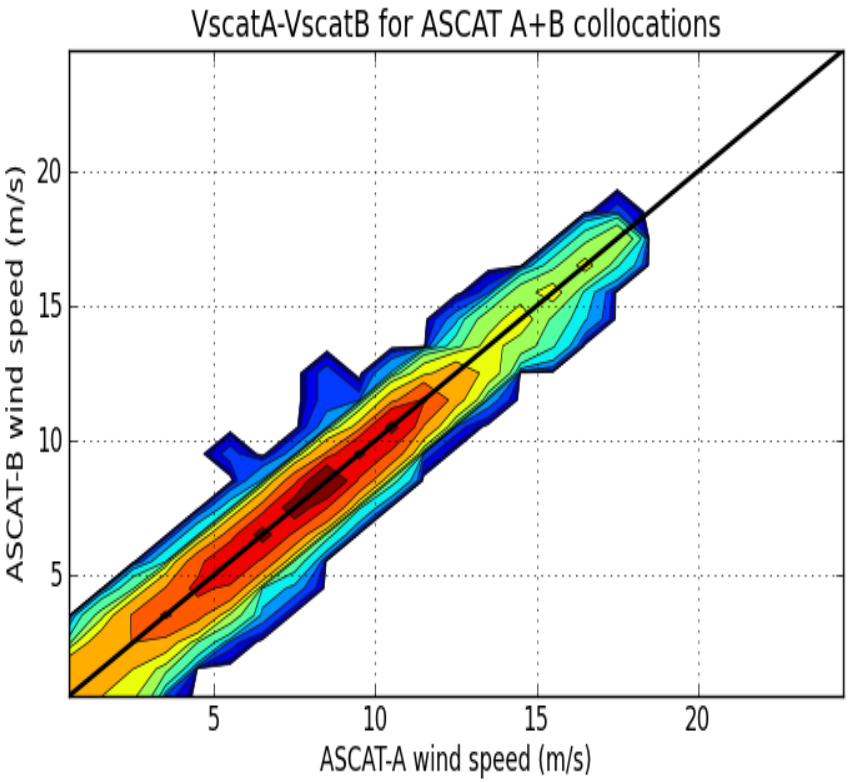
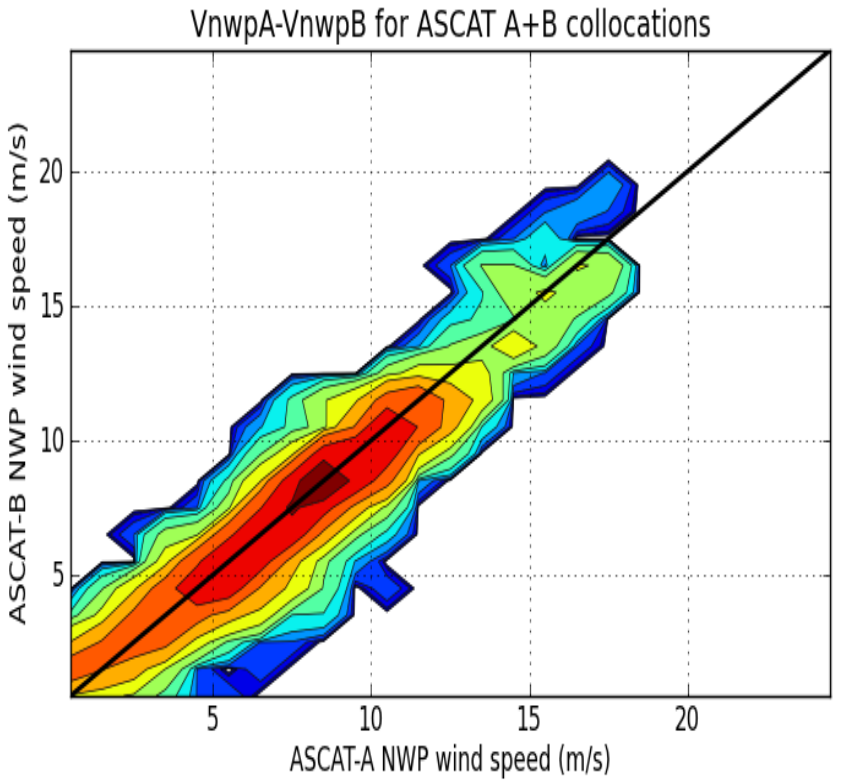
- KNMI OWDP shows very similar performance for OSCAT and HY-2A after simple HY-2A corrections
- KNMI OWDP shows more data than NSOAS, but obtains good speed verification (little rain contamination left)
- Wind direction of NSOAS needs attention
- Not sure about quality flags

Summary

- Make MetOp-B operational soon
- Release AWDP B part soon
- Need full resolution product for 6.25-km product and QC: rain, structures at sea …
- Exploit Kp, MLE
- OSCAT 25-km product
- Release OWDP
- Develop confidence in HY2A with NSOAS

Collocation MetOp-A&B



2 orbits of A and B
Only ocean
wvc_quality all right
Δt = 48/52 minutes Δx = 10 km
Total number collocations =6691

Collocation MetOp-A&B