Satellite Winds Activities at Météo-France

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[1] *CNRM and GAME, Météo-France and CNRS*
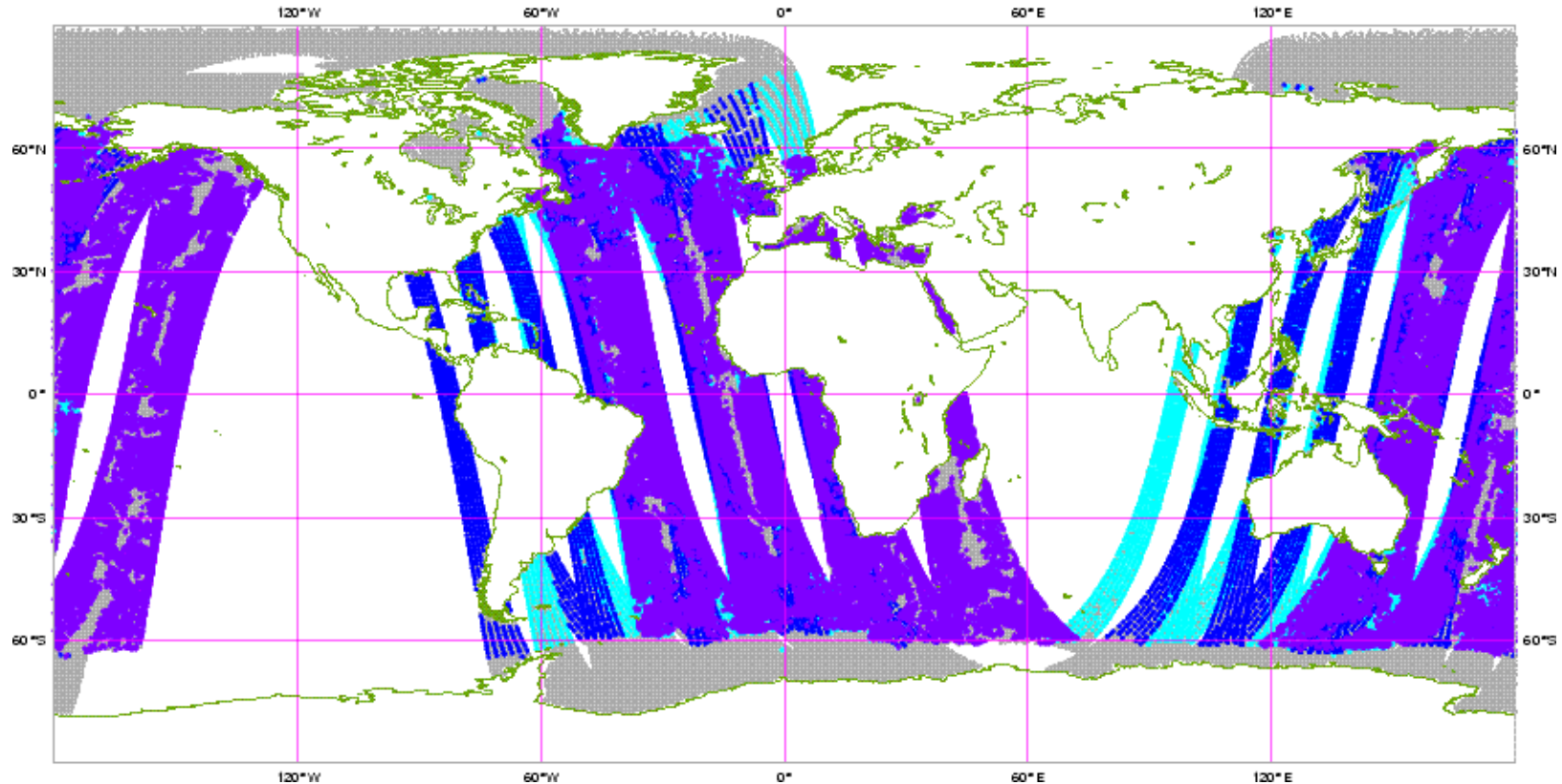[2] *LACy, La Réunion University, CNRS and Météo-France*

METEO FRANCE
Toujours un temps d'avance

Outline

- Operational use of scatterometer winds

- OSCAT and ASCAT-B assimilations

- Scatterometers impact

Operational use of scatterometer winds (1/3)

Scatterometer Winds on a 6-hours assimilation window (centred here on 0 UTC) in 2013

Scatterometer Winds **available**

Data assimilated: **ASCAT-A**, operational since Feb 2008

ASCAT-B, operational since July 2013

OSCAT, operational from July 2013, discontinued on Feb 2014

Operational use of scatterometer winds (2/3)

Product:

- L2 wind product from the EUMETSAT OSI-SAF (KNMI)
- 50km resolution (25km grid for ASCAT data)
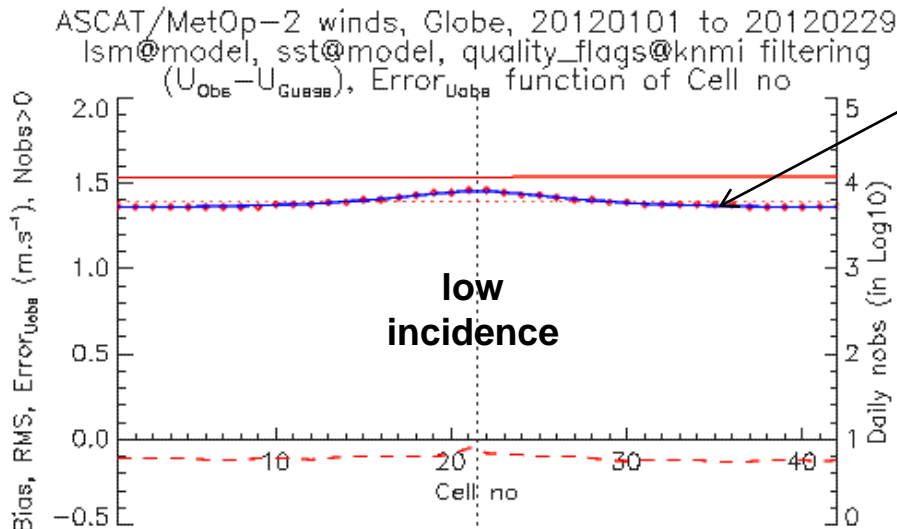
Main news for the assimilation:

- Since July 2013, observation error dependence on cross-track position

OSCAT:

- Azimuth check between the 2 most likely solutions is required
  (rejection if |dir(sol1) – dir(sol2)| < 135deg)

Observation error specification

Specified obs error

ASCAT/MetOp-2 winds, Globe, 20120101 to 20120229
lsm@model, sst@model, quality_flags@knmi filtering
$(U_{Obs} - U_{Guess})$, Error$_{Uobs}$ function of Cell no

low incidence

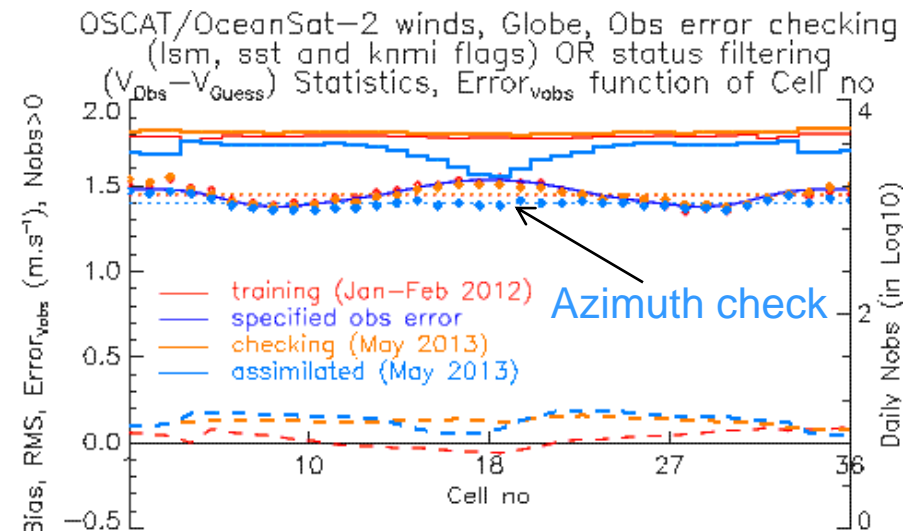**ASCAT (zonal component)**

Averaged errors:
  Ucomp error: 1.4m/s
  Vcomp error: 1.5m/s
Cross-track modulation: +5% / -2%
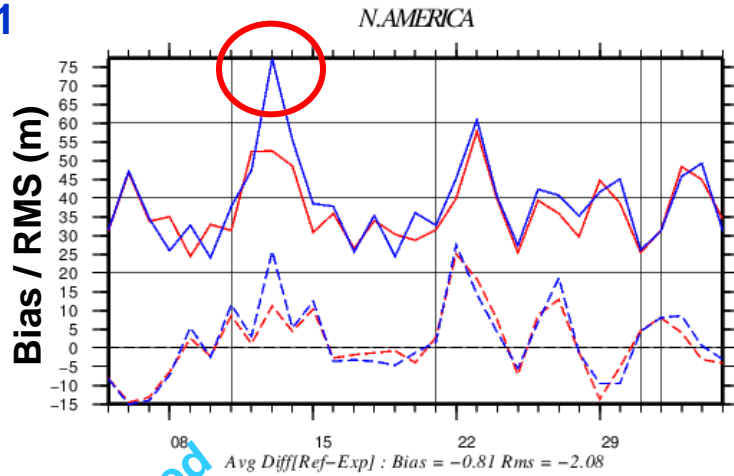
OSCAT (meridian component)

U/Vcomp mean error: 1.5m/s
Cross-track modulation: +/-8%

OSCAT/OceanSat-2 winds, Globe, Obs error checking
(lsm, sst and knmi flags) OR status filtering
$(V_{Obs} - V_{Guess})$ Statistics, Error$_{vobs}$ function of Cell no

— training (Jan-Feb 2012)
— specified obs error
— checking (May 2013)
— assimilated (May 2013)

Azimuth check

OSCAT-t1

OSCAT-t2

worst scores improved

+azimuth control

Reference w/o OSCAT

Test with OSCAT

N.AMERICA

Avg Diff[Ref-Exp] : Bias = -0.81 Rms = -2.08

EUROPE

Avg Diff[Ref-Exp] : Bias = 0.47 Rms = -1.09

N.AMERICA

Avg Diff[Ref-Exp] : Bias = -0.98 Rms = -0.46

EUROPE

Avg Diff[Ref-Exp] : Bias = 0.90 Rms = -0.39

Bias / RMS (m)

Forecast validity (day)
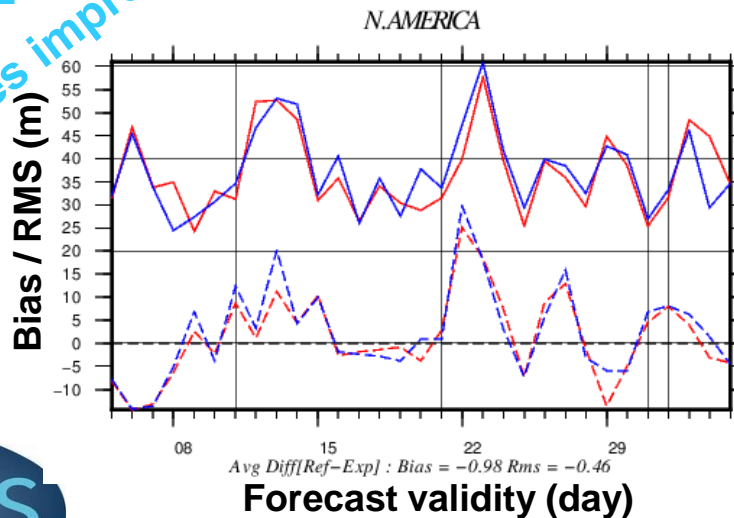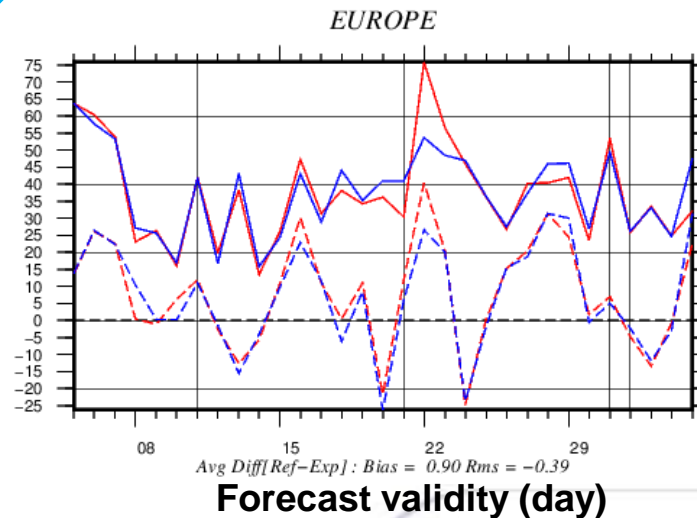
ARPEGE 00 UTC forecast scores differences

OSCAT with azimuth check | **ASCAT-B adding**

RMS(Z) difference / TEMP
December 2012, 24 cases, 0.25m isoline
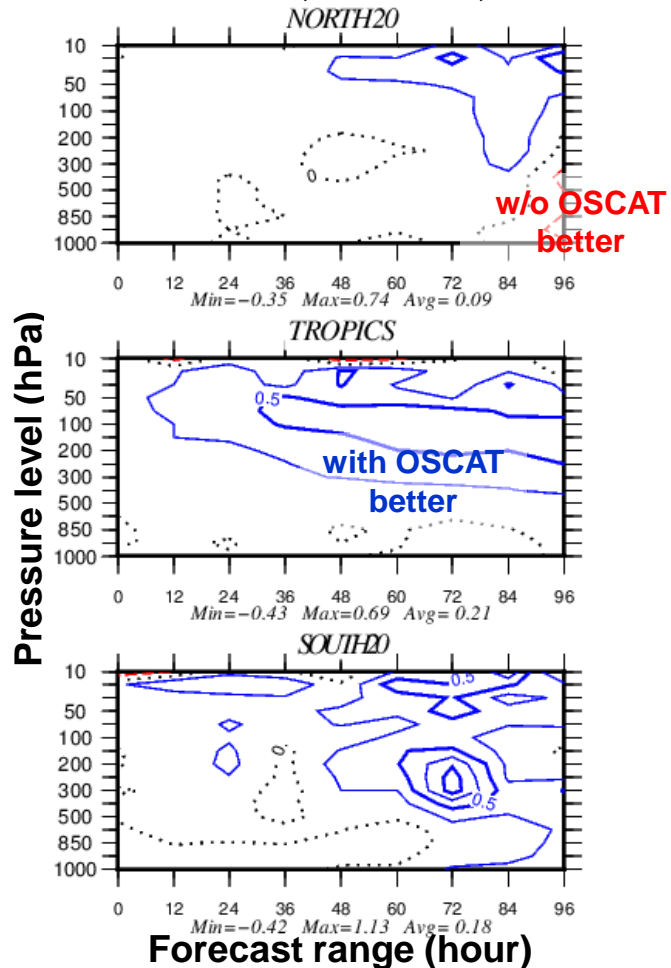
RMS(WIND) difference / IFS analysis
February 2013, 28 cases, 0.05m/s isoline

w/o OSCAT better

with OSCAT better

with ASCAT-B better

Pressure level (hPa)

Forecast range (hour)

METEO FRANCE
Toujours un temps d'avance
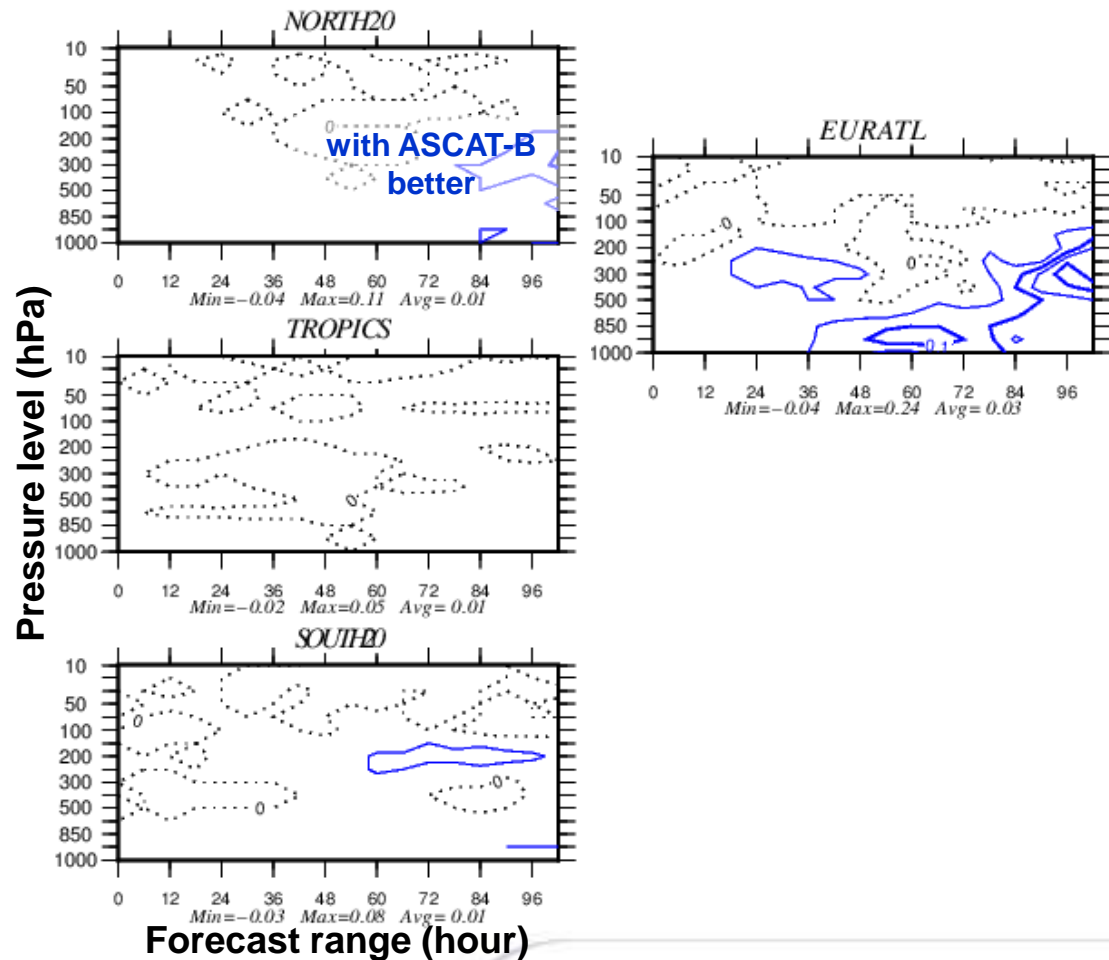
OSCAT-t2 versus without OSCAT, January 2012 (3/3)
regional model ALADIN-Réunion (South-West Indian ocean)

Tropical Cyclones position error

Control
OSCAT

6 hours

Predictability improvement of
TC trajectories with OSCAT

Position Error [km]

Forecast Lead [Hr]

(c) Meteo France DIR/RE/CRC
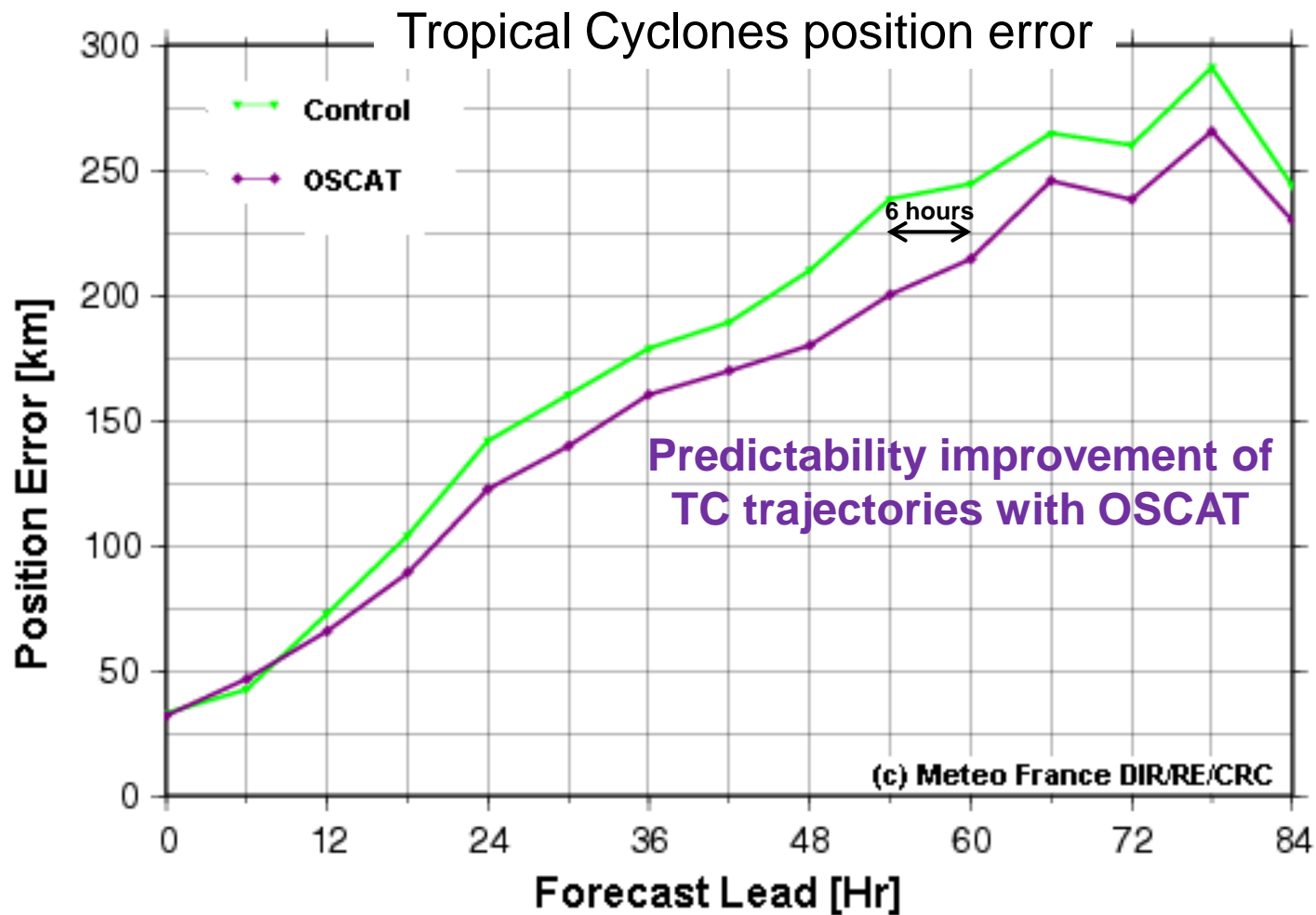
Scatterometer winds impact in operational ARPEGE (1/3)
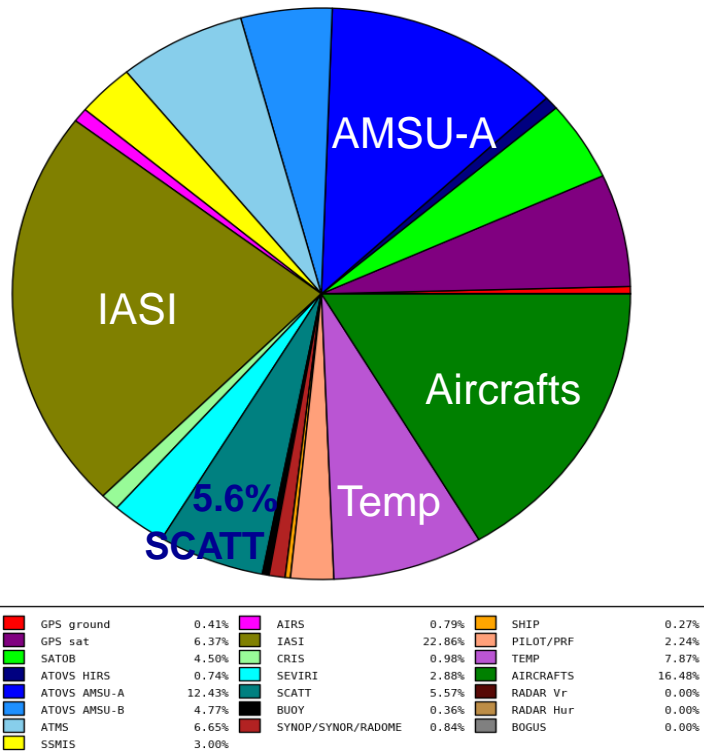
## Degrees of Freedom for Signal in % (observations impact in the analysis)

Part des DFS par type d'obs
analyses cut-off long - ARPEGE metropole oper
observations conventionnelles et satellites
cumul du DFS sur la période 2013122700 - 2013122718 : 233933

GPS ground	0.41%	AIRS	0.79%	SHIP	0.27%
GPS sat	6.37%	IASI	22.86%	PILOT/PRF	2.24%
SATOB	4.50%	CRIS	0.98%	TEMP	7.87%
ATOVS HIRS	0.74%	SEVIRI	2.88%	AIRCRAFTS	16.48%
ATOVS AMSU-A	12.43%	SCATT	5.57%	RADAR Vr	0.00%
ATOVS AMSU-B	4.77%	BUOY	0.36%	RADAR Hur	0.00%
ATMS	6.65%	SYNOP/SYNOR/RADOME	0.84%	BOGUS	0.00%
SSMIS	3.00%				

Forecast Error Contribution (reduction) in %

September 2012: ASCAT-A
September 2013: ASCAT-A&B, OSCAT

7.9% (3.2% ASCAT, 4.7% OSCAT)

- ASCAT-A&B, OSCAT in 2013: 2% of used data
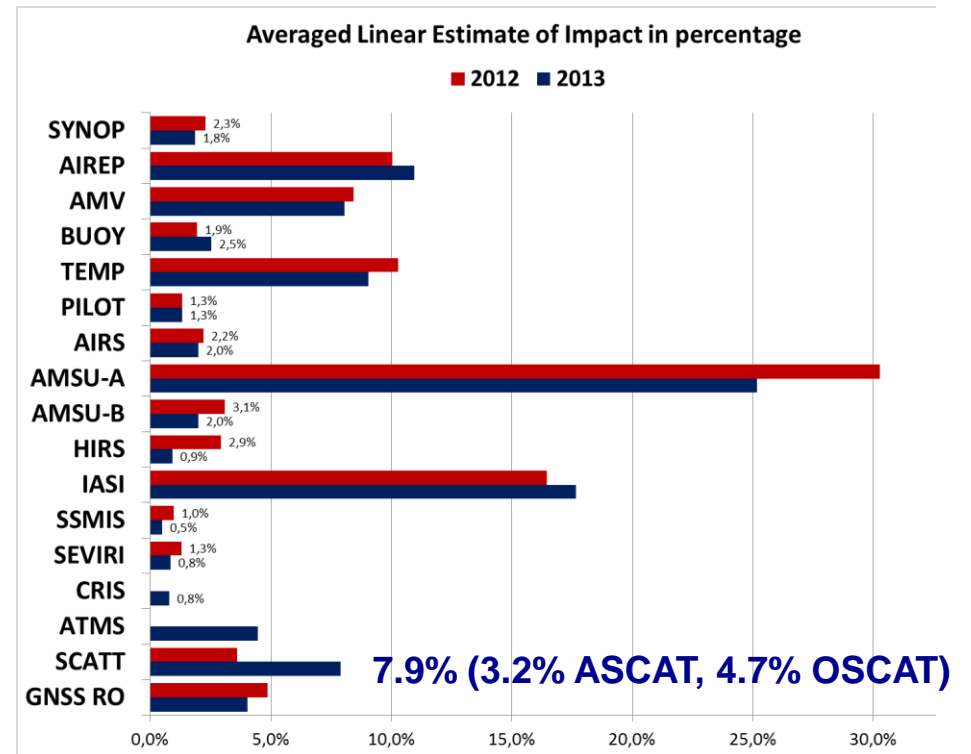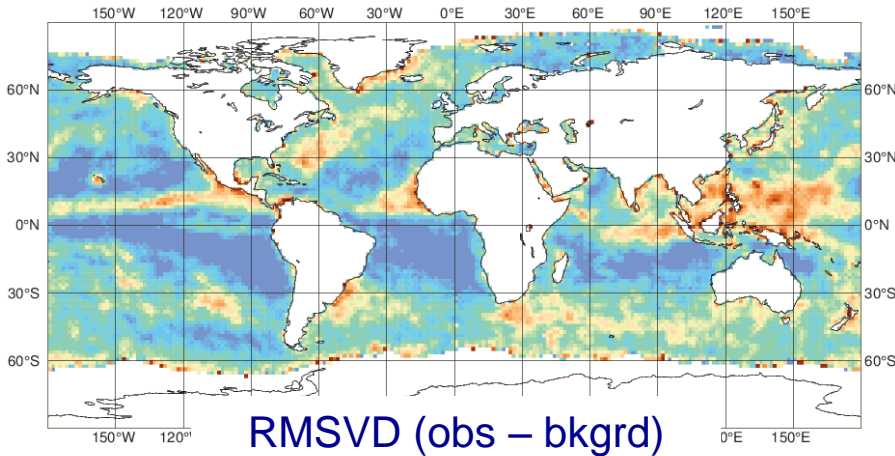
Scatterometer winds impact in operational ARPEGE (2/3)

ASCAT-A

10mvectordiff (m/s) from METOP-A/ASCAT
Best ambiguous wind, Used data [time step = 6 hours]
RMS of first guess departure (obs-fg), All_surfaces
Exp = OPER, Data period = 2013-08-31 21:00 - 2013-09-30 21:00
Grid : 1.50 x 1.50 / Min: 0.140 Max: 5.895 Mean: 1.934
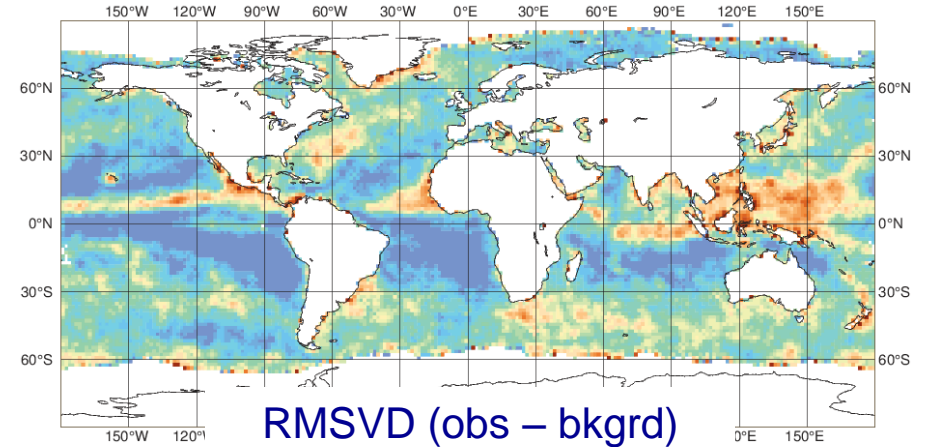

RMSVD (obs – bkgrd)

ASCAT-B

10mvectordiff (m/s) from METOP-B/ASCAT
Best ambiguous wind, Used data [time step = 6 hours]
RMS of first guess departure (obs-fg), All_surfaces
Exp = OPER, Data period = 2013-08-31 21:00 - 2013-09-30 21:00
Grid : 1.50 x 1.50 / Min: 0.014 Max: 7.387 Mean: 1.937

RMSVD (obs – bkgrd)

OSCAT

10mvectordiff (m/s) from 421/2288
Best ambiguous wind, Used data [time step = 6 hours]
RMS of first guess departure (obs-fg), All_surfaces
Exp = OPER, Data period = 2013-08-31 21:00 - 2013-09-30 21:00
Grid : 1.50 x 1.50 / Min: 0.292 Max: 6.105 Mean: 1.901

RMSVD (obs – bkgrd)
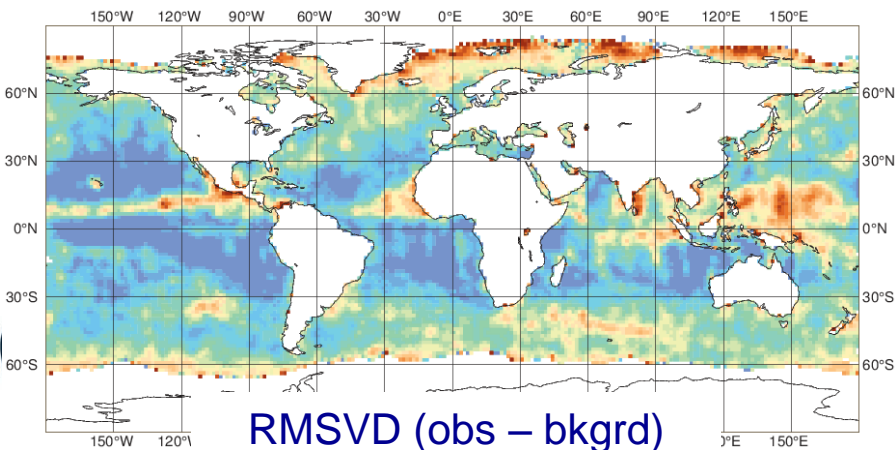
ALL SCATT

Averaged Linear Estimate of Impact (LEI): -10673 J/kg
From 2013/09/01 at 00UTC to 2013/09/30 at 18UTC / Grid: 2° × 2°
ive function : Total energy of the 24h forecast error
Scatterometer, parameter: U/V-comp neutral wind, level: 10m

Improvement   LEI   Degradation
-38. -18. -14. -10. -6. -2.   2. 6. 10. 14. 18. 30.

24h Forecast Error Contribution
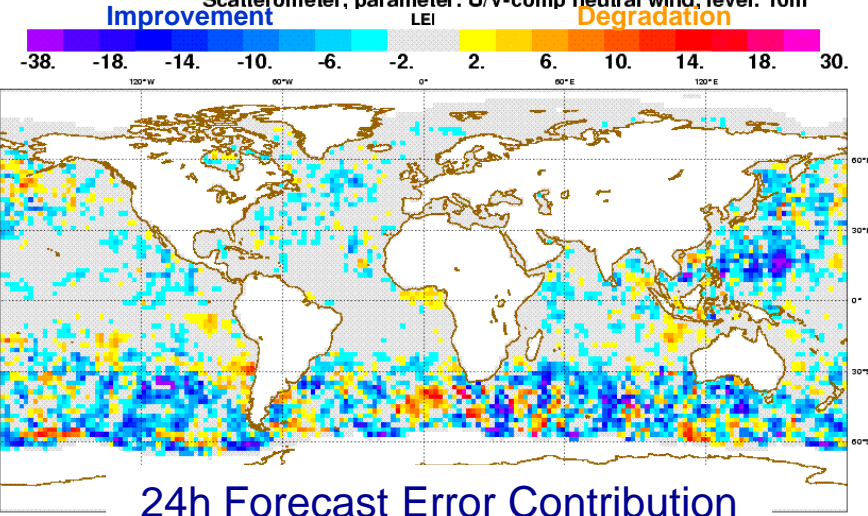
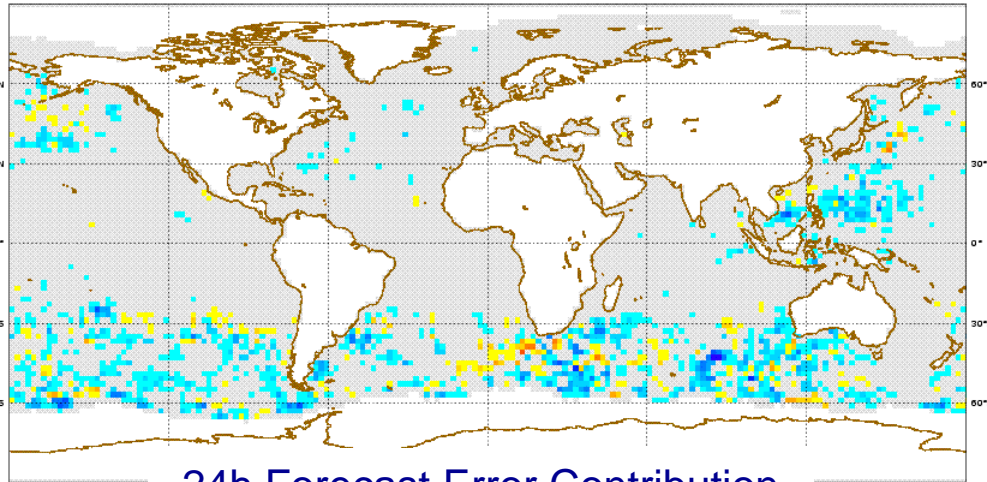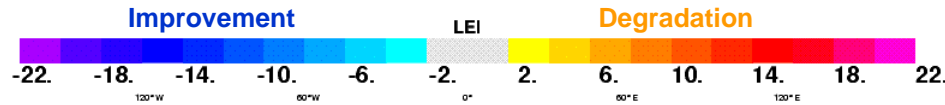# Scatterometer winds impact in operational ARPEGE (3/3)

ASCAT-A & B

Averaged Linear Estimate of Impact (LEI): -4905 J/kg
Experiment: 56FR / From 2013/09/01 at 00UTC to 2013/09/30 at 18UTC / Grid: 2° × 2°
Objective function : Total energy of the 24h forecast error
Observation type: Ascat, parameter: U/V-comp neutral wind, level: 10m

Improvement LEI **Degradation**

| -22. | -18. | -14. | -10. | -6. | -2. | 2. | 6. | 10. | 14. | 18. | 22. |

24h Forecast Error Contribution

OSCAT

Averaged Linear Estimate of Impact (LEI): -5768 J/kg
Experiment: 56FR / From 2013/09/01 at 00UTC to 2013/09/30 at 18UTC / Grid: 2° × 2°
Objective function : Total energy of the 24h forecast error
Observation type: Oscat, parameter: U/V-comp neutral wind, level: 10m

Improvement LEI **Degradation**

| -34. | -18. | -14. | -10. | -6. | -2. | 2. | 6. | 10. | 14. | 18. | 32. |

24h Forecast Error Contribution

- FEC (ASCAT): smooth, degradation areas limited
- FEC (OSCAT): forecast error reduction globally higher, but contribution noisier, almost all degradation zones come from OSCAT
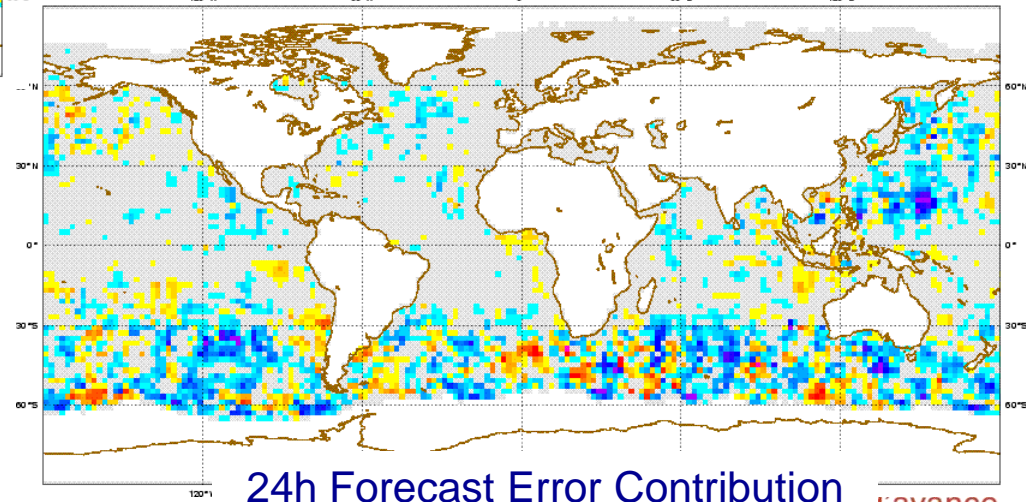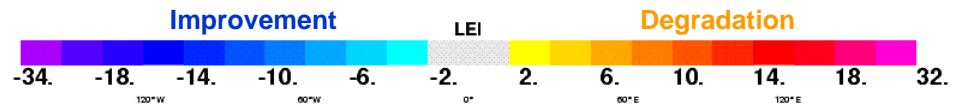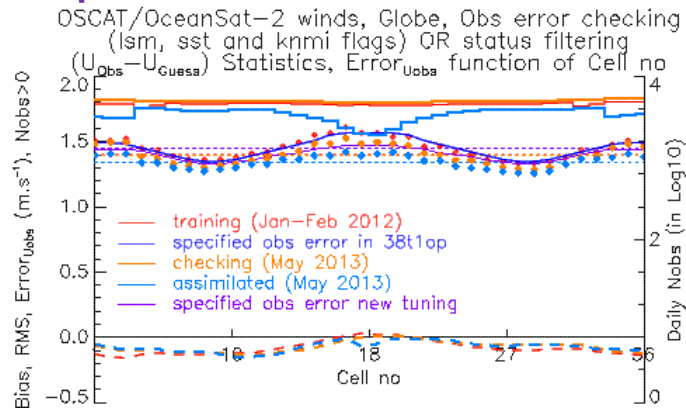
Conclusion

- OSCAT was beneficial for the forecast skill under condition of a safe selection of data, ASCAT-B is also beneficial but more lightly

- Scatterometer winds adjust the model especially for the tracking of the tropical cyclones and the southern storms

- Operational use of scatterometer winds suffers now of the loss of OSCAT

- Scatterometer constellation well distributed may have an important impact in term of short term forecast error reduction

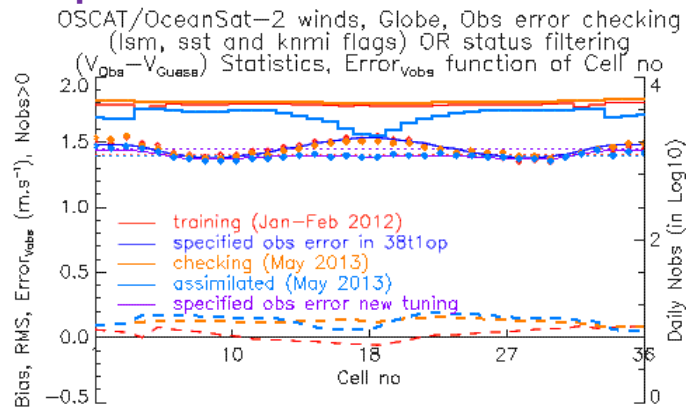 - There are still rough things, so I think we can do even better!

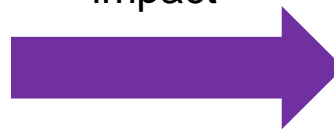# As example, OSCAT could have been even better

New OSCAT error tuning

Ucomp error: 1.5m/s

OSCAT/OceanSat-2 winds, Globe, Obs error checking (lsm, sst and knmi flags) OR status filtering ($U_{Obs}-U_{Guess}$) Statistics, Error$_{Uobs}$ function of Cell no

- training (Jan-Feb 2012)
- specified obs error in 38t1op
- checking (May 2013)
- assimilated (May 2013)
- specified obs error new tuning

Vcomp error: 1.4m/s

OSCAT/OceanSat-2 winds, Globe, Obs error checking (lsm, sst and knmi flags) OR status filtering ($V_{Obs}-V_{Guess}$) Statistics, Error$_{Vobs}$ function of Cell no

- training (Jan-Feb 2012)
- specified obs error in 38t1op
- checking (May 2013)
- assimilated (May 2013)
- specified obs error new tuning

Forecast score impact

RMS(Z) scores difference / TEMP isoline 0.25m

NORTH20

Min=-0.08 Max=0.6 Avg= 0.12

new OSCAT error tuning better

TROPICS

Min=-0.14 Max=0.17 Avg=-0.01

SOUTH20

Min=-0.35 Max=0.3 Avg=-0.01

Pressure level (hPa)

Forecast range (hour)