# Assimilation of Scatterometer Winds at Météo-France

<u>Christophe Payan</u>, Nathalie Boullot <sup>(1)</sup>, Dominique Mékies <sup>(2)</sup>

<sup>(1)</sup> CNRM and GAME, Météo-France and CNRS <sup>(2)</sup> LACy, La Réunion University, CNRS and Météo-France



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### Outline

Operational use of scatterometer winds

OSCAT assimilation

Scatterometer impact





### Operational use of scatterometer winds (1/3)

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



Swaths overlap, but ASCAT-A and ASCAT-B separated by 50 minutes, OSCAT is 2h30 later

EO FRANCE

Toujours un temps d'avance

With 1h timeslot in 4DVar, ASCAT(A+B)=1.8\*ASCAT(A)



### Operational use of scatterometer winds (2/3)

Product:

- L2 wind product from the EUMETSAT OSI-SAF (KNMI)
- 50km resolution (25km grid for ASCAT data)
- Received in NRT by EUMETCAST, WMO BUFR format

Quality control (assimilated data):

- No model land fraction
- Model SST > -1°C for ice contamination
- Model or observation speed < 35 m/s</p>
- KNMI Quality Flags unset (monitoring, variational control, distance to cone (including ice screening for ASCAT, rain contamination for OSCAT))

OSCAT:

Azimuth check between the 2 most likely solutions (>135deg)





### Operational use of scatterometer Winds (3/3)

Assimilation:

- Spatial correlations removal by 100km thinning for ASCAT, weight 0.27 for OSCAT
- Assimilated as neutral wind, zonal/meridian components
- Observation error dependence on cross-track position (since July 2013)
- No-bias correction
- All ambiguous solutions considered (until 4), including ASCAT winds
- De-aliasing of ambiguous solutions done on-the-fly during the assimilation processing



## OSCAT



OSCAT-t1 versus without OSCAT, on January 2012 (1/6) ARPEGE Forecast score on Z / TEMP, zoom North America



#### OSCAT-t1 versus without OSCAT, on January 2012 (2/6) OSCAT Forecast Error Contribution for the forecast run of 09/01 r0



- Forecast error contribution generally weak (grey is within 5% of the max value)
  - Globally, OSCAT is detrimental on this run (+499 J/Kg)
    - Some areas have higher impacts, including the North Pacific



Averaged Linear Estimate of Impact (LEI): 14209 J/kg Experiment: B2TH / From 2012/01/09 at 00UTC to 2012/01/09 at 00UTC / Grid:  $2^{\circ} \times 2^{\circ}$ 

#### OSCAT-t2: test 1 +azimuth CTRL versus without OSCAT, January 2012 (3/6) OSCAT Forecast Error Contribution for the forecast run of 09/01 r0

-1600.



run	FEC (J/Kg) N. Pacific	FEC (J/Kg) Global	Score RMS(Z500) N.A +96h / TEMP (m)
Reference	n.a	n.a	53
OSCAT-t1	+14209	+499	77
M1+M2	-15570	-29280	53
OSCAT-t2	-1424	-9405	53

Averaged Linear Estimate of Impact (LEI): -9405 J/kg  $^{1000}_{2000}$  eriment: B3GZ / From 2012/01/09 at 00UTC to 2012/01/09 at 00UTC / Grid: 2° × 2° Objective function : Total energy of the 24h forecast error Observation type: Oscat, parameter: U/V-comp neutral wind, level: 10m

Averaged Linear Estimate of Impact (LEI): -1424 J/kg Experiment: B3GZ / From 2012/01/09 at 00UTC to 2012/01/09 at 00UTC / Grid: 2° × 2° Objective function : Total energy of the 24h forecast error Observation type: Oscat, parameter: U/V-comp neutral wind, level: 10m





OSCAT-t2: test 1 +azimuth CTRL versus without OSCAT, January 2012 (4/6) ARPEGE Forecast score on Z500 r0+96h / TEMP, North America & Europe



#### OSCAT-t2: test 1 +azimuth CTRL versus without OSCAT, 2 periods (5/6) ARPEGE forecast scores RMS(Z) difference / TEMP, large areas



January 2012: RMS(Z) score more neutral with the azimuth check (++NH, -SH)

- December 2012 (pre-operational context): positive impact of OSCAT (with azimuth check) confirmed
  - Toujours un temps d'avance

# OSCAT-t2 versus without OSCAT, January 2012 (6/6) regional model ALADIN-Réunion (South-West Indian ocean)



frontières

## Scatterometer winds impact in operational ARPEGE (1/2)

# Degrees of Freedom for Signal in % (observations impact in 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



#### Forecast Error Contribution (reduction) in %

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





ASCAT-A&B, OSCAT in 2013: 2% of used data



#### Scatterometer winds impact in operational ARPEGE (2/2)



OSCAT

60°N

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: 1.901 120°E 150°W 30°W 60°E 90°E 150°E 120°W 90°W 60°W 0°F 30°E





Averaged Linear Estimate of Impact (LEI): -10673 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: Scatterometer, parameter: U/V-comp neutral wind, level: 10m



## Conclusion

- OSCAT was beneficial for the forecast skill under condition of a safe selection of data
- Operational use of scatterometer winds suffers now of the loss of OSCAT
- Scatterometer winds are very beneficial for tracking the tropical cyclones and the southern storms
- Scatterometer constellation well distributed may have an important impact in term of forecast error reduction
  - There are still rough things, so I think we can do even better!





### As an example, OSCAT could have been even better

impact

#### New OSCAT error tuning

#### Ucomp error: 1.45m/s



#### Vcomp error: 1.40m/s





