

IMPROVEMENTS IN THE USE OF SCATTEROMETER WINDS AT METEO FRANCE

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Brief history

- QuikScat winds assimilated since 10/2004, in-house inversion with QSCAT-1, only 2 most likely solutions on up to 4 considered in the assimilation step.
- ERS-2 winds assimilated since 09/2007, in-house inversion with CMOD5.4.
- Ascet winds on Metop-2 assimilated since 02/2008, from Eumetsat OSI-SAF (KNMI), with CMOD5.
- Impact estimated in the frame of the GSM Arpège, with operational use extended to the LAM models (Aladin and Arome).
- Better quality than similar data (Ships, Buoys) and a global oceanic coverage.
- Neutral or weak positive impact on the forecast scores with, for QuikScat data, a strict selection of the observations, with a high rate of rejection.

Overview

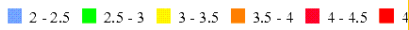
- Use of **4** instead of **2** most likely solutions for Quikscat winds.
- **Neutral** wind instead of **Real** wind in the assimilation.

Metop versus QuikScat 2 solutions (oper until 06/2008):

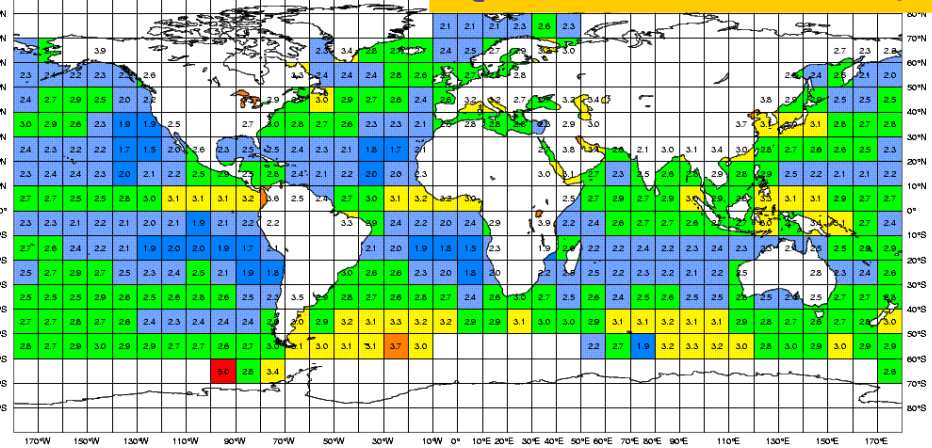
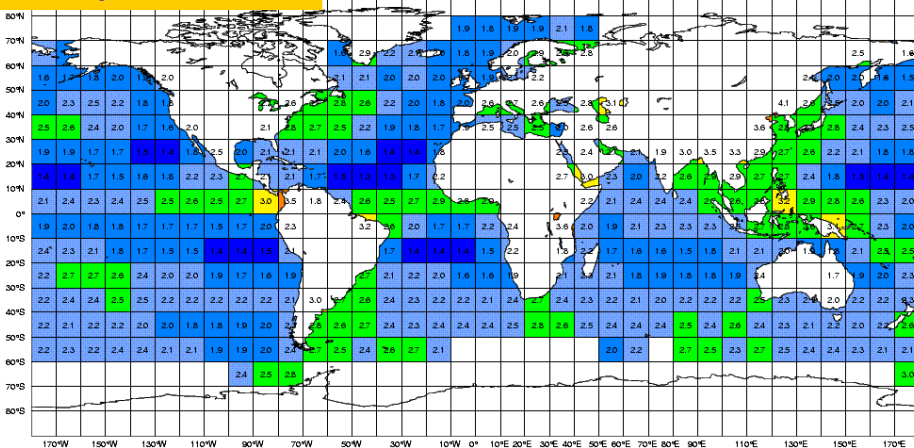
DIFF VECTOR (Obs-Background)

2nd Quarter 2008

Metop: 2.3m/s



QuikScat 2sols: 2.7m/s



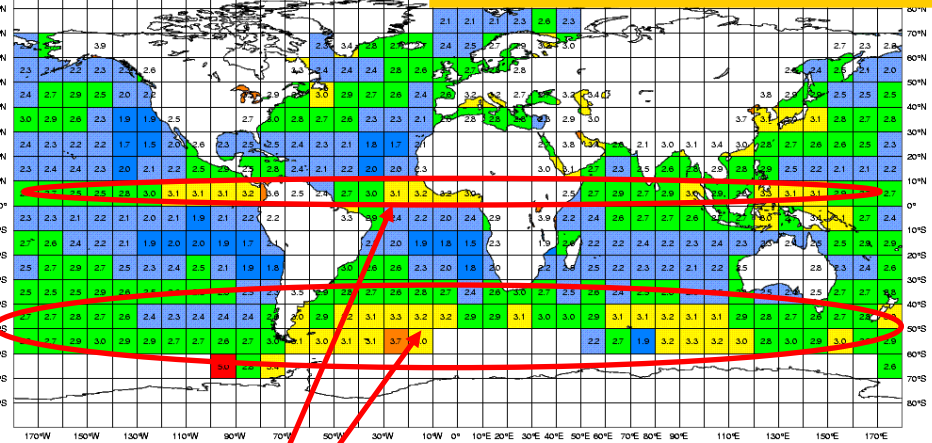
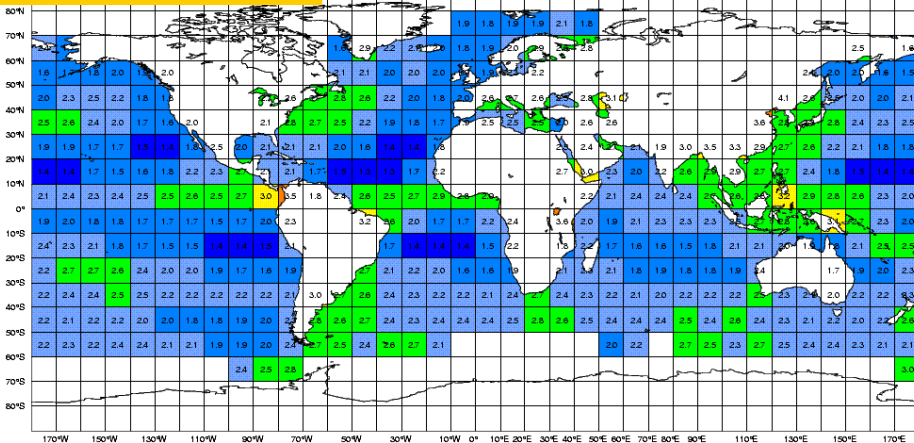
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- With the use of the 2 most likely solutions only, Quikscat winds have higher differences than Ascats winds wrt the model background in rainy/strong wind areas (ITCZ, baroclinic areas).

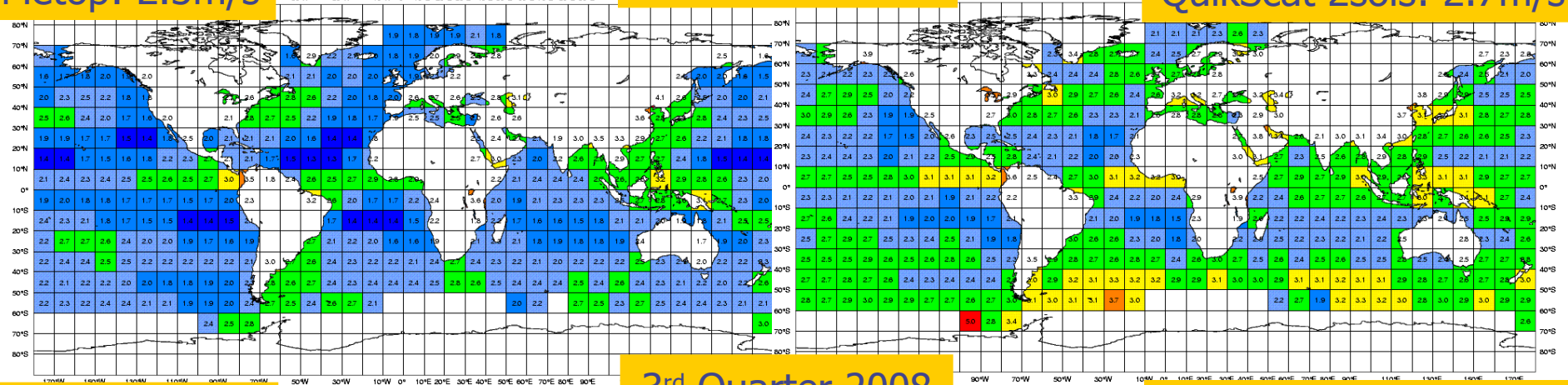
Metop versus QuikScat 4 solutions (oper since 07/2008):

DIFF VECTOR (Obs-Background)

2nd Quarter 2008

Metop: 2.3m/s

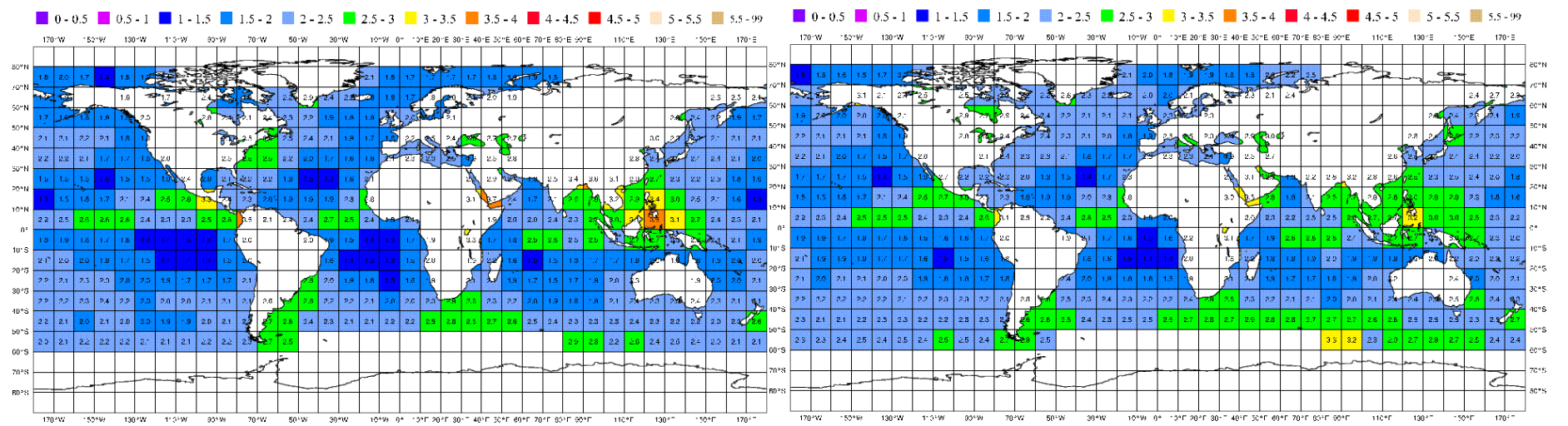
QuikScat 2sols: 2.7m/s



3rd Quarter 2008

Metop: 2.2m/s

QuikScat 4sols: 2.3m/s



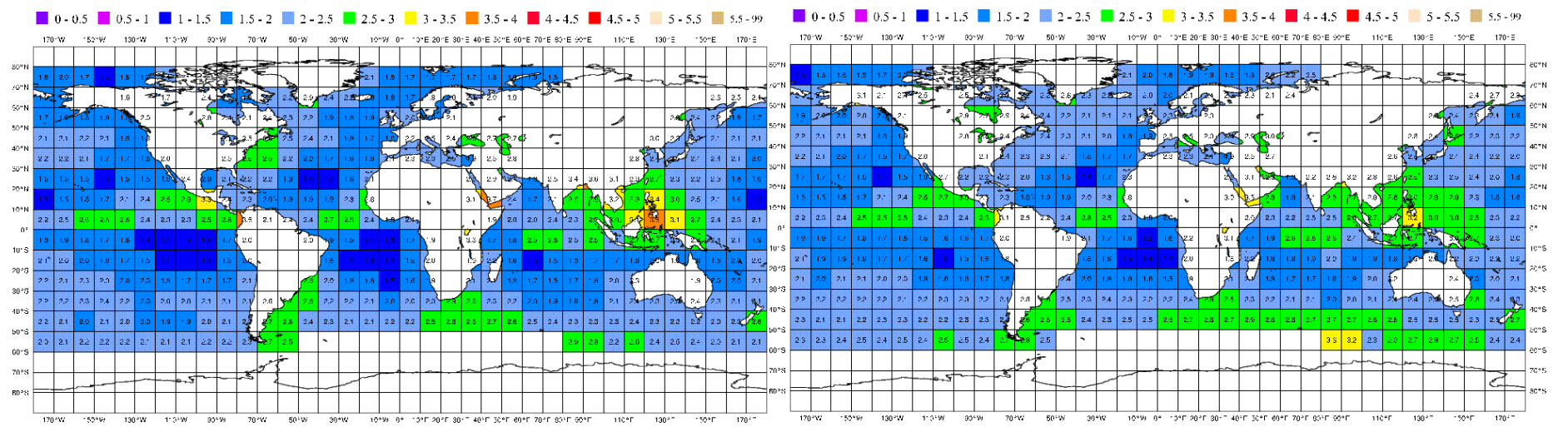
Metop versus QuikScat 4 solutions (oper since 07/2008):

- Differences between Ascat and QuikScat have disappeared with 4 wind solutions for QuikScat.
- Without losing information where differences to the background have already been in agreement (and lower)!
- Test showed nevertheless a neutral impact on forecasts until 4 days!

3rd Quarter 2008

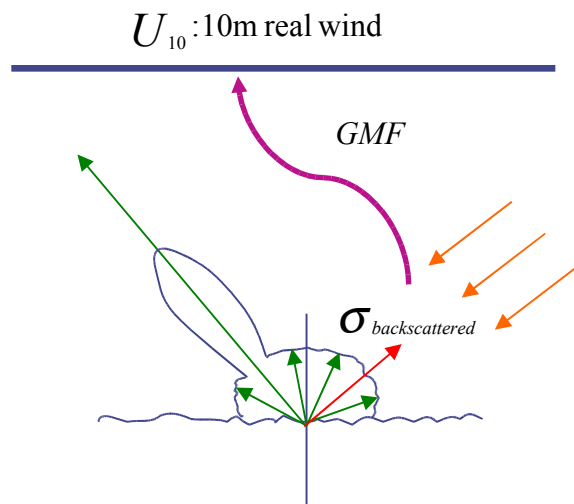
Metop: 2.2m/s

QuikScat 4sols: 2.3m/s



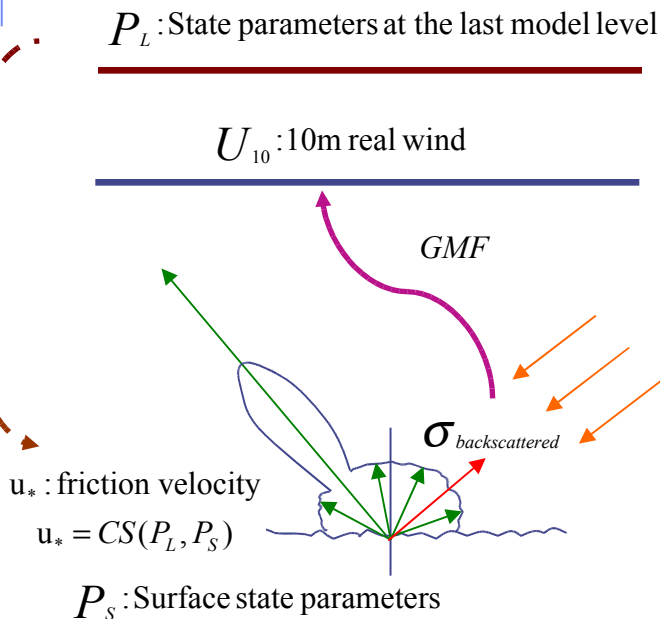
Neutral Wind versus Real Wind?

- Geophysical Model Function: conditions of stability (CS) treated implicitly
 - true in mean but source of error for a singular observation
 - in theory, $U_{10} = \text{GMF}(\sigma_o, \text{CS})$, in practice not possible
- => solution: $U_{10N} = \text{GMF}_N(\sigma_o, \text{CS}=\text{neutre})$



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➤ observation operator (Geleyn 1987):

$$U_{10} = U_L [\text{LOG}(z, z = z_0, m) - \text{COR}(\text{CS})] / \text{BD}(U_L, u_*)$$

with

U_L model wind at the last level, $\sim 10 \text{ m}$

z_0 roughness length

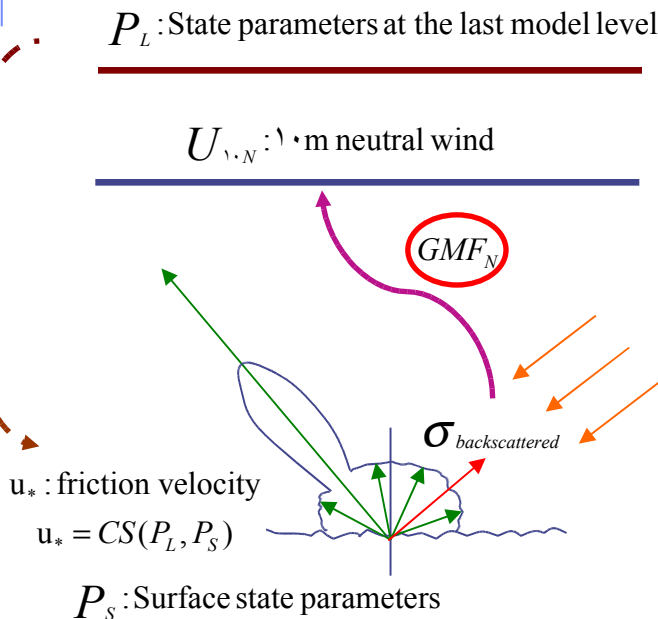
LOG logarithmic function of z_0 and z

COR corrective term function of stability conditions

BD drag coefficient function of U_L and u_*

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➤ observation operator (Geleyn 1987):

$$U_{10,N} = U_L [LOG(z, z_0) - COR(CS)] / BD(U_L, u_*)$$

with

U_L model wind at the last level, ~10 m

z_0 roughness length

LOG logarithmic function of z_0 and z

COR corrective term function of stability conditions

BD drag coefficient function of U_L and u_*

Neutral Wind versus Real Wind: impact?

- test of neutral wind in the global model Arpège, from 22/11/2008 to 08/01/2009.
- in an emergency context (late due to pb of reproductibility in the surface operator) and after the switch to a neutral product for Ascat winds from KNMI (CMOD5.N used since 20/11).
- reference: E-suite Arpège (with a new scheme of turbulence (Cuxart et al, 2000)). Previous operational scheme based on Louis, 1979.
- for ERS-2 winds, home-made inversion with CMOD5.N and for QuikScat winds, change in the speed bias correction.



Metop: +0.3m/s

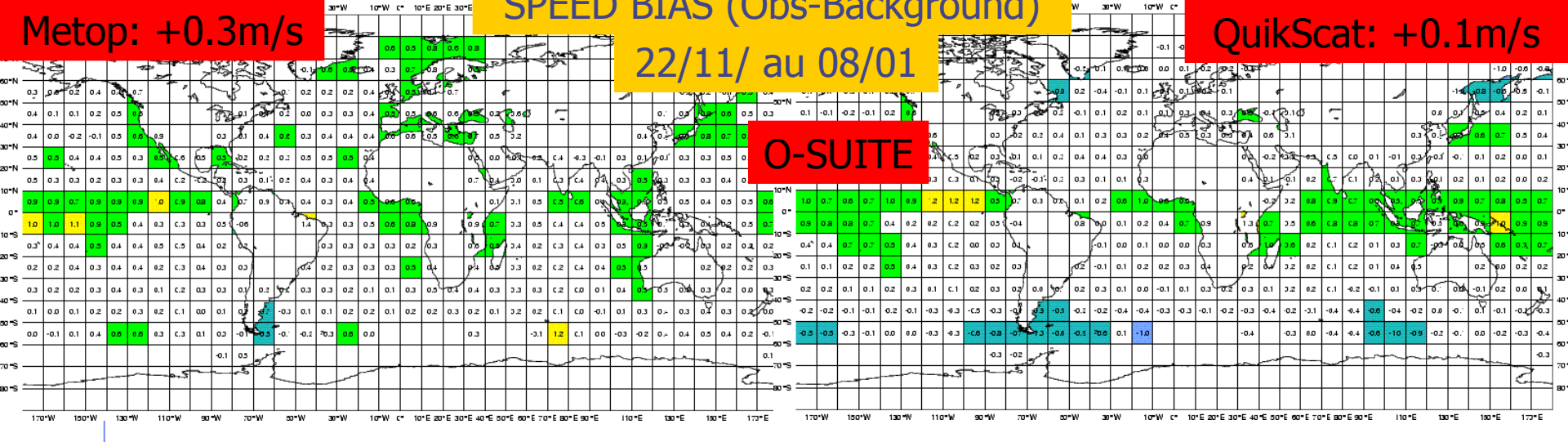
SPEED BIAS (Obs-Background)

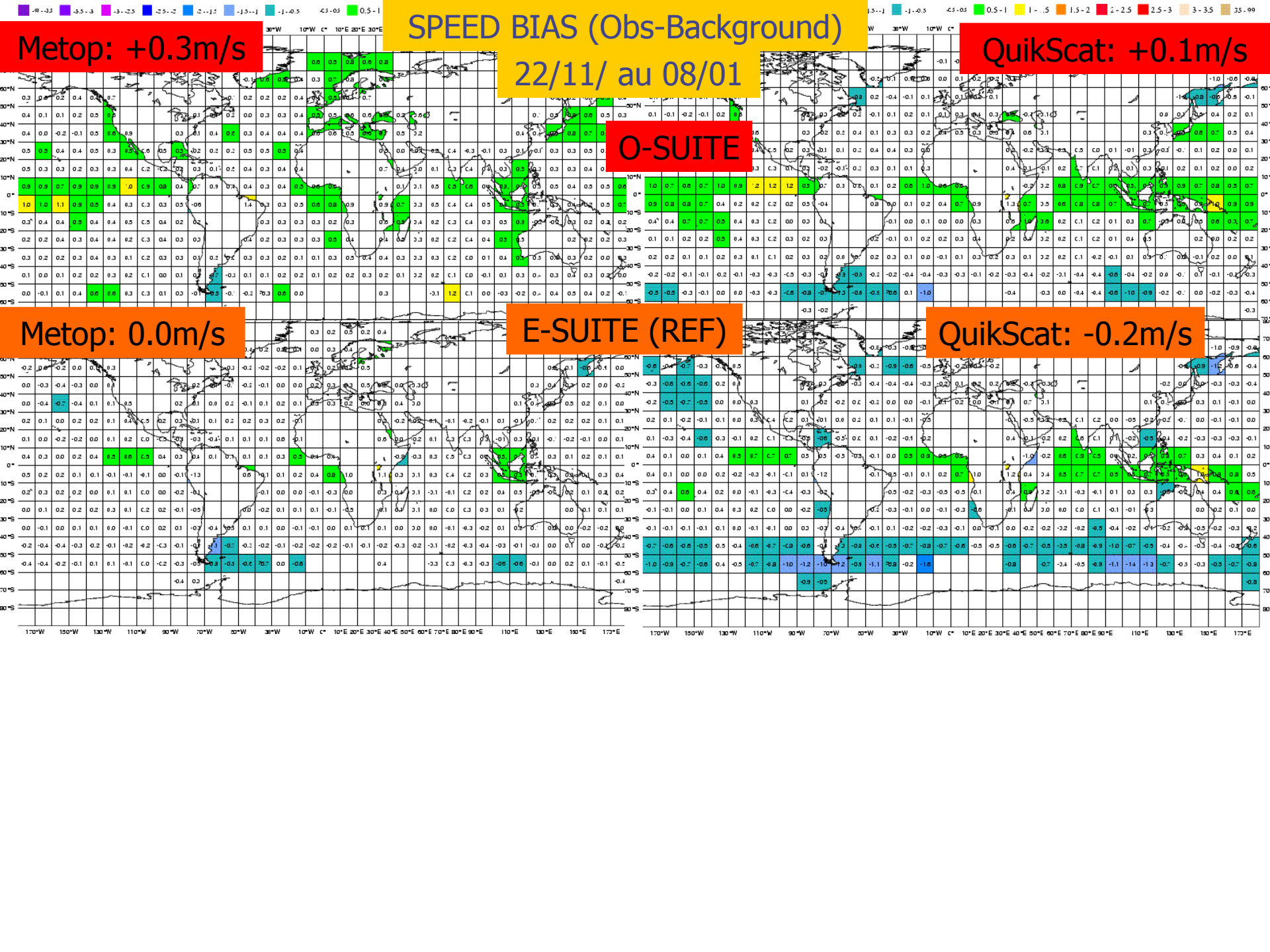
22/11/ au 08/01

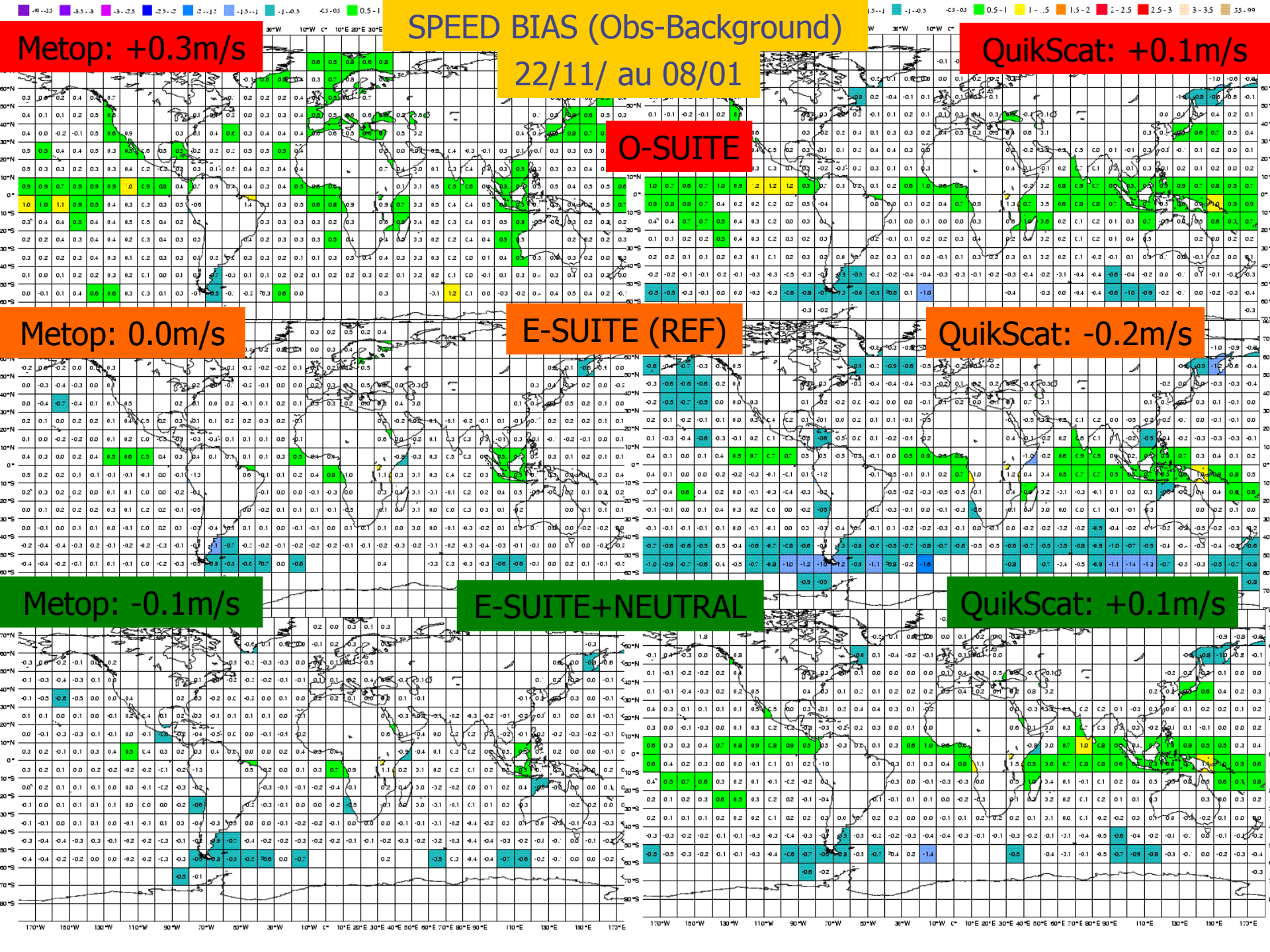
O-SUITE



QuikScat: +0.1m/s







Neutral Wind versus Real Wind: impact?

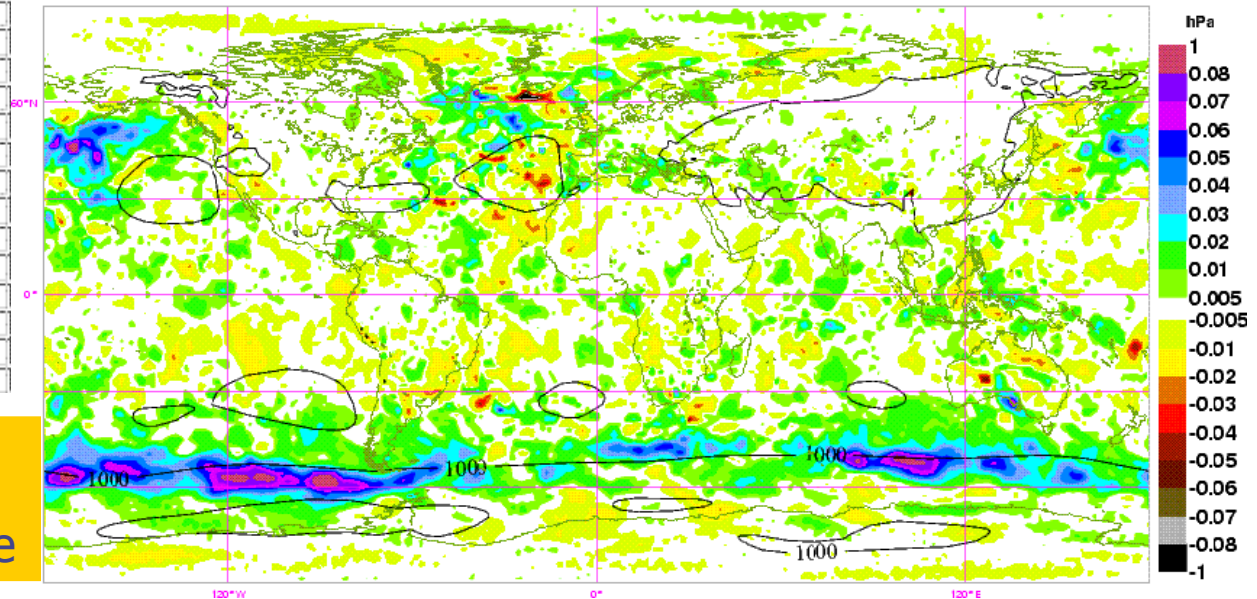
- Neutral-wind operator impact is neutral for Ascat/E-suite.
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- Speed bias improved for QuikScat/O-suite+E-suite (ITCZ+Mid-latitudes).
- Forecast impact positive/E-suite on the first ranges of forecast (->+24h) on SOUTH20 (Bootstrap Test/its own analysis).
- Confirmed by reduction of the analysis increments on the MSLP.

Domain	SUD20								TROPIC										
	0	12	24	36	48	60	72	84	96	0	12	24	36	48	60	72	84	96	
10																			
30	++		++		+														
50	++		+																
100																			
150	++	+																	
200	++	+																	
250	+	+																	
300	+	+																	
400	+																		
500	++	+	+																
700	++	+	+																
850	++	++	++																
925	++	++	++																
1000	++	++	++																

Diff in Fc-rms: rms(A6388+6-A6388+0) - rms(AB0P0+6-AB0P0+0)
 Par=MSLP, FcValid=20081121H12-20090109H12, Step=6, 197 cases
 NH=0.0013 SH= 0.0077 Trop= -0.0003 Eur=0.0016 NAmer= -0.0007 NATl= 0.0004 NPac= 0.0088



Blue: increments reduction

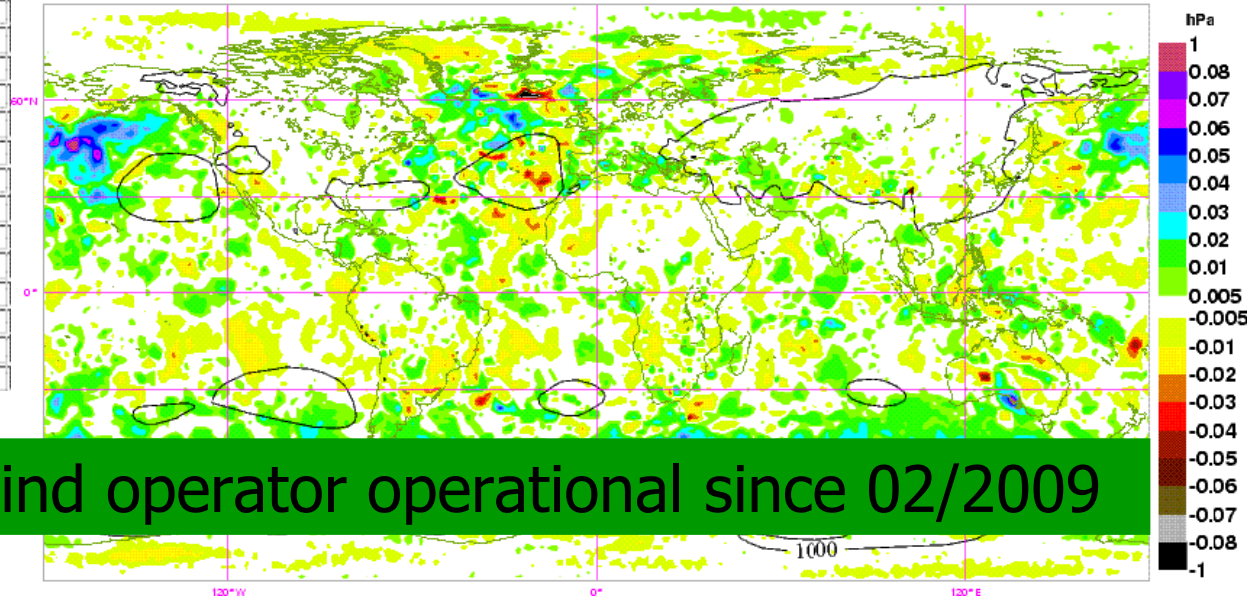
Yellow: increments increase

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Range																				
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Neutral-wind operator operational since 02/2009

Summary

- Equivalent quality between Ascet and QuikScat 4 solutions.
- Neutral-wind operator improves speed bias of QuikScat, is without effect on Ascet after turbulence scheme change and in the end better agreement between the Model and its Analysis.

Outlook

- Quality control improvements (ice,...)
- Tuning of observation errors, thinning,...
- Failure of QuikScat since last November, stop of ERS-2?
- Other instruments (OceanSat-2, ...)?