

Use of ATOVS raw radiances in the operational assimilation system at Météo-France

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on behalf of

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ITSC-XIII
St^e Adèle, Canada
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Status of ATOVS data

- ◆ Operational use of **AMSUA** raw radiances
 - ◆ Raw radiances instead of preprocessed radiances:
22 October 2002 (+ European & American profilers)
 - ◆ NOAA17 on top of NOAA15 & NOAA16:
17 December 2002
- ◆ Pre-operational suite with **HIRS** data
(+ revision of rain detection for **AMSUA**)
- ◆ Research experiments with **AMSUB** data

Assimilation of AMSUA raw radiances

- T_s in the control variable
- T extrapolation above the model top (1 hPa) up to 0.1 hPa by regression
- 250 km thinning

Conditions for use ✓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
3 < scan position < 28					✓	✓	✓	✓	✓	✓	✓	✓			
Open sea ($T_s \geq 271.45$ K)					✓	✓	✓	✓	✓	✓	✓	✓			
Sea ice ($T_s < 271.45$ K)							✓	✓	✓	✓	✓	✓			
Land orog < 500m / 1500 m for channels 5/6					✓	✓	✓	✓	✓	✓	✓	✓			
Clear ob-fg _{ch4} < 1.5 K 0.7 K					✓	✓	✓	✓	✓	✓	✓	✓			
Cloudy ob-fg _{ch4} > 1.5 K lat > 30° for channel 8 0.7 K								✓	✓	✓	✓	✓			

or CLWP(ch1; ch2) > 0.1 mm

Assimilation of AMSUA raw radiances

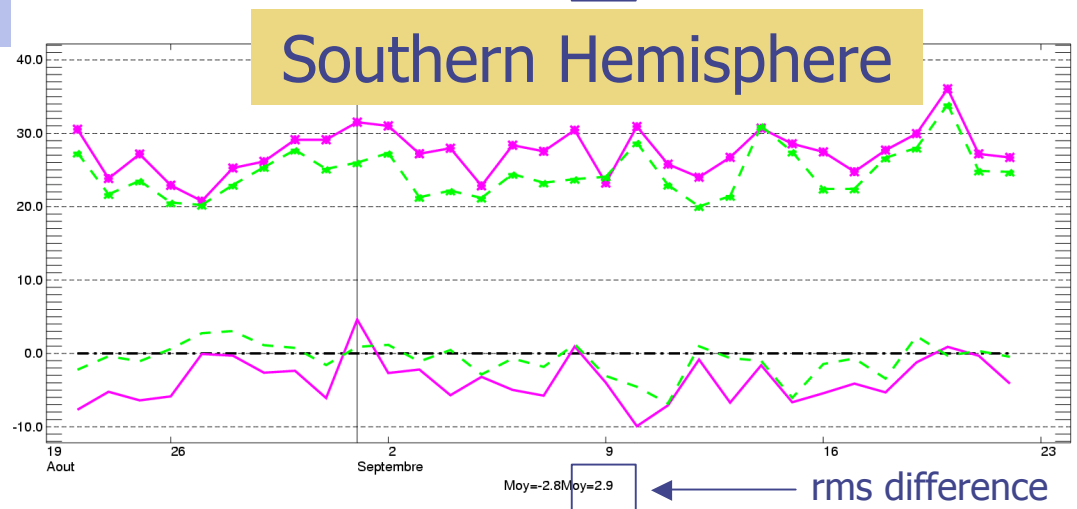
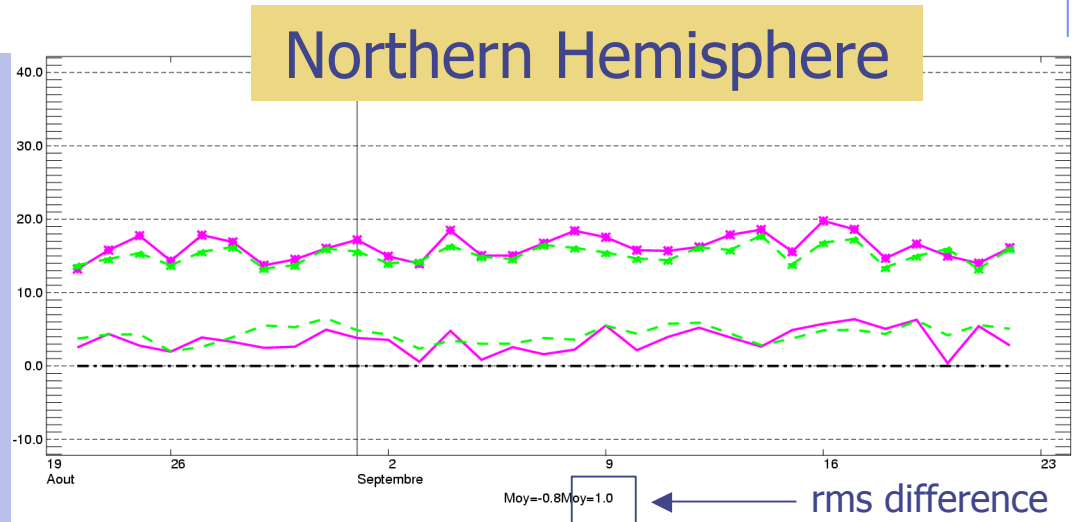
Time series of rms errors and biases

24 hour forecast
200 hPa geopotential
scores over 1 month
22 Aug - 22 Sep 2002

scores computed wrt
own analysis

Preprocessed radiances

Raw radiances



Research experiments with HIRS radiances

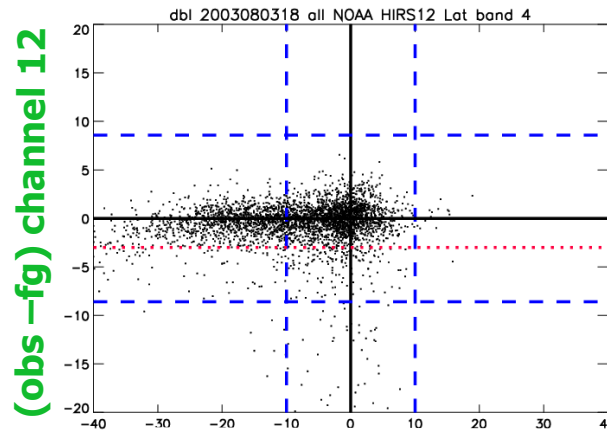
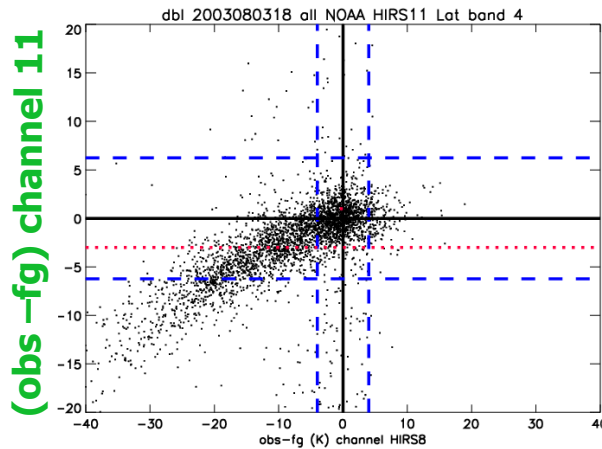
- On top of AMSUA data
- 250 km thinning (as for AMSUA)

Conditions for use	✓	1	2	3	4	5	6	7	8	10	11	12	13	14	15
$3 < \text{scan position} < 54$					✓	✓	✓	✓			✓	✓		✓	✓
Sea ($T_s > 271.45 \text{ K}$)					✓	✓	✓	✓			✓	✓		✓	✓
Land ($\text{orog} < 1500 \text{ m}$)												✓			
$x(\text{lat}) < (\text{ob-fg})_{\text{ch } 8} < y(\text{lat})$					✓	✓	✓	✓			✓	✓		✓	✓
$(\text{ob-fg})_{\text{ch } 11/12} > -3 \text{ K}$											✓	✓			

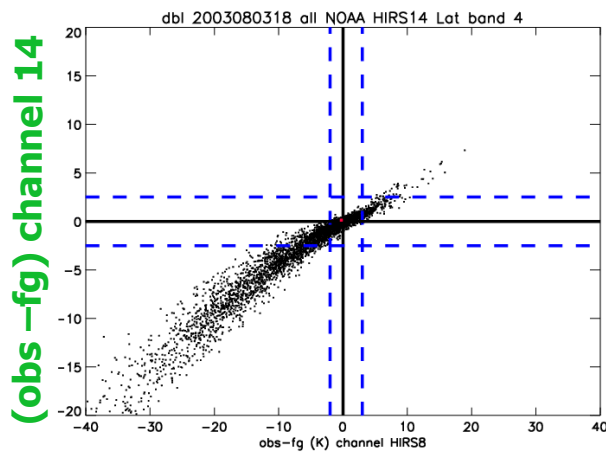
water vapour channels

Cloud detection and quality control

2003080318 [60°N-90°N]



Thresholds for
first guess
quality control
 $(\text{obs-guess})^2 < a(s_o^2 + s_b^2)$



(obs -fg) channel 8

Thresholds for cloud detection
(channel 8)

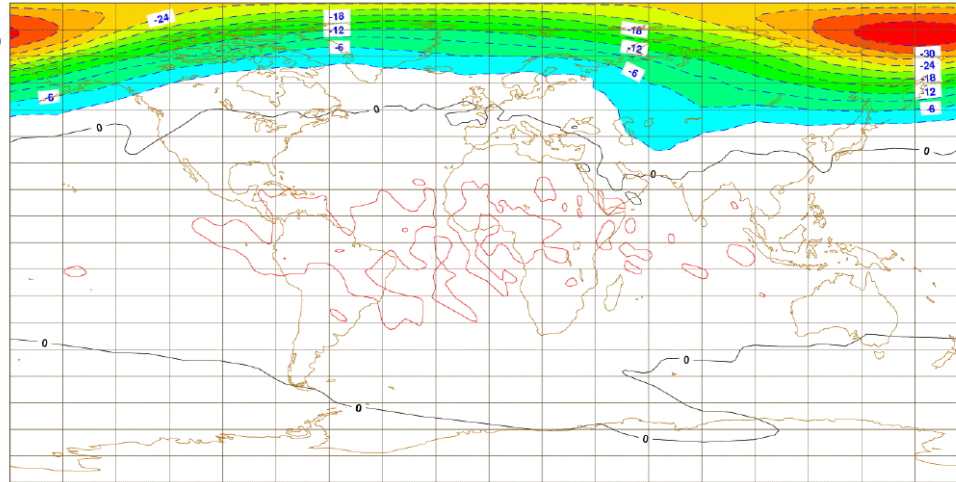
Cloud also estimated in CO₂ channels 1 to 8
(via gradient) and used to quality control other
HIRS channels (Kelly, 2002)

« Ringing » problem in the stratosphere over the North Pole

Ctr = without HIRS

Exp = with HIRS

1hPa T analysis difference Exp-Ctr 2003080918

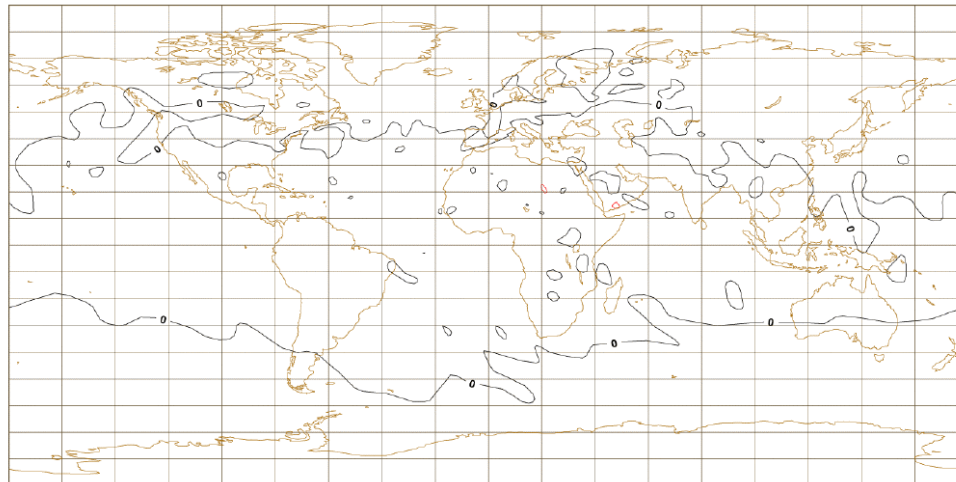


Zonal mean
(2 weeks)
analysis dif.
exp-ctr

$-11K < dif < 3K$

75 = [60°N-90°N]

1hPa T analysis diff Exp-Ctr 2003080918

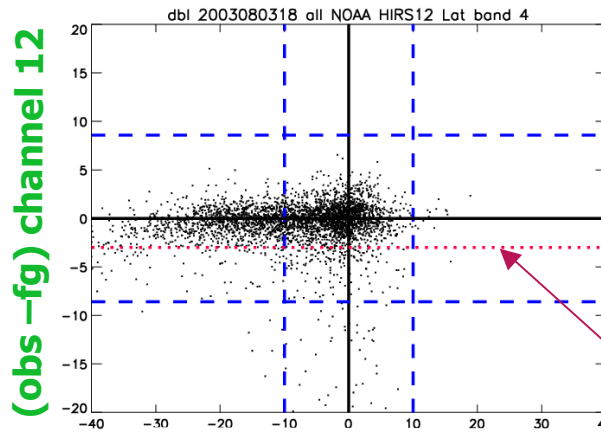
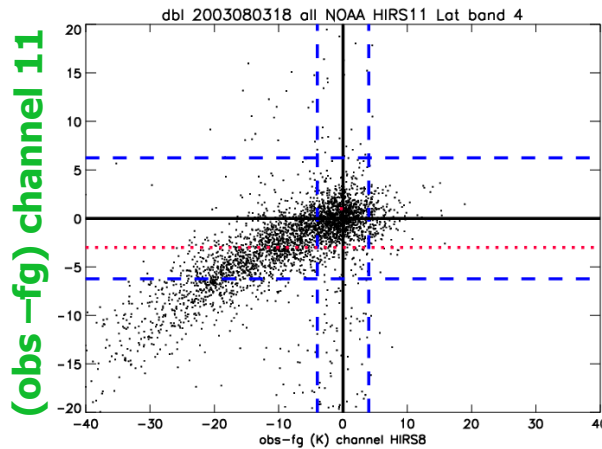


$|dif| < 0.2K$

Additional constraints:
obs-guess_{ch 11} > -3 K
obs-guess_{ch 12} > -3 K

Cloud detection and quality control

2003080318 [60°N-90°N]

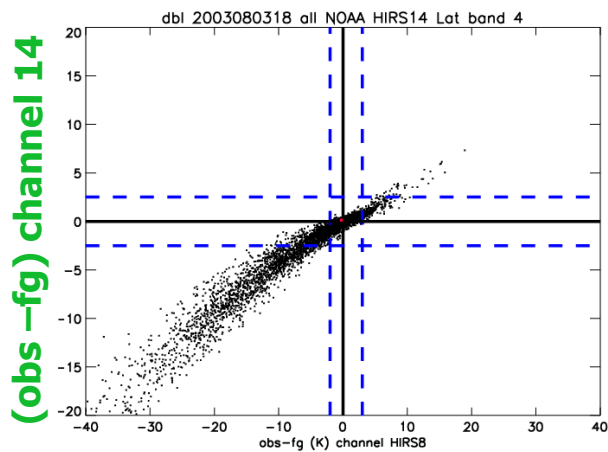


Thresholds for first guess quality control
 $(\text{obs} - \text{guess})^2 < a(s_o^2 + s_b^2)$

Additional thresholds for cloud detection (channels 11 and 12)

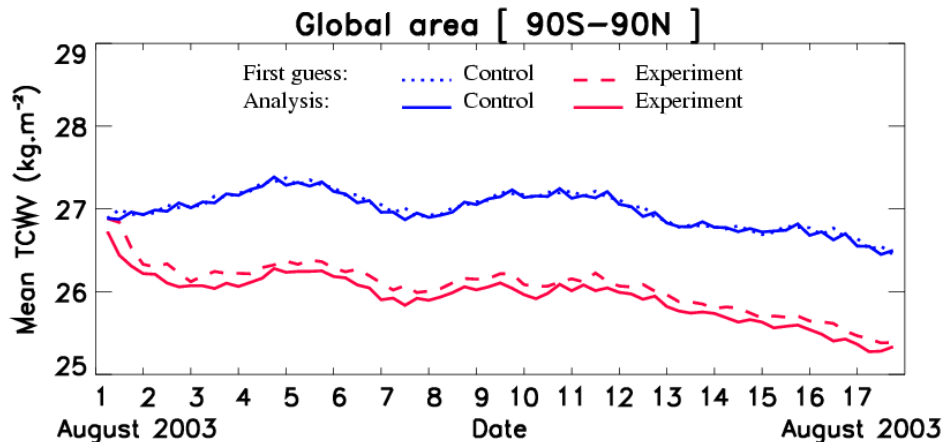
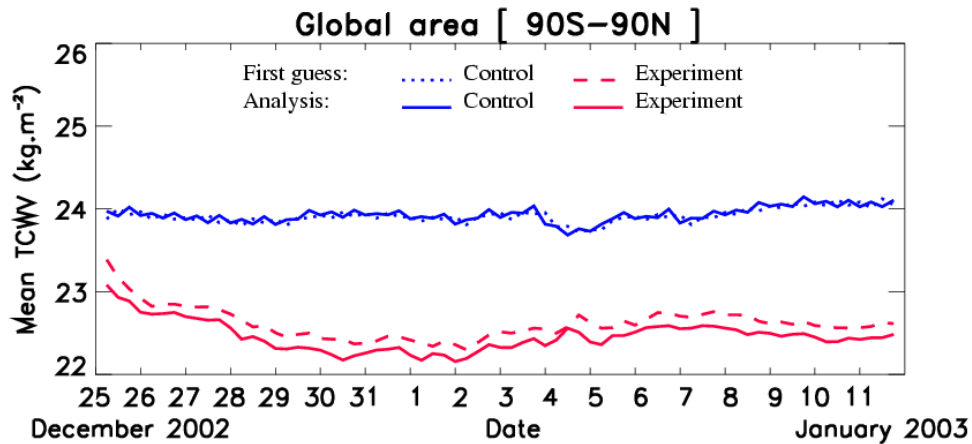
(obs - fg) channel 8

Thresholds for cloud detection (channel 8)



Cloud also estimated in CO₂ channels 1 to 8 (via gradient) and used to quality control other HIRS channels (Kelly, 2002)

TCWV time series



WINTER

%	Global	Sea	Land
Globe	-6.1	-7.4	-0.1
N. Hem	-3.0	-4.3	0.8
Tropics	-8.0	-9.6	-0.6
S. Hem	-4.7	-3.2	0.5

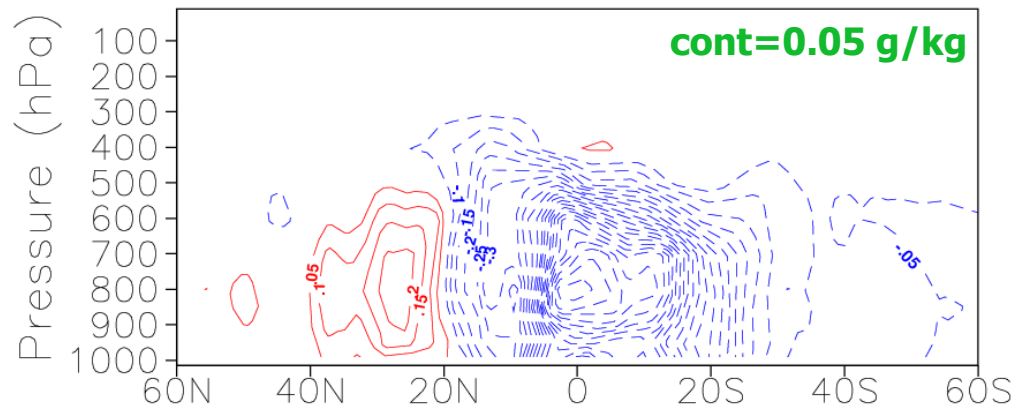
SUMMER

%	Global	Sea	Land
Globe	-3.9	-5.1	-0.3
N. Hem	1.1	1.9	-0.1
Tropics	-7.1	-8.7	-0.7
S. Hem	-3.3	-3.7	0.7

Humidity profile (summer)

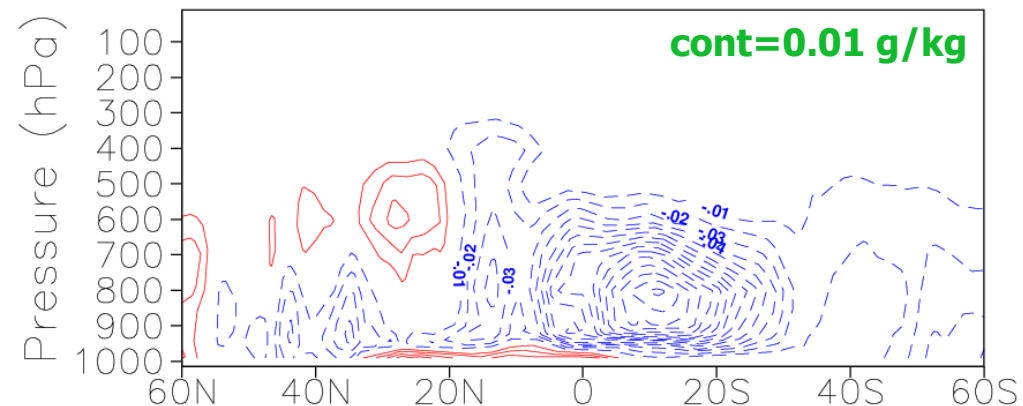
Analysis difference
exp – ctr

Global TCWV dif
-3.9 %



Exp increments
an – fg

Global TCWV inc
-0.4 %



Scores (winter)

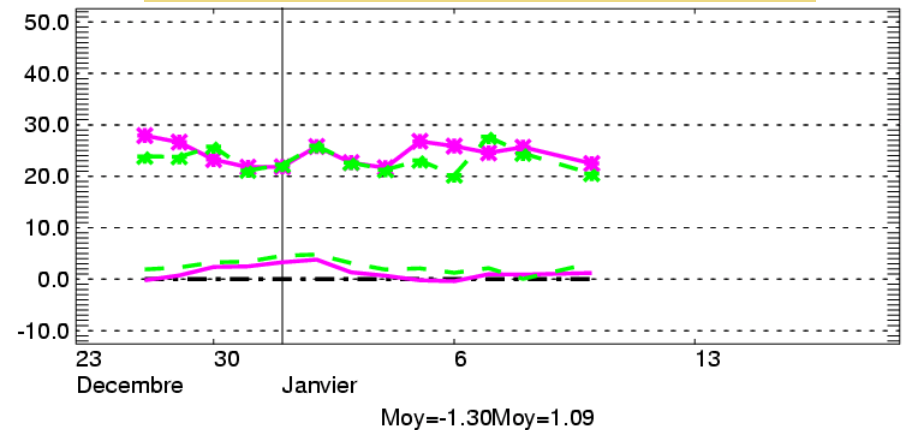
Time series of rms errors and biases
48 hour forecast - 500 hPa geopotential
2 weeks - 26 Dec 2002 – 10 Jan 2003

scores computed
wrt own analysis

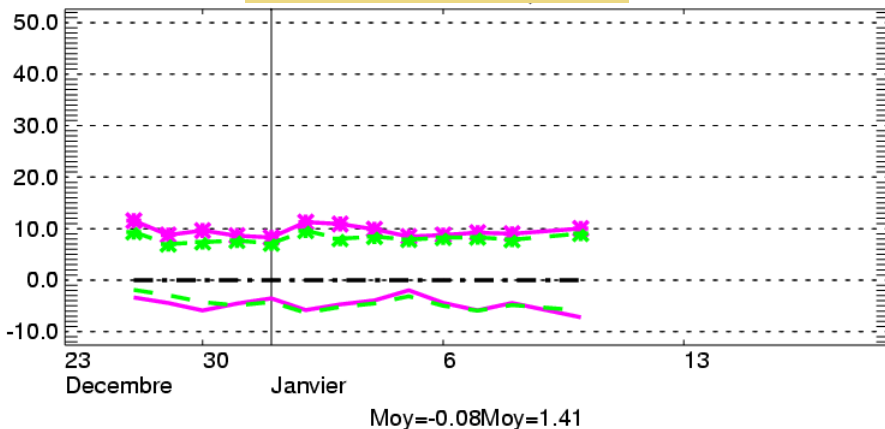
without HIRS

with HIRS

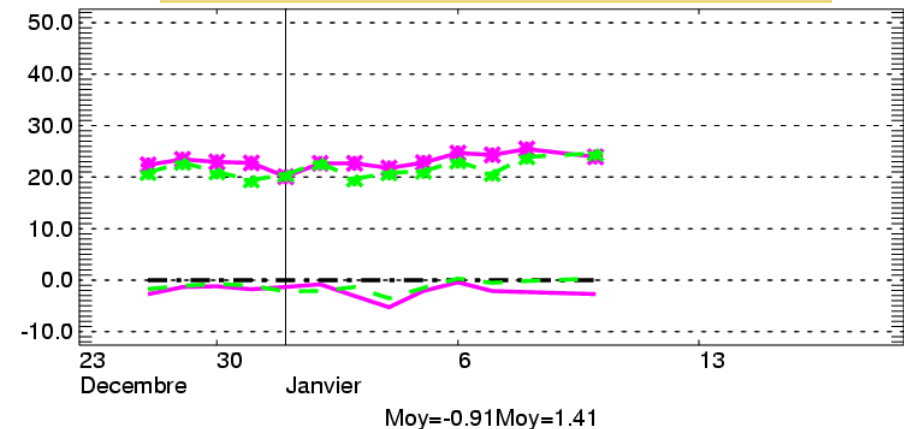
Northern Hemisphere



Tropics



Southern Hemisphere



Forecast scores (rmse & bias) over Europe (summer)

with HIRS without HIRS

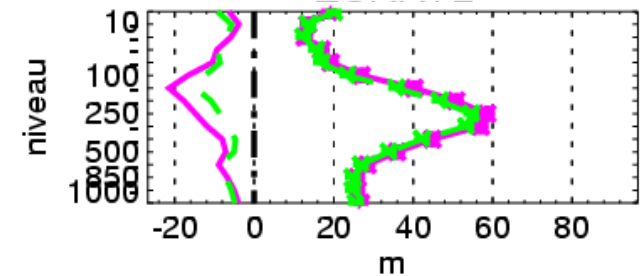
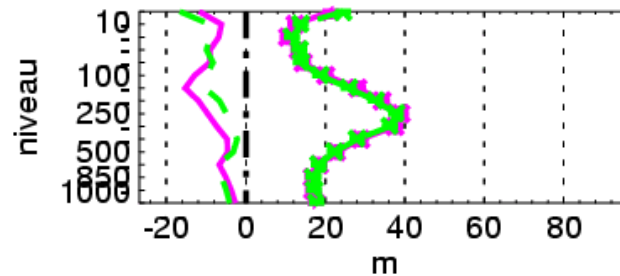
scores computed wrt own analysis

forecast range

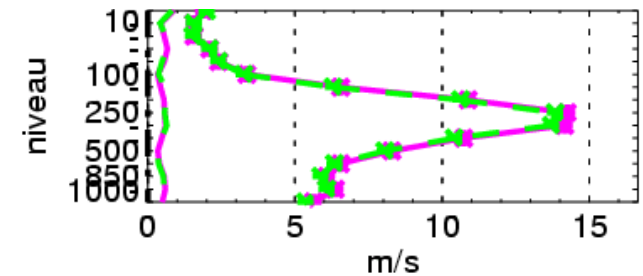
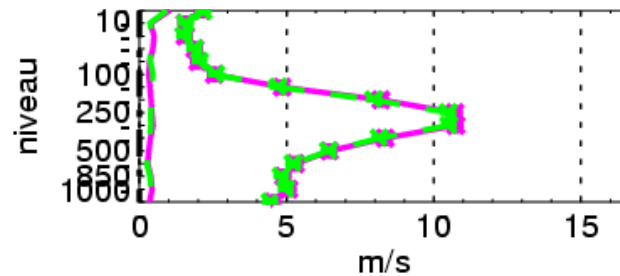
72 hour

96 hour

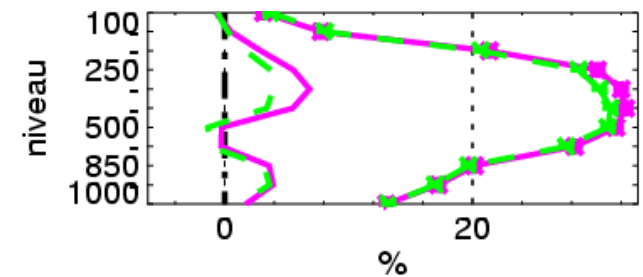
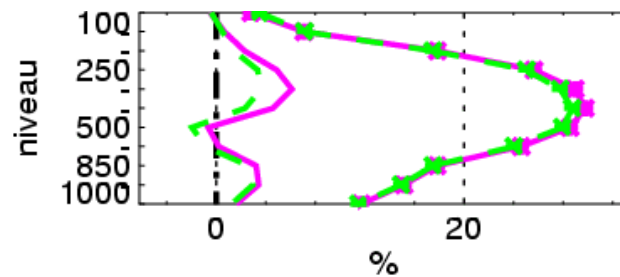
geopotential



wind



rel. humidity



Assimilation of AMSUB data

- On top of AMSUA+HIRS data
- 250 km thinning (as for AMSUA and HIRS)

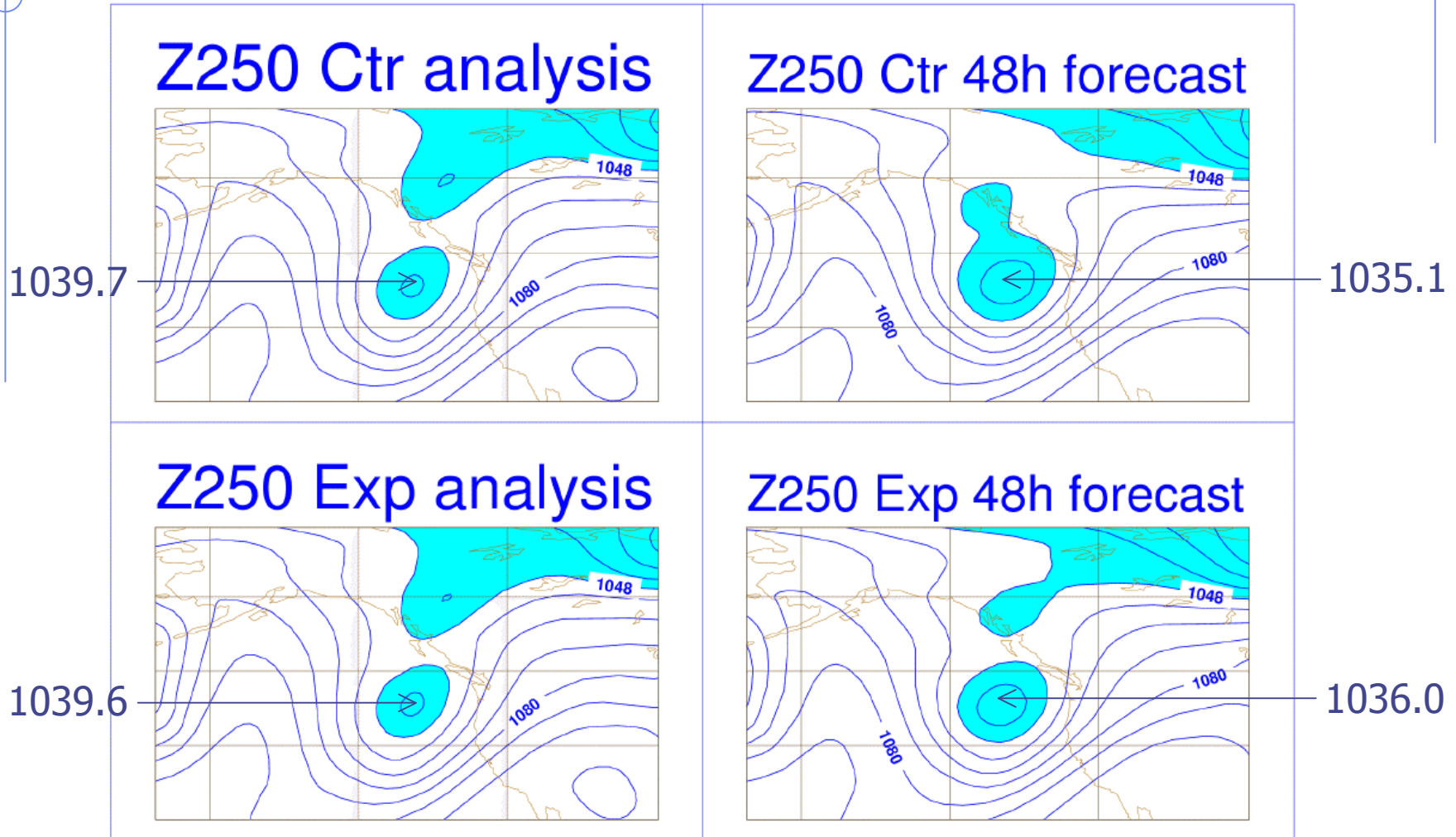
Conditions for use ✓	1	2	3	4	5
9 < scan position < 82			✓	✓	✓
Sea			✓	✓	✓
Land orog < 1000m/1500m for channels 4/5				✓	✓
Ts > 278 and ob-fg _{ch 2} < 5 K			✓	✓	✓

Case study (2003081000 vt)

Ctr=without AMSUB

Exp=with AMSUB

unit = geopotential height/9.8/10 = [dam]



Perspectives

- HIRS in pre-operational suite
 - ✓ to be operational this winter
- AMSUB experiments
 - ✓ other periods, tuning of bias correction coefficients...
- Optimisation (AMSUA, HIRS, AMSUB)
 - ✓ σ_0 tuning (cf. B. Chapnik & F. Rabier, B10)
 - ✓ thinning, blacklisting, ...
- EARS/Lannion data (short cut-off analyses)
 - ✓ in global model ARPEGE
 - ✓ in regional model ALADIN/AROME
 - 3DVar in test mode this winter
 - data to be compared to MSG/SEVIRI data (cf. T. Montmerle, 2.17)