

Status and plans on ground based – GNSS for NWP models at Météo-France

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Outline

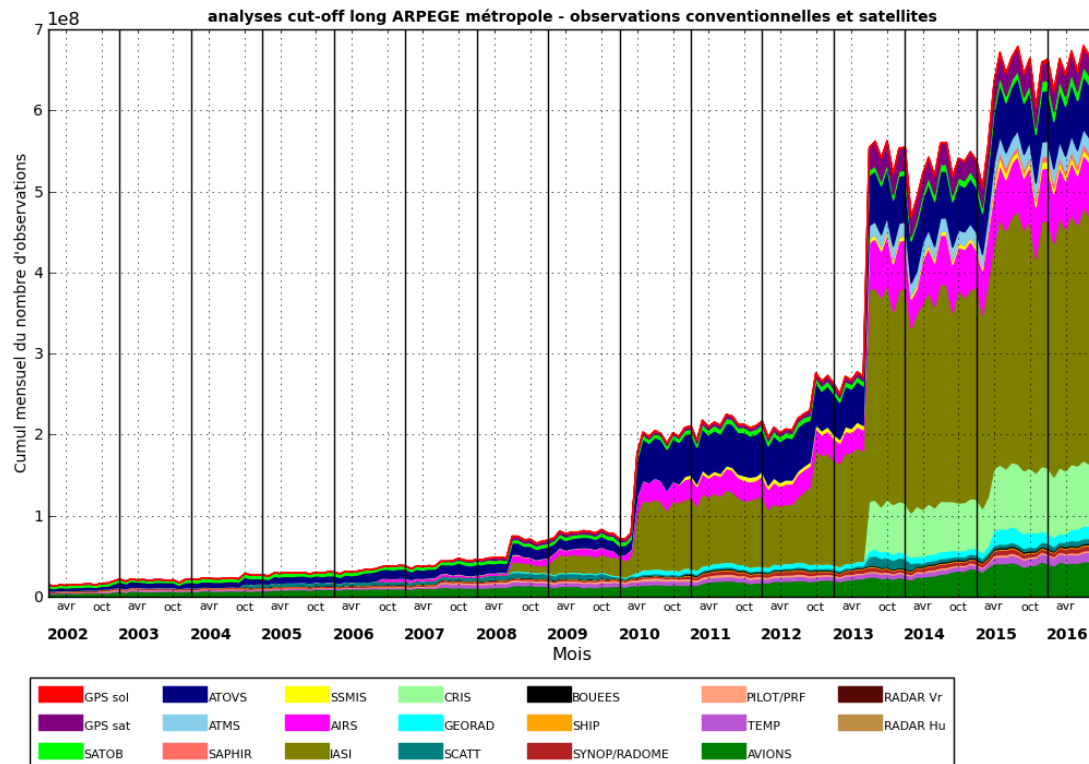
- The NWP models :
 - ARPEGE
 - AROME-France
- Ongoing activities

The global model ARPEGE

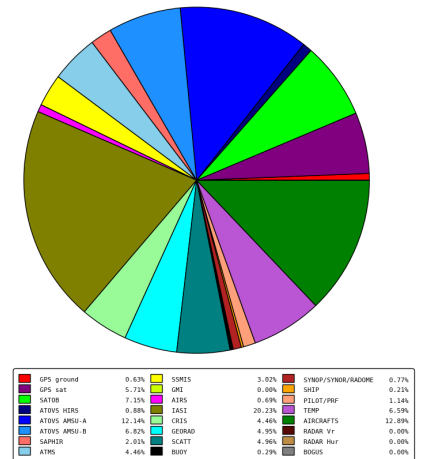
Global spectral model with variable grid mesh (7 km -> 35 km) – L105

4D-Var data assimilation system (30 min time slots since 04/2015) +
EDA for B-matrix - Forecasts up to 144 h

Evolution des cumuls mensuels de nombre d'observations utilisées par type d'observation



Part des DFS par type d'obs
analyses cut-off long - ARPEGE métropole dbl
observations conventionnelles et satellites
cumul du DFS sur la période 2015120100 - 2015120118 : 481780



Ground based
GNSS => 0.6 %

DirOP/COMPAS 02-octobre-2016

- Resolution 1,3 km / 90 levels (top at 10 hPa)
- 3D-Var data assimilation system : hourly cycling
- Forecasts up to 48 h range

analyses AROME France - observations conventionnelles et satellites

Cumul mensuel du nombre d'observations

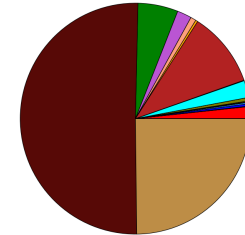
Mois

2009 2010 2011 2012 2013 2014 2015 2016

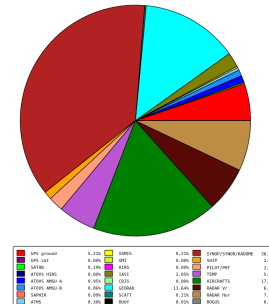
Legend:

- GPS sol
- GPS sat
- SATOB
- ATOVS
- ATMS
- SAPHIR
- SSMIS
- AIRS
- IASI
- CRIS
- GEORAD
- SCATT
- BOUEES
- SHIP
- SYNOP/RADOME
- PILOT/PRF
- TEMP
- RADAR Vr
- RADAR Hu

Part des DFS par type d'obs
analyses cut-off AROME - AROME France dbl
observations conventionnelles et satellites
cumul de DFS sur la période 2015112000 - 2015112023 : 408959



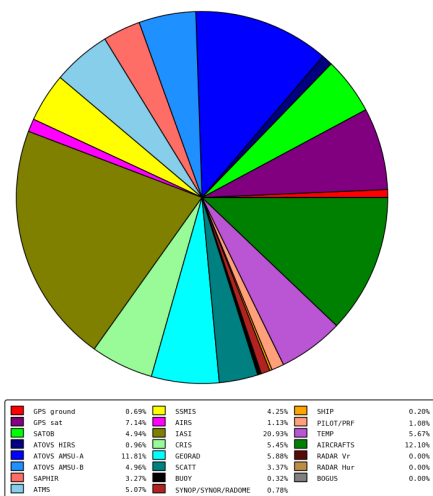
Part des DFS par type d'obs
analyses cut-off AROME - AROME France d6l
observations conventionnelles et satellites
cumul du DFS sur la période 2015120100 - 2015120123 : 149861



Ground based
GNSS => 1.5 to 5 %

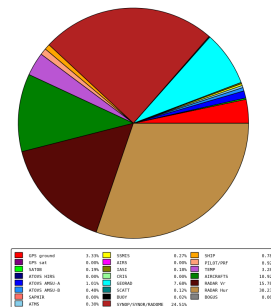
Information content

Part des DFS par type d'obs
analyses cut-off long - ARPEGE metropole dbf
observations conventionnelles et satellites
cumul du DFS sur la période 2015021300 - 2015021318 : 488659

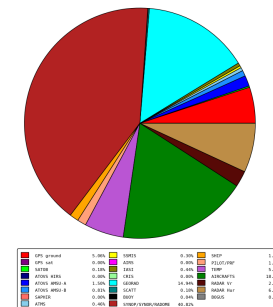


ARPEGE : 0.7 %

Part des DFS par type d'obs
analyses cut-off AROME - AROME France dbf
observations conventionnelles et satellites
cumul du DFS sur la période 2015032400 - 2015032423 : 228247

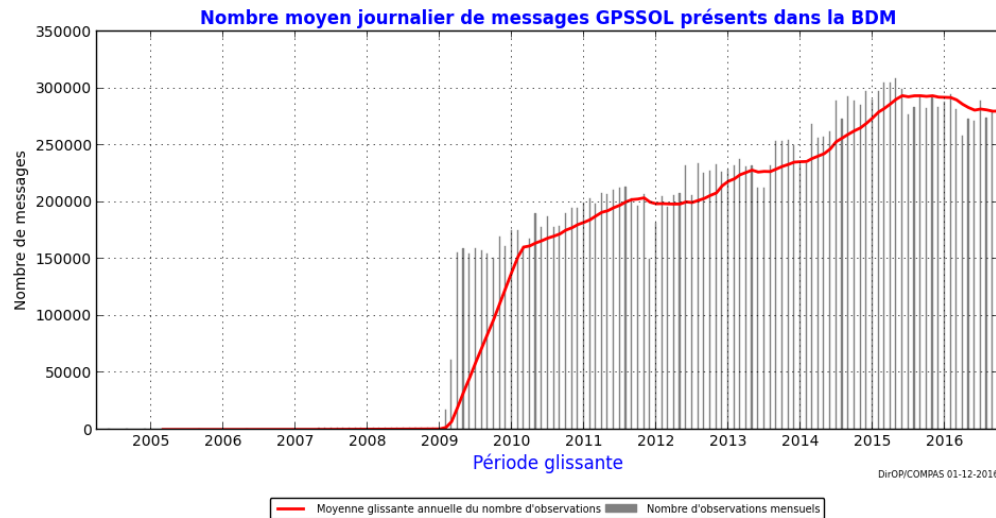
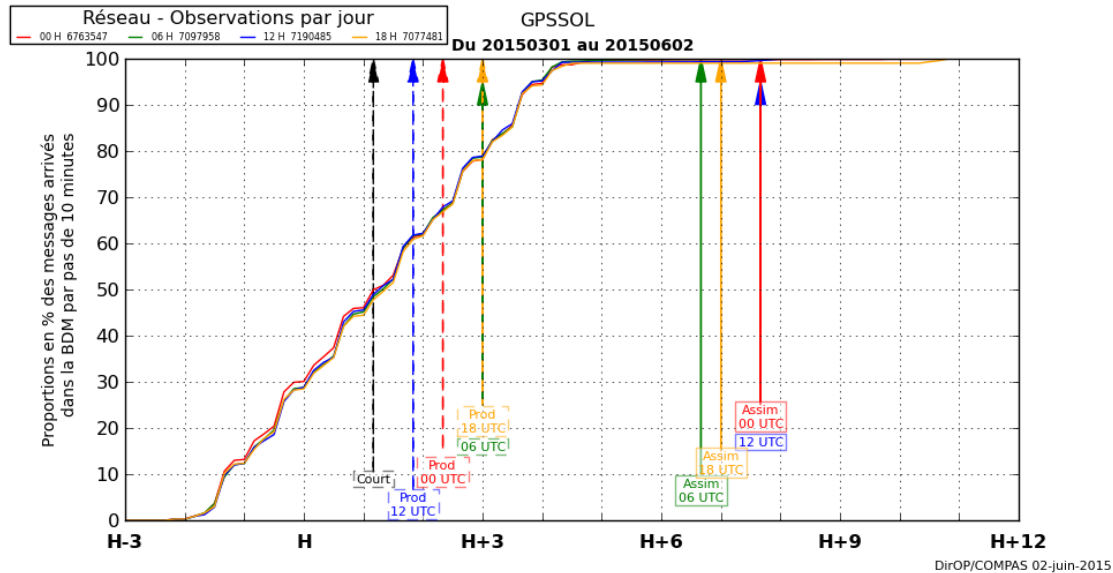


Part des DFS par type d'obs
analyses cut-off AROME - AROME France dbf
observations conventionnelles et satellites
cumul du DFS sur la période 2015032300 - 2015032323 : 140630



AROME : 3.3 -> 5.2 %

Timeliness and availability

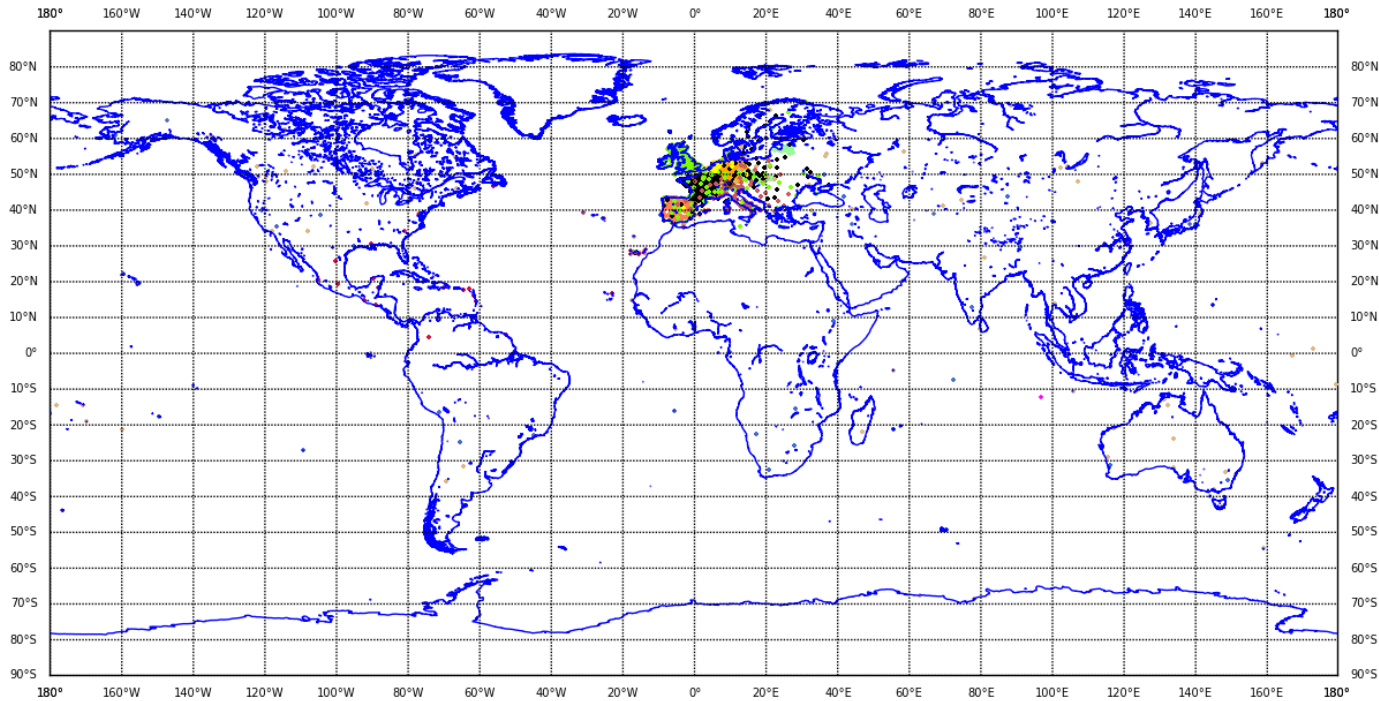


Assimilation in ARPEGE

METEO-FRANCE couverture de donnees - GPS - 2016/12/01 00H UTC cut-off long

Nombre total d'observations avant screening : 97483

2373 LPT
3252 LPTR
6554 METO
2338 METG
8214 GFZ
677 GOPG
1345 GOP1
4915 ASI
8104 ASIC
13100 ROBH
8876 ROBQ
6172 ROBG
1503 KNM3
1180 KNM4
465 BKG
8170 SGN
12472 SGN1
531 SGNC
7242 IGE2
0 DITT



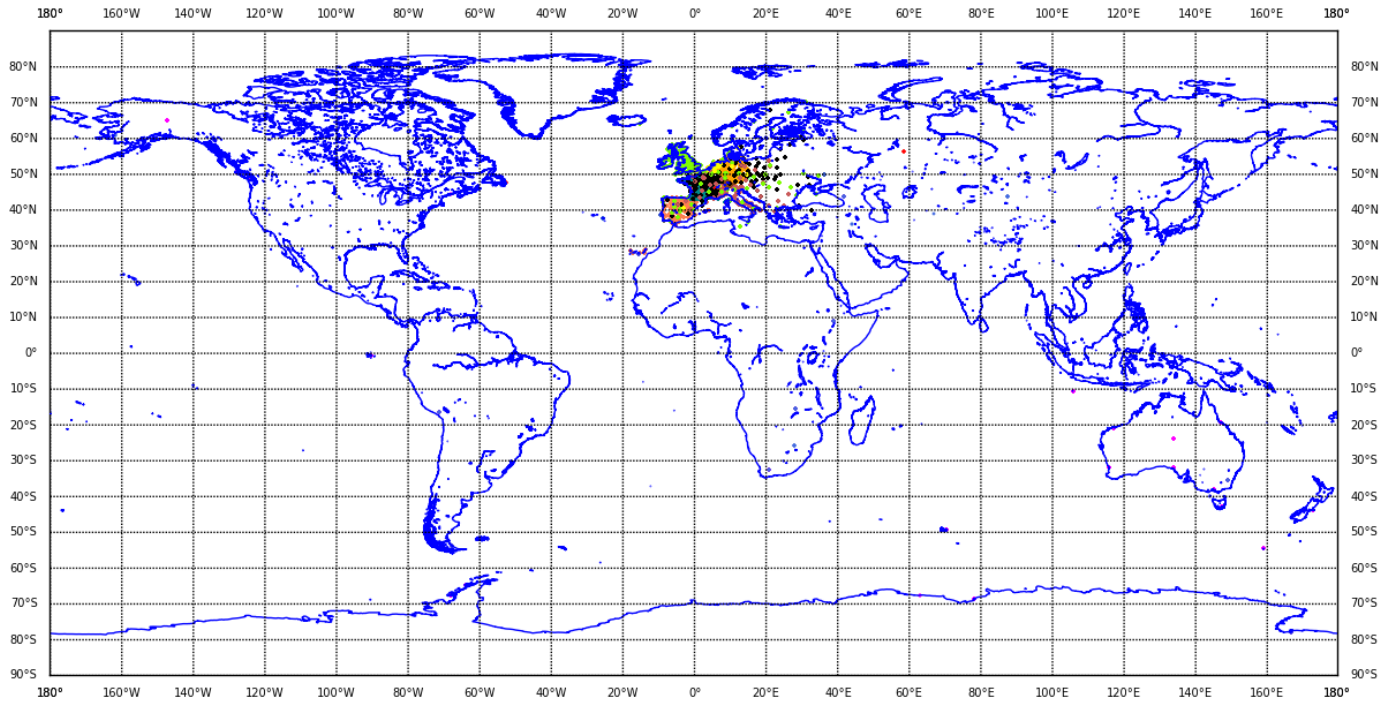
ARPEGE oper

Before screening : 97483

Assimilation in ARPEGE

METEO-FRANCE couverture de donnees - GPS - 2016/12/01 00H UTC cut-off long
Nombre total d'observations apres screening : 21321

629 LPT
377 LPTR
2204 METO
598 METG
2638 GFZ
212 GOPG
162 GOP1
1866 ASI
0 ASIC
2815 ROBH
0 ROBQ
0 ROBG
347 KNM3
269 KNM4
341 BKG
2566 SGN
4076 SGN1
0 SGNC
2221 IGE2
0 DITT



ARPEGE oper

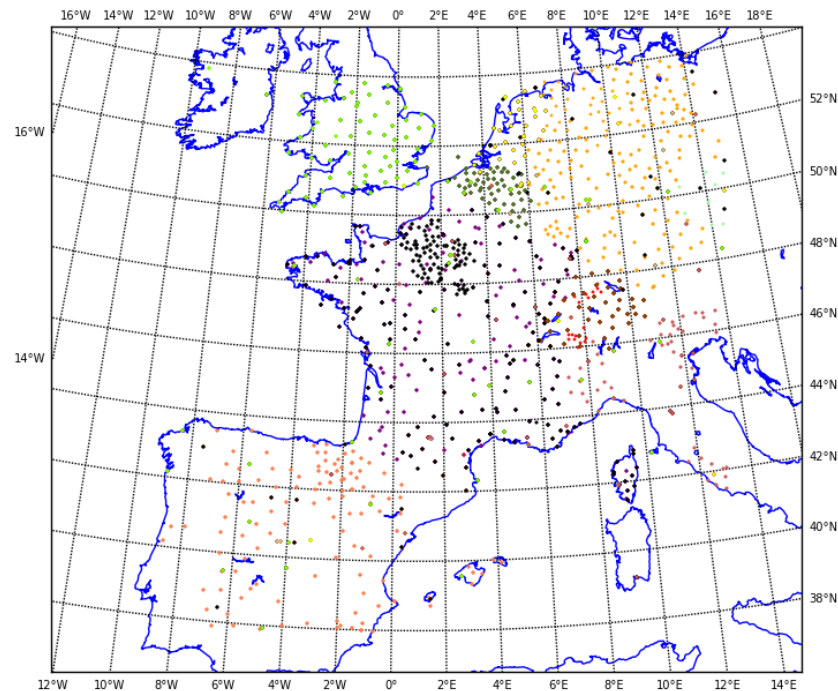
After screening : 21321

Assimilation in AROME

136 LPT
484 LPTR
339 METO
12 METG
423 GFZ
6 GOPG
20 GOP1
224 ASI
0 ASIC
1072 ROBH
887 ROBQ
132 ROBG
76 KNM3
140 KNM4
51 BKG
832 SGN
0 SGN1
0 SGNC
465 IGE2
0 DITT

METEO-FRANCE couverture de donnees - GPS - 2016/12/01 00H UTC

Nombre total d'observations avant screening : 5299



AROME France oper

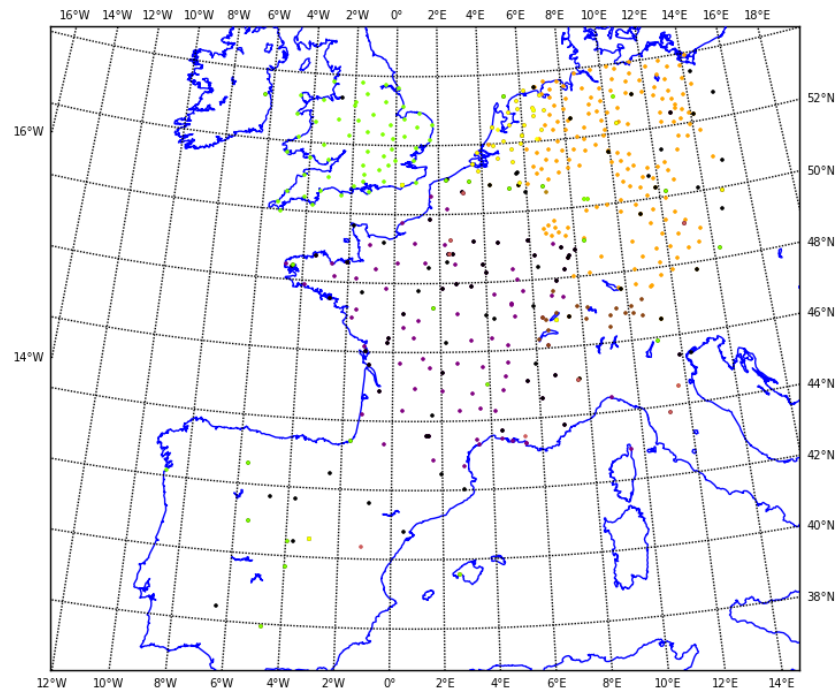
Before screening : 5299

Assimilation in AROME

0 LPT
20 LPTR
85 METO
0 METG
174 GFZ
0 GOPG
0 GGP1
12 ASI
0 ASIC
122 ROBH
0 ROBQ
0 ROBG
31 KNM3
24 KNM4
31 BKG
117 SGN
0 SGN1
0 SGNC
0 IGE2
0 DITT

METEO-FRANCE couverture de donnees - GPS - 2016/12/01 00H UTC

Nombre total d'observations apres screening : 616



AROME France oper

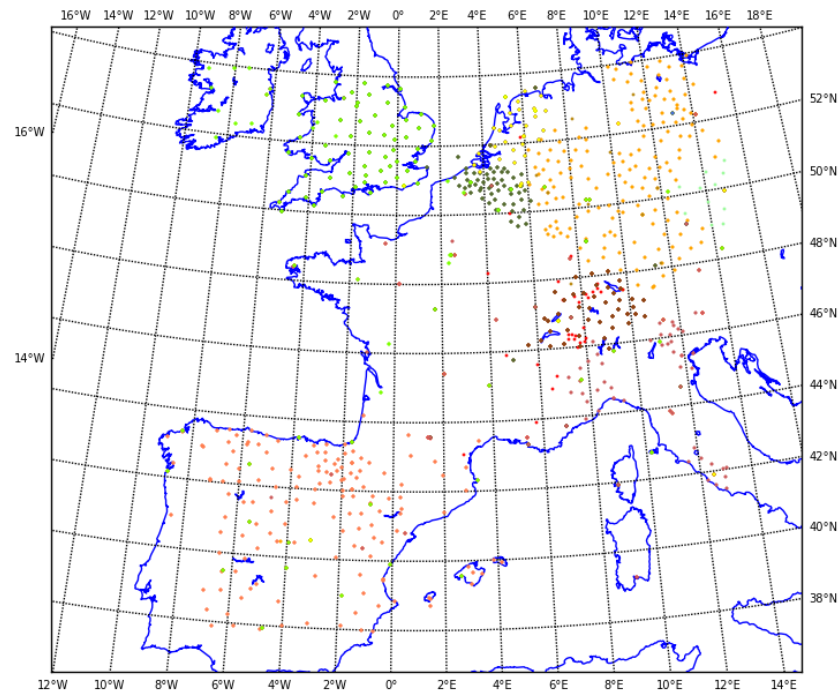
After screening : 616

Assimilation in AROME

147 LPT
220 LPTR
357 METO
18 METG
388 GFZ
7 GOPG
21 GOP1
216 ASI
0 ASIC
0 ROBH
592 ROBQ
0 ROBG
74 KNM3
56 KNM4
51 BKG
0 SGN
0 SGN1
0 SGNC
552 IGE2
0 DITT

METEO-FRANCE couverture de donnees - GPS - 2016/12/01 03H UTC

Nombre total d'observations avant screening : 2699



AROME France oper

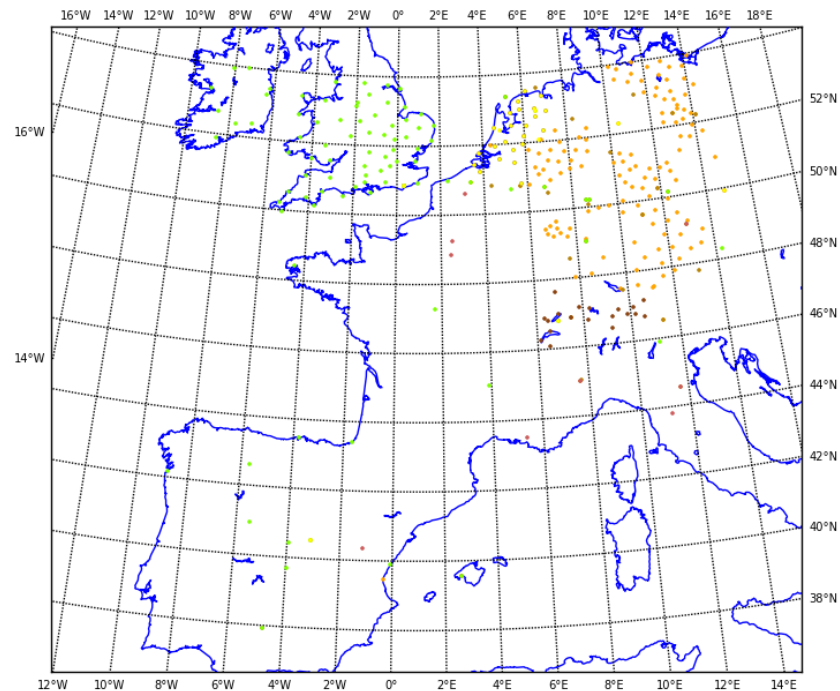
Before screening : 2699

Assimilation in AROME

0 LPT
20 LPTR
94 METO
0 METG
139 GFZ
0 GOPG
0 GOP1
13 ASI
0 ASIC
0 ROBH
0 ROBQ
0 ROBG
31 KNM3
24 KNM4
31 BKG
0 SGN
0 SGN1
0 SGNC
0 IGE2
0 DITT

METEO-FRANCE couverture de donnees - GPS - 2016/12/01 03H UTC

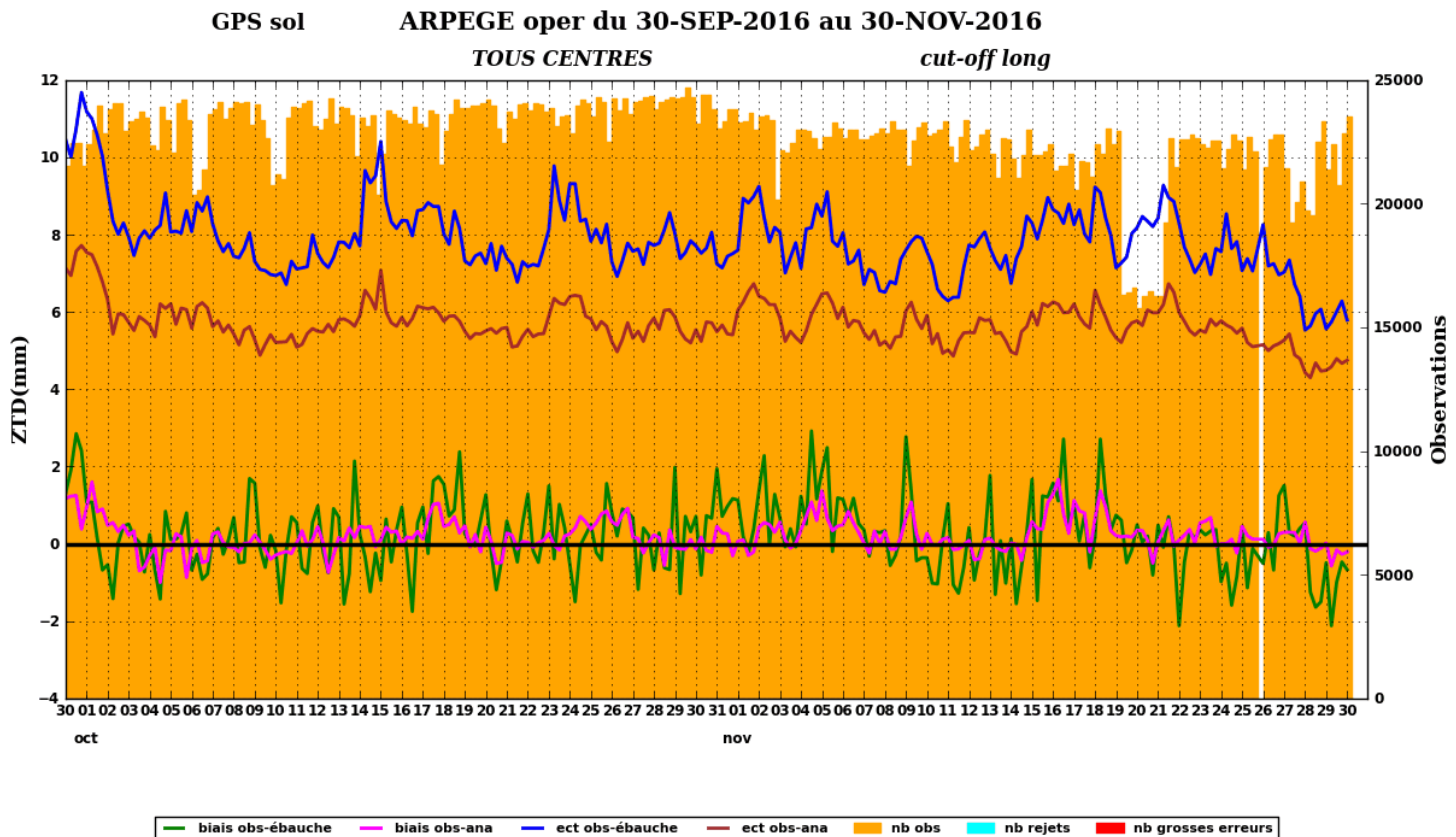
Nombre total d'observations apres screening : 352



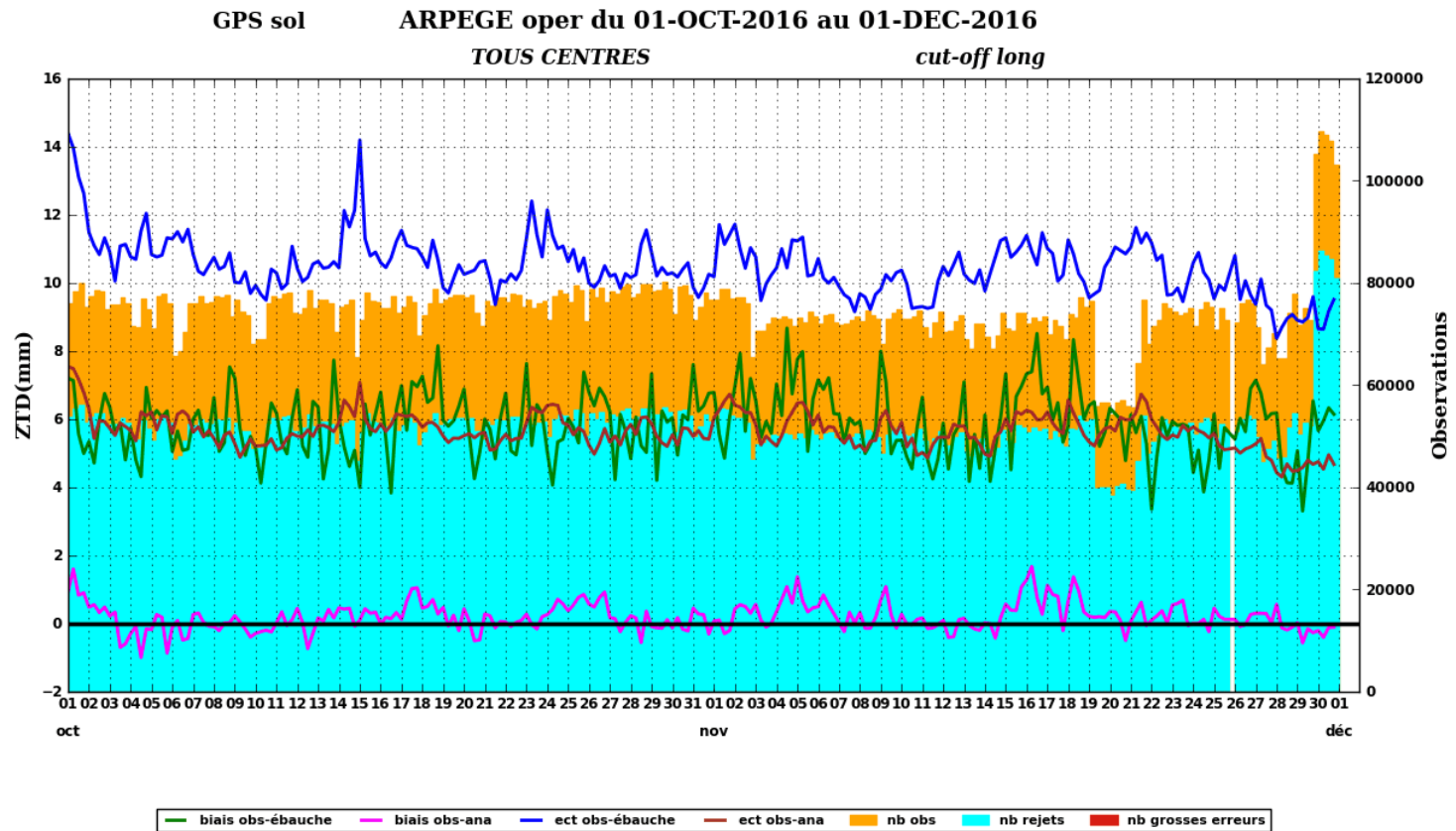
AROME France oper

After screening : 352

Operational monitoring (ARPEGE)



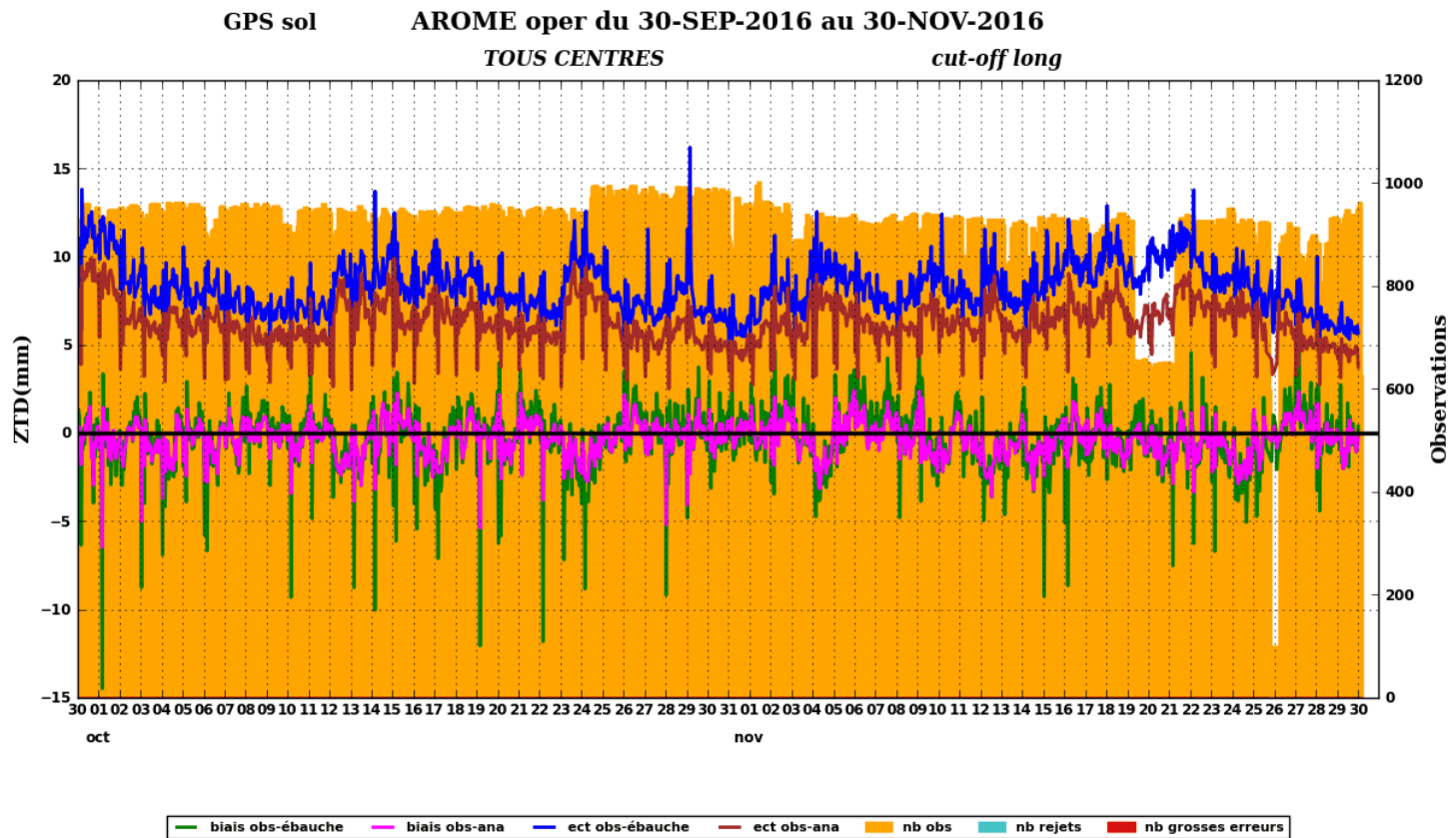
Operational monitoring (ARPEGE)



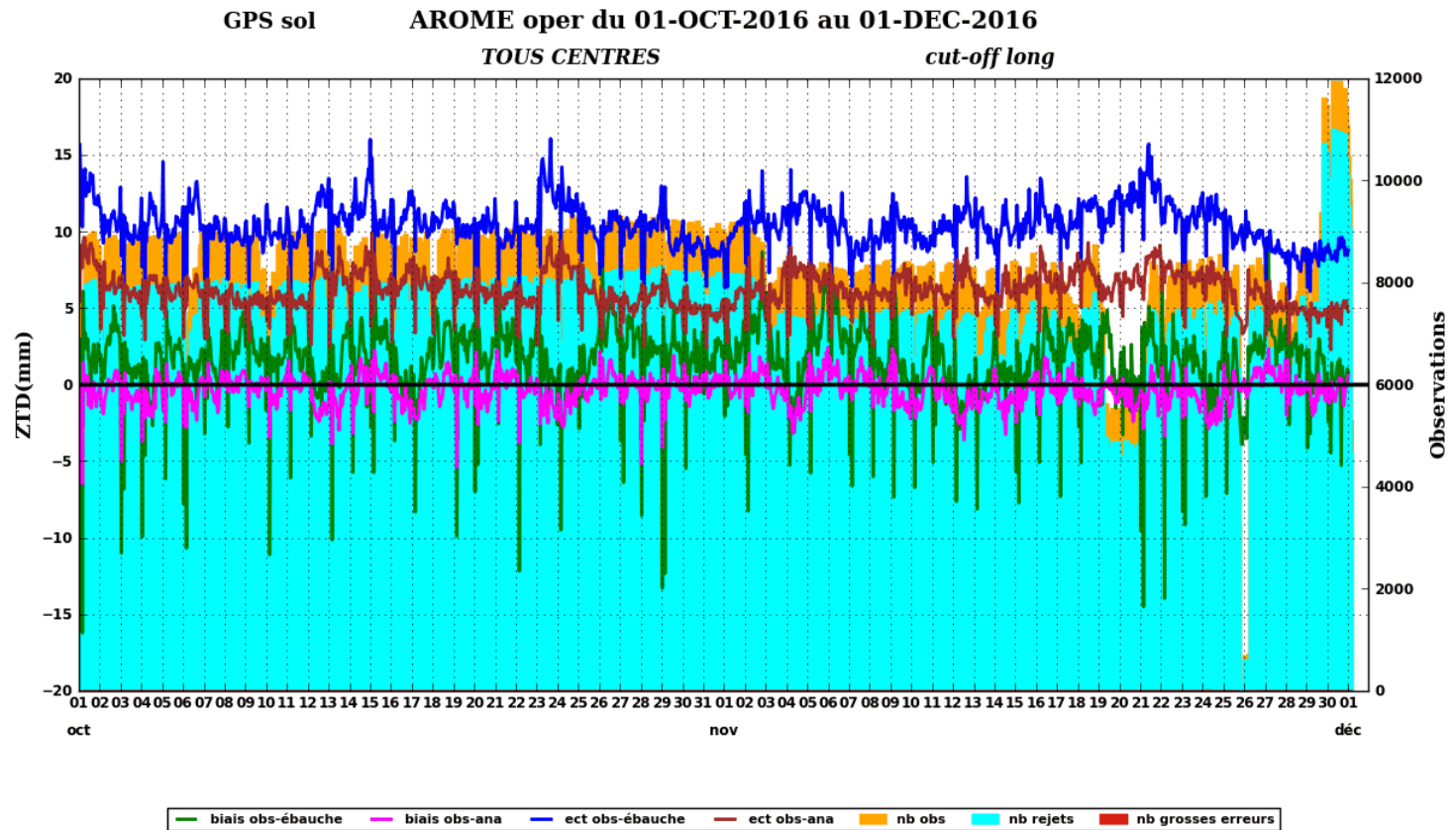
New analysis centres: ASIC -> 15/11, ROBQ and ROBG -> 30/11

Loss of analysis centres: NOAA -> 04/10

Operational monitoring (AROME)



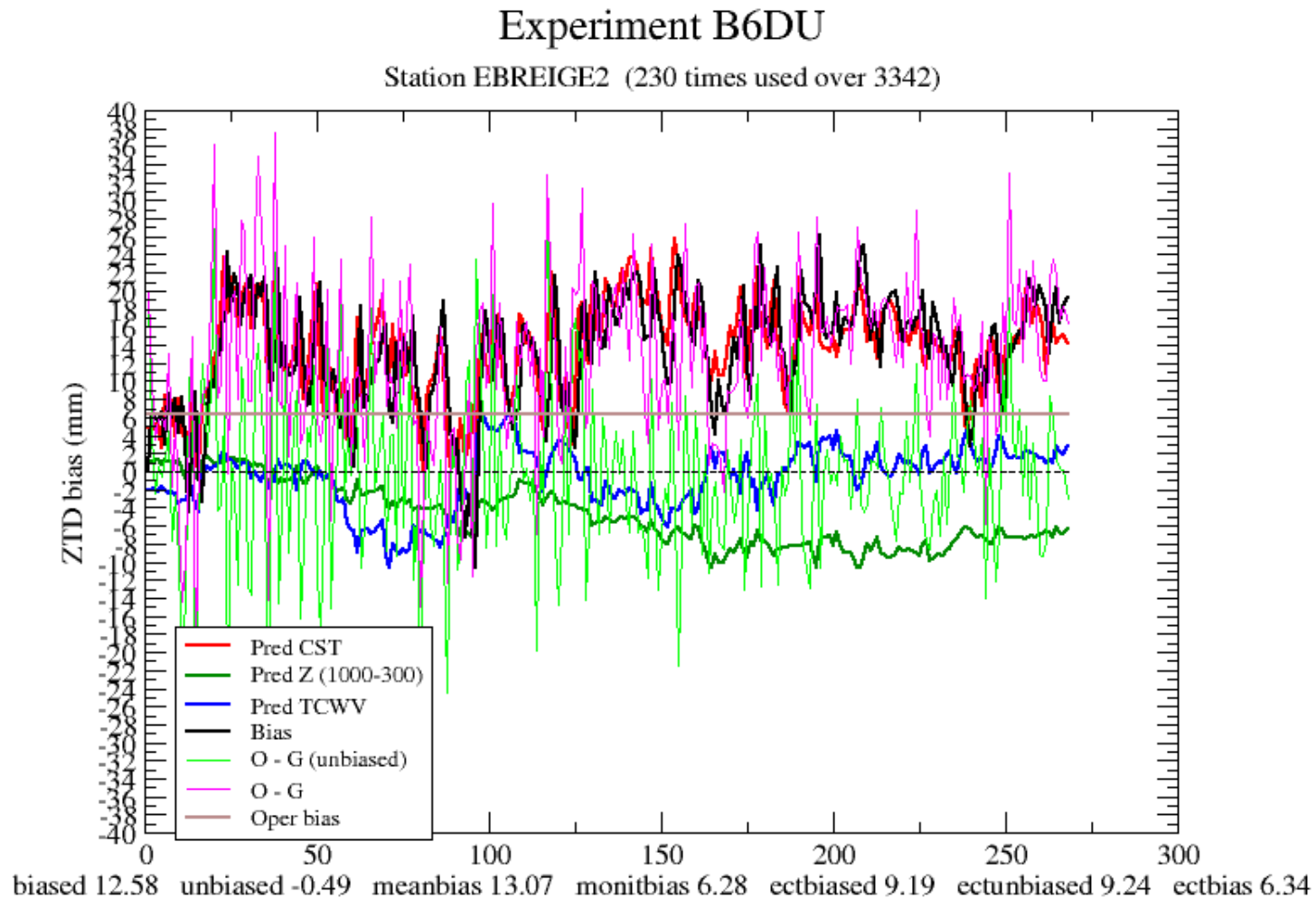
Operational monitoring (AROME)



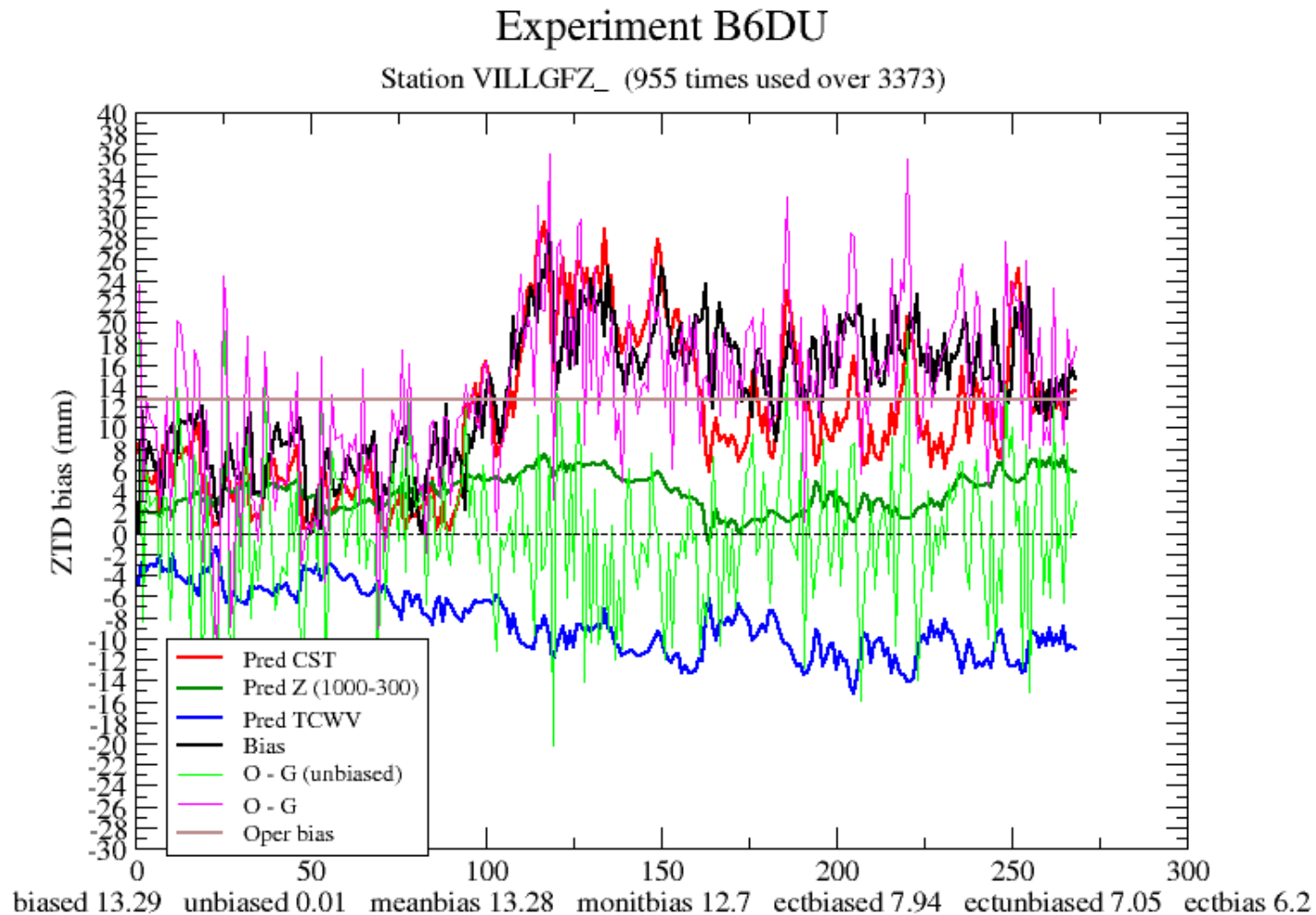
Ongoing activities

- Use of VARBC (Cst; TWCV; $\Delta Z[1000-300\text{hPa}]$) in the current e-suite for ARPEGE and AROME (to become operational by Spring 2017)
- Development of an observation operator in order to assimilate ZTD gradients in AROME (collaborations with Météo-Maroc)
- Issues : how to get back NOAA network ?
- Longer term activities : assimilation of STD in AROME (through collaborations with KNMI)
- MF observation department and IGN proposal : possibility of installing receivers on board commercial ships where RAOB are done regularly (E-ASAP): how to process the data ?

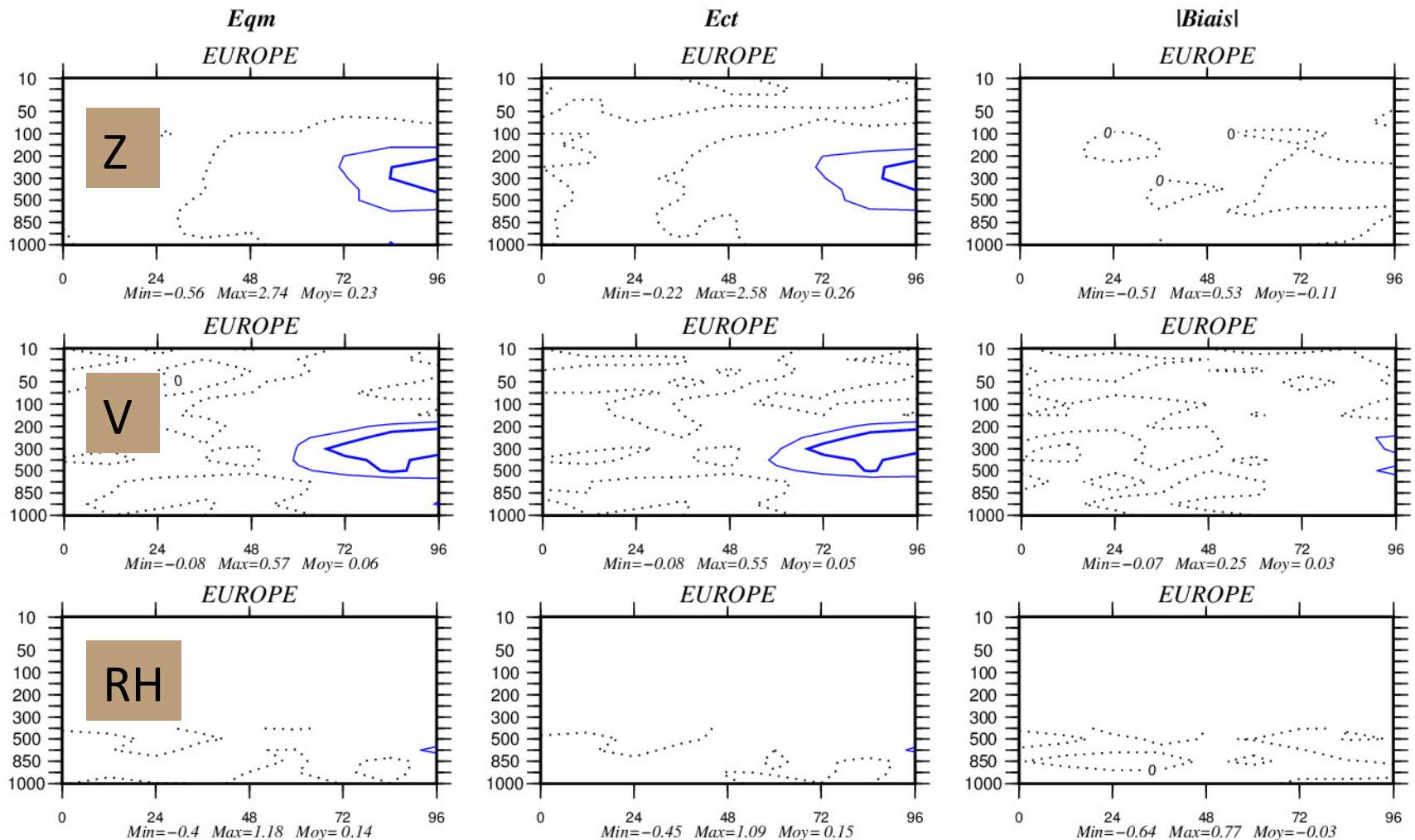
Variational bias correction in ARPEGE



Variational bias correction in ARPEGE



Variational bias correction in ARPEGE



Forecast scores : Static BC – Var BC

