Environment Canada Environnement Canada

Canada

Performance attendue de la prochaine implémentation du système global déterministe

Séminaire interne

Présentateurs: L. Garand et M. Roch

Dorval, 17 avril 2015

Dans cette présentation #2 de 3 en vue de passe PAR: EnKF+SGPD+SRPD

- Changements au système d'assimilation EnVar et impact de l'ajout d'observations
- Impact incluant tous les changements dans SGPD versus système opérationnel

Autres séminaires:

1 : Changements au modèle et impact (10 avril)

3 : Changements au système régional et impact (24 avril)

Technical modifications to EnVar

- Analysis increment now computed on vertically staggered levels (required recalculation of climatological B matrix)
- Innovation (O-B) computed directly from background state on new vertical coordinate (Vcode=5005)
- Bias correction coefficients for radiance observations now computed from innovations from all synoptic times instead of only 0UTC and 12UTC → better global sampling for each instrument
- Horizontal domain now decomposed in 2 dimensions; previously only by latitude → improves scalability and allows higher processor counts and reduced memory requirements per node
- Observations near geographical pole are moved at shorter distance than previously in background check
- Additional improvements to make code more general, efficient, and compatible with Intel compiler

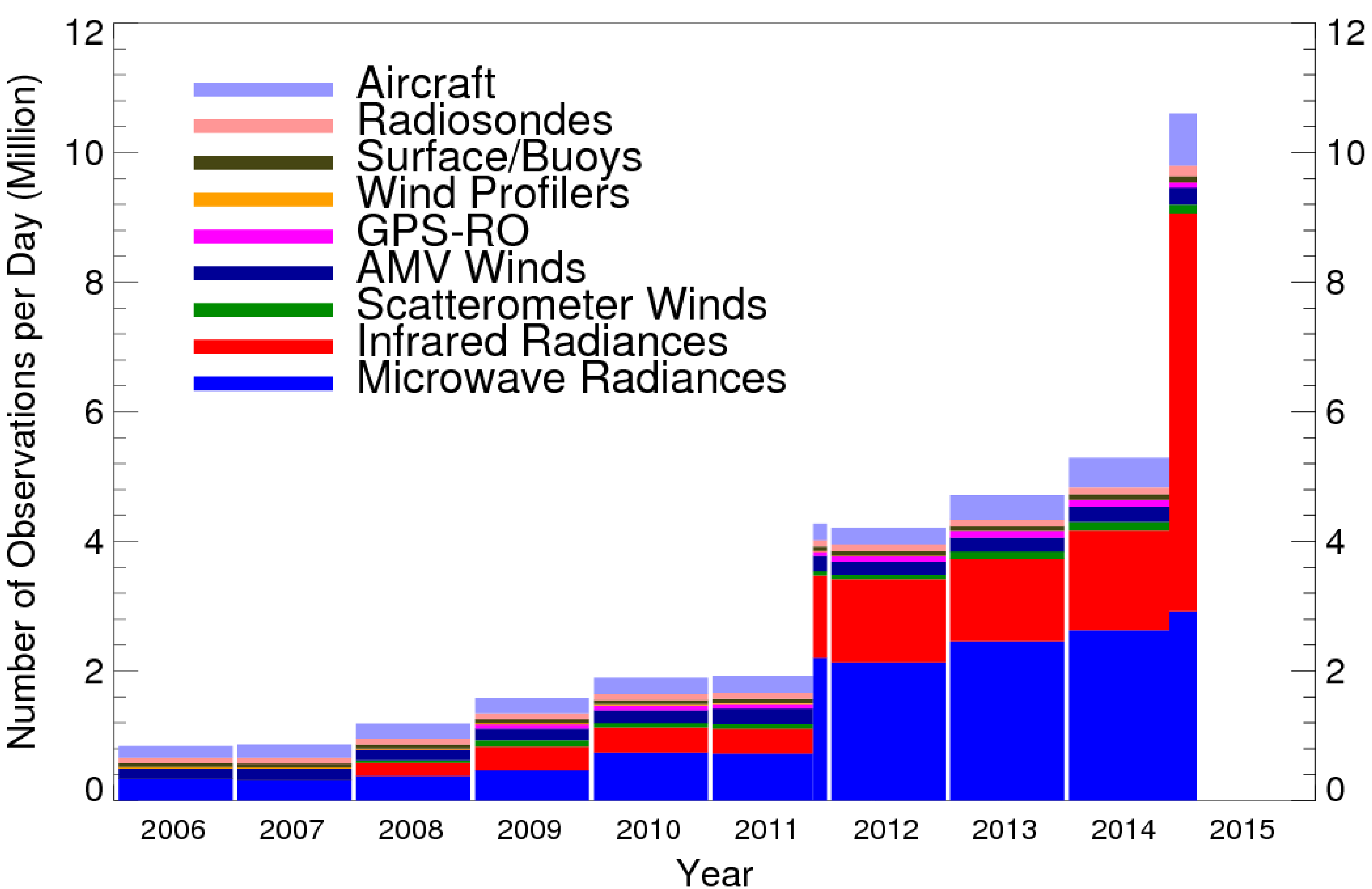
Ajout d'observations
pour passe parallèle de mai-juillet 2015

- ATMS (+ 17 canaux MW)
- GPS-sol (+ ~620 sites, surtout Europe)
- Cris (+ 103 canaux IR)
- Corrélation inter-canaux (pour toutes les radiances IR+MW)

- En tout + ~3M obs/jour (+25 % pour atteindre ~14 M/jour)

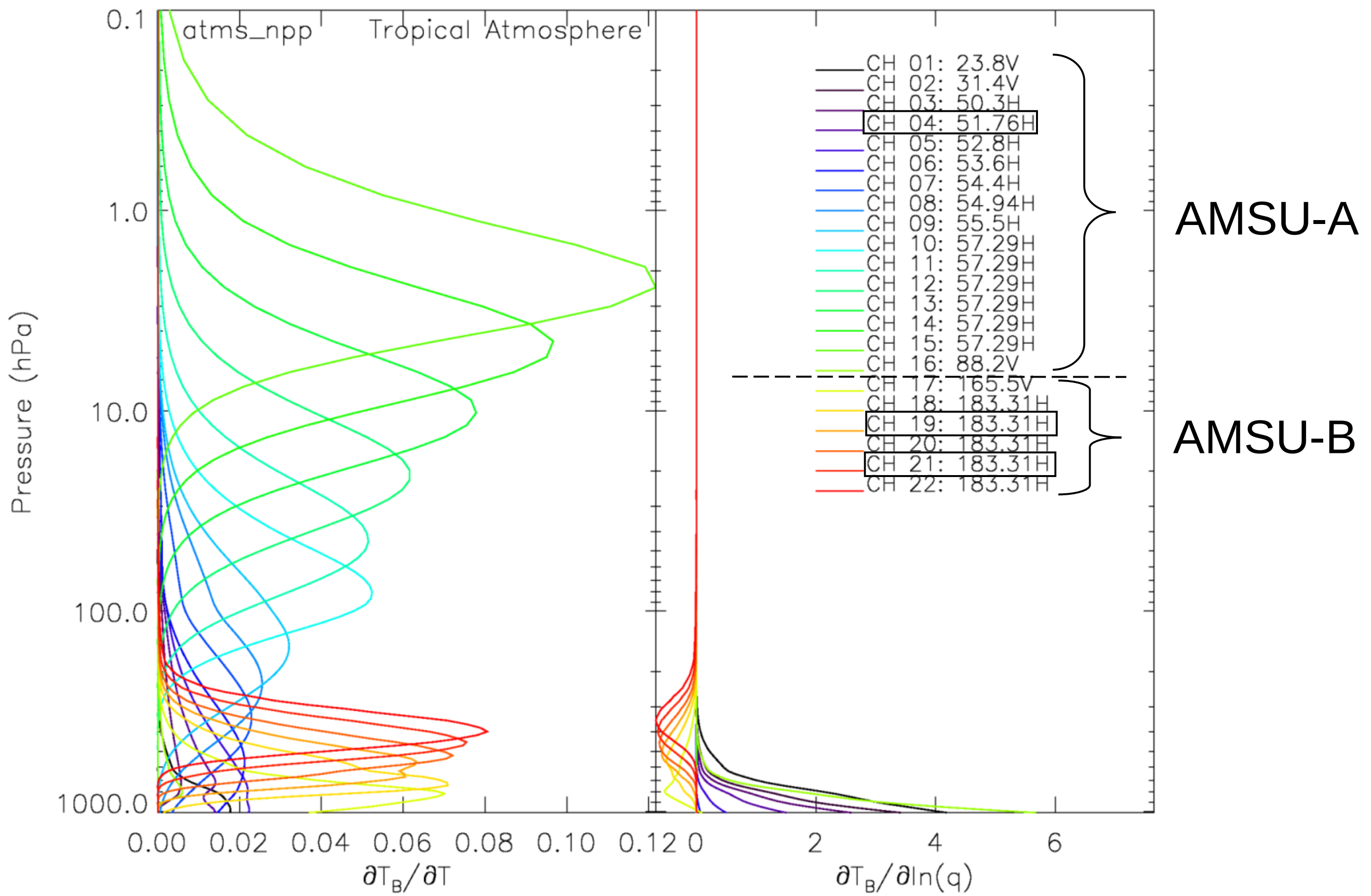
- Equipe principale pour ces composantes:
- ARMA: S. Heilliette, S. MacPherson, L. Garand, S. Laroche,
- CMDA: A. Beaulne, C. Côté

Observations assimilées opérationnellement

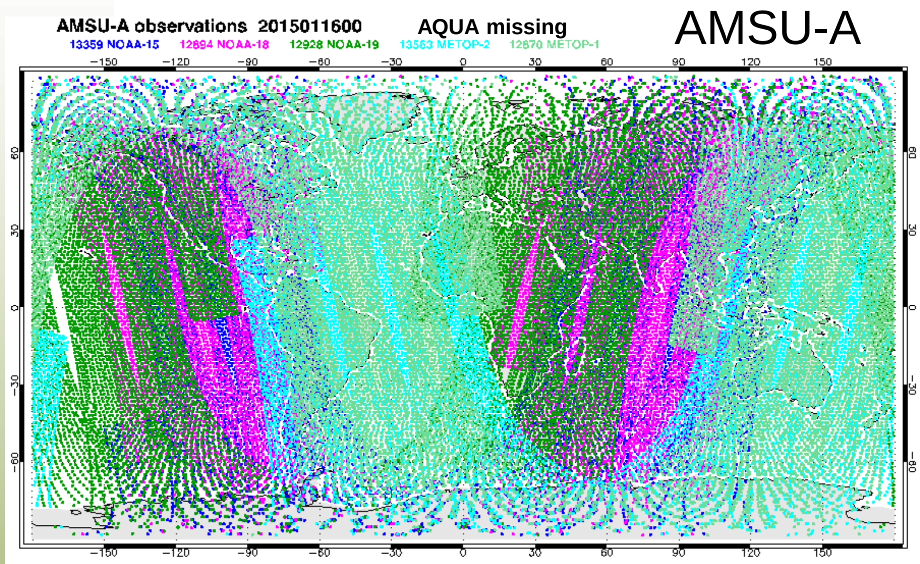


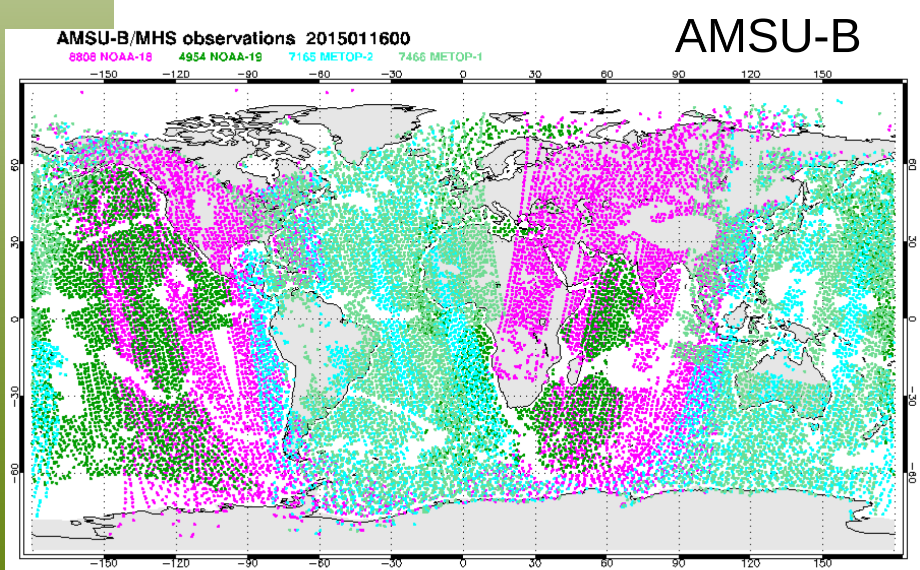
Advanced Technology Microwave Sounder ATMS

Combines AMSUA/B in one instrument



ATMS, similar but differs from AMSUA/B

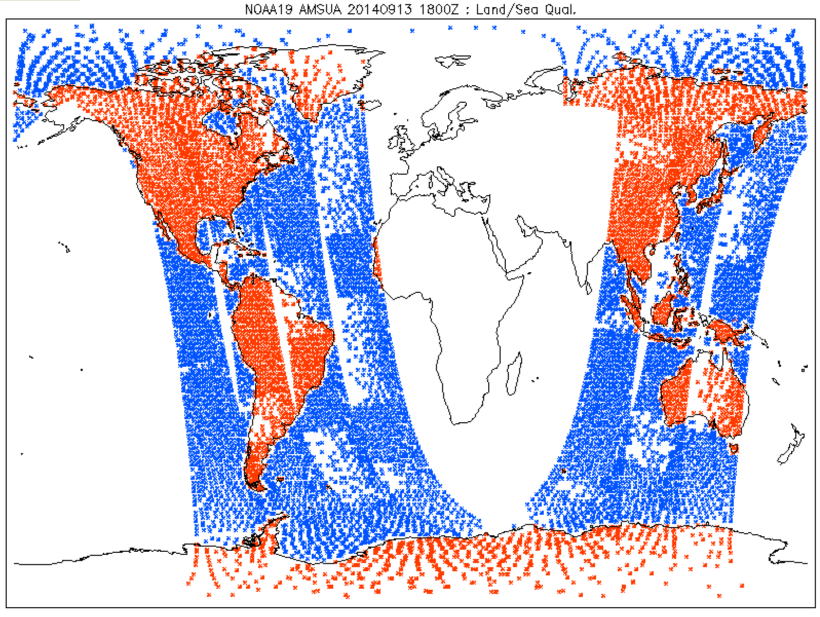




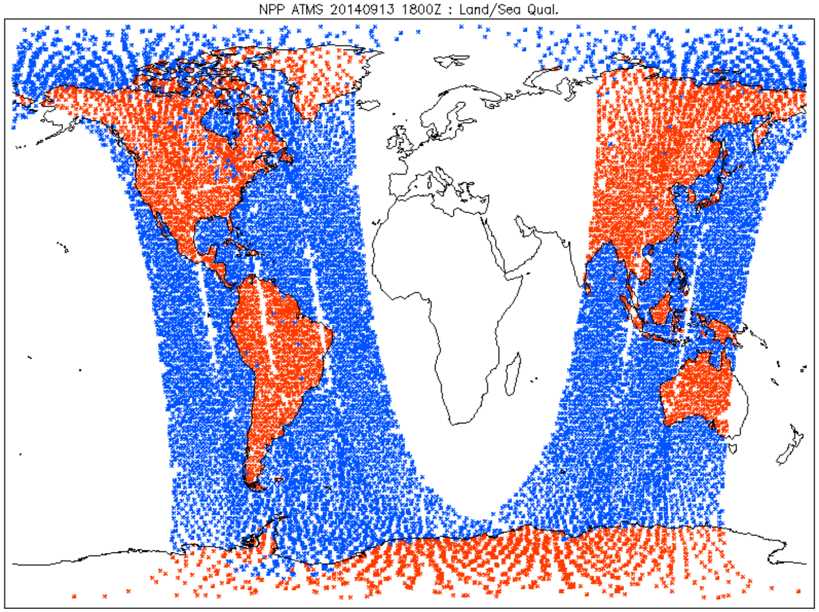
- Currently we assimilate AMSU-A data from 6 satellites and AMSU-B/MHS from 4 satellites
- **ATMS** combines AMSU-A and AMSU-B in a single 22 channel instrument with some differences.
- Main differences:
  - 96 FOV vs 30 FOV for AMSU-A with higher spatial resolution (32 km vs 48 km)
  - Slightly wider scan swath
  - 1 extra AMSU-A (window/sfc) and 2 extra AMSU-B channels
  - Higher noise level for TT sounding channels (.50K vs .25 K)

Data Coverage Comparison from POSTALT file (thinned assimilated data)

NOAA 19 AMSU-A



ATMS



Channel	AMSU A/B equiv.	Center Freq .(GHz)	Max Bandwidth (GHz)	Temperature Sensitivity (K) NEΔT	Calibration Accuracy	Beam Width (degrees)	Characterization At Nadia
1	1	23.8 V	0.27	0.9	2.0	5.2 (**75 km**)	window-water vapor 100 mm
2	2	31.4 V	0.18	0.9	2.0	5.2	window-water vapor 500 mm
3	3 (V)	50.3 **H**	0.18	1.20	1.5	2.2 (**32 km**)	window-surface emissivity
4	**new**	51.76 H	0.40	0.75	1.5	2.2	window-surface emissivity
5	4 (V)	52.8 **H**	0.40	0.75	1.5	2.2	surface air
6	5	53.596±0.115 H	0.17	0.75	1.5	2.2	4 km ~ 700 mb
7	6	54.40 H	0.40	0.75	1.5	2.2	9 km ~ 400 mb
8	7 (V)	54.94 **H**	0.40	0.75	1.5	2.2	11 km ~ 250 mb
9	8	55.50 H	0.33	0.75	1.5	2.2	13 km ~ 180 mb
10	9	57.2903 H	0.33	0.75	1.5	2.2	17 km ~ 90 mb
11	10	57.2903±0.115 H	0.078	1.20	1.5	2.2	19 km ~ 50 mb
12	11	57.2903 H	0.036	1.20	1.5	2.2	25 km ~ 25 mb
13	12	57.2903±0.322 H	0.016	1.50	1.5	2.2	29 km ~ 10 mb
14	13	57.2903±0.322 ±0.010 H	0.008	2.40	1.5	2.2	32 km ~ 6 mb
15	14	57.2903±0.322 ±0.004 H	0.003	3.60	1.5	2.2	37 km ~ 3 mb
16	15 (89) / 1	87-91(88.20) V	2.0	0.5	2.0	2.2	window H O 150 mm
17	2 (150/157)	**165.5** V	3.0	0.6	2.0	1.1 (**16** km)	H_2O 18 mm
18	5	183.31±7.0 H	2.0	0.8	2.0	1.1	H_2O 18 mm
19	**new**	183.31±4.5 H	2.0	0.8	2.0	1.1	H_2O 4.5 mm
20	4	183.31±3.0 H	1.0	0.8	2.0	1.1	H_2O 2.5 mm
21	**new**	183.31±1.8 H	1.0	0.8	2.0	1.1	H_2O 1.2 mm
22	3	183.31±1.0 H	0.5	0.9	2.0	1.1	H_2O 0.5 mm

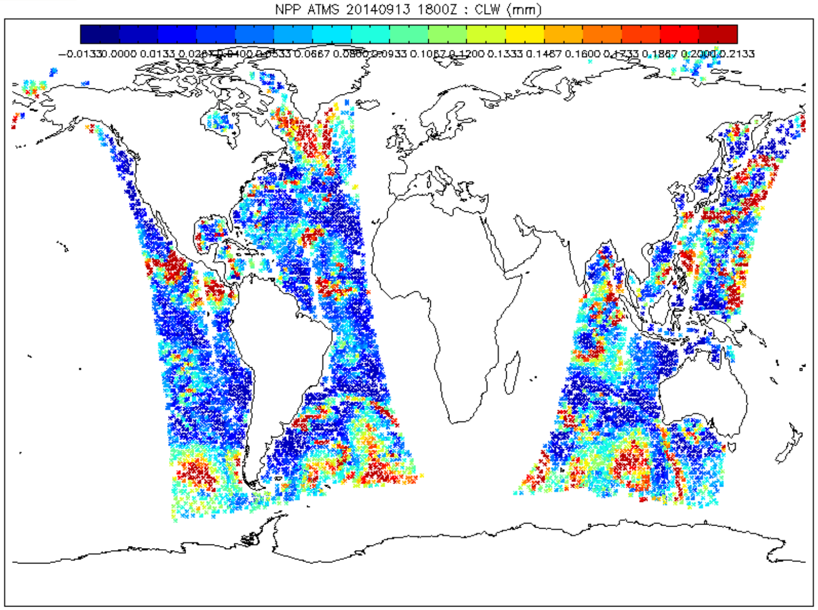
ATMS Data Processing

- Averaging is needed to bring noise level to that of AMSU-A instrument. The AAPP program *ATMS_BEAMWIDTH* is used to do this using the raw BUFR data (resamples data to wider AMSU-A beam width).

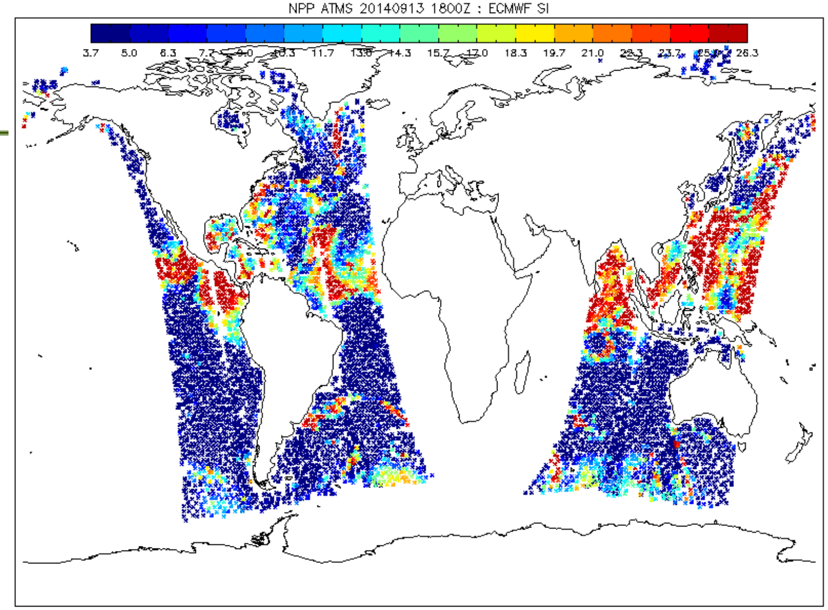
- Like AMSU-B/MHS, data must be pre-thinned prior to the background check phase of assimilation due to high data volume (reduced to10% using *BGCK.TOVSREDUCER* program).

- Extreme FOV 1, 96 have anomalous mean O-P so data are excluded from analysis (in *BGCK.TOVSFILT* program).

ATMS Cloud Liquid Water (CLW)



ATMS Scattering Index (SI)

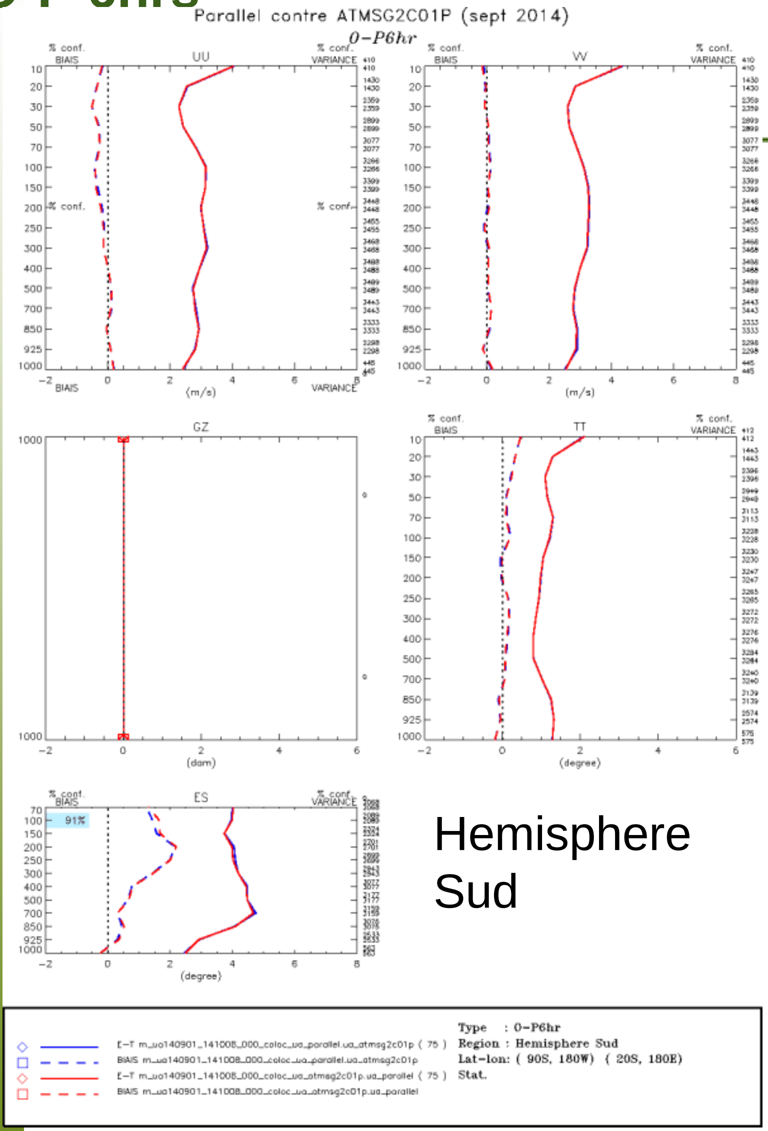


- QC for ATMS Tb data follows that done for AMSU-A and AMSU-B/MHS
- CLW and SI (and other quantities) are computed from Tb data using new ATMS-specific algorithms provided by NRL Monterey (in BGCK program *SATQC_ATMS*).
- Like AMSU-A, CLW and SI are used to filter cloud-affected radiances for low-peaking channels over ice-free oceans

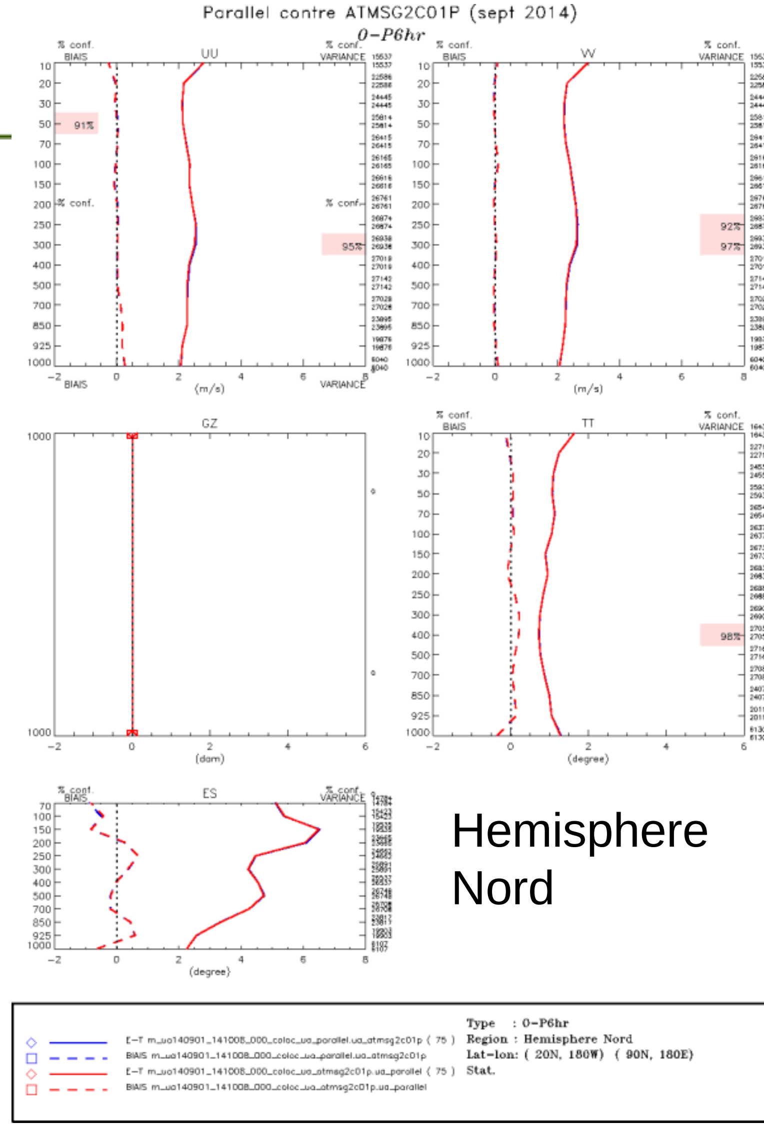
ATMS Data Impact Test

- La suite d'assimilation utilisee est /users/dor/afsd/chc/**ATMSG2C01P**
- Cette suite valide la **Passe Parallele (controle)** du 1er septembre 2014 + ajout des donnees ATMS.
- Periode du 1er septembre 2014 au 8 octobre 2014 (5 semaines)
- Corrélation Inter-canaux exclue
- Erreur d'observation définie comme pour AMSU: erreur= f std(O-P)

Resultats Arcad
O-P 6hrs

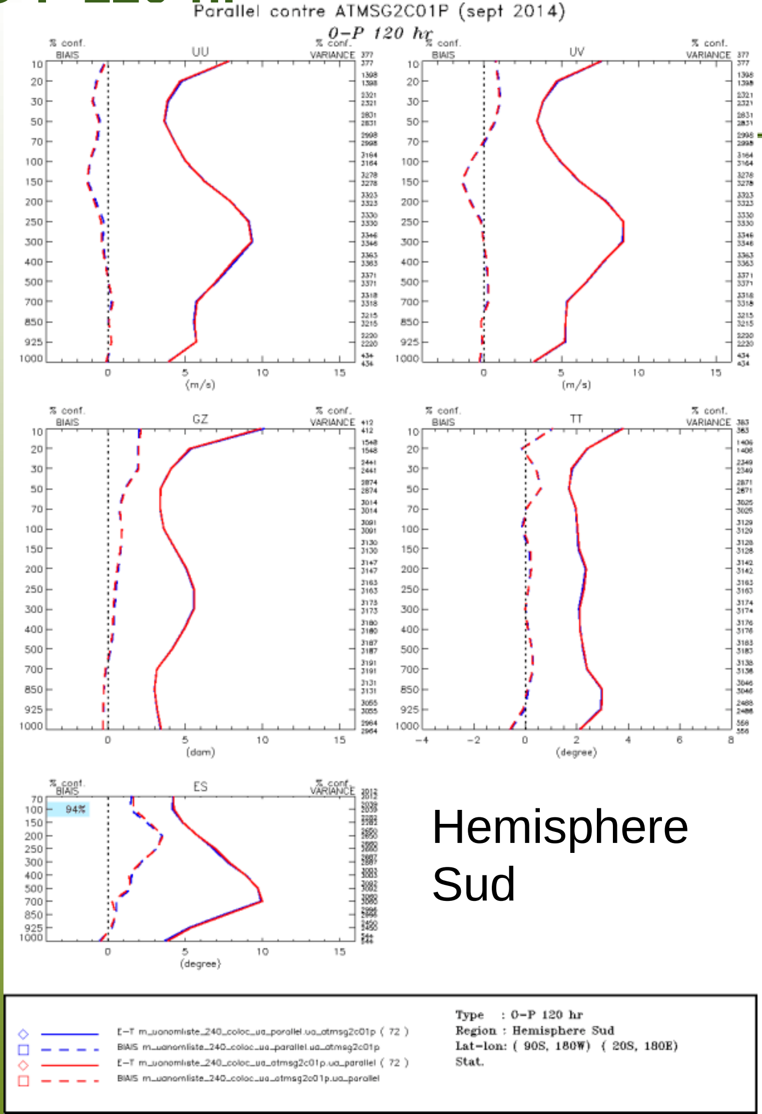


Hemisphere Sud

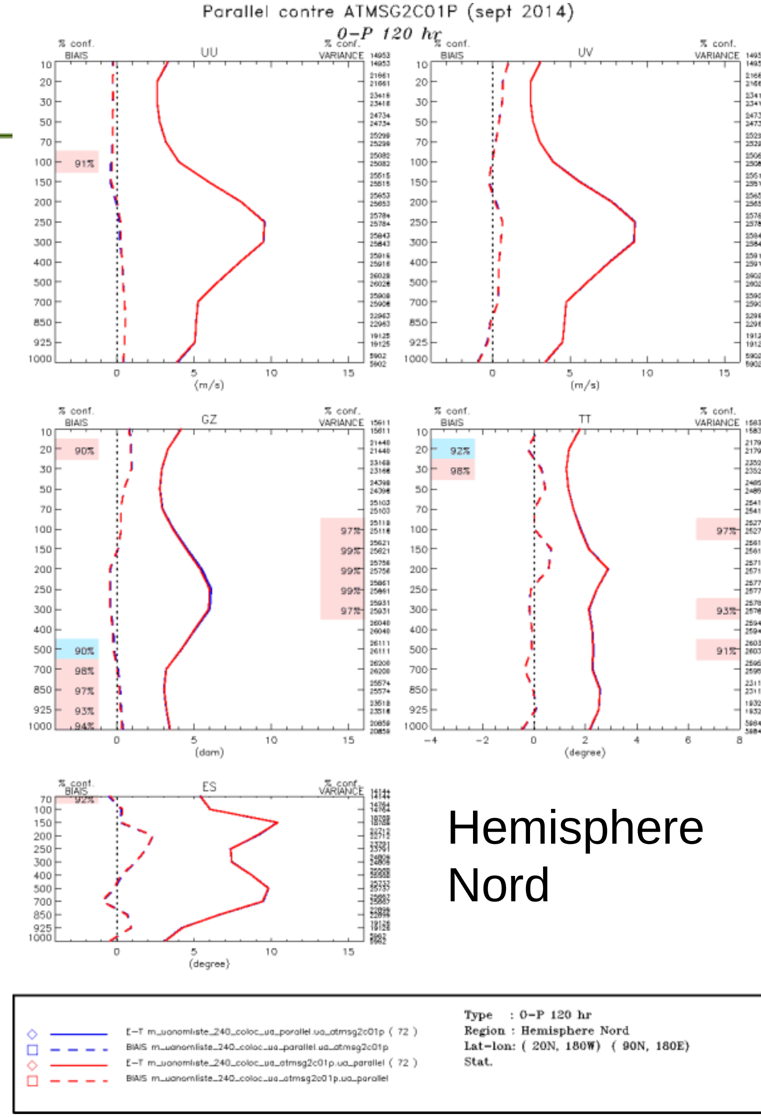


Hemisphere Nord

Resultats Arcad
O-F 120-hr



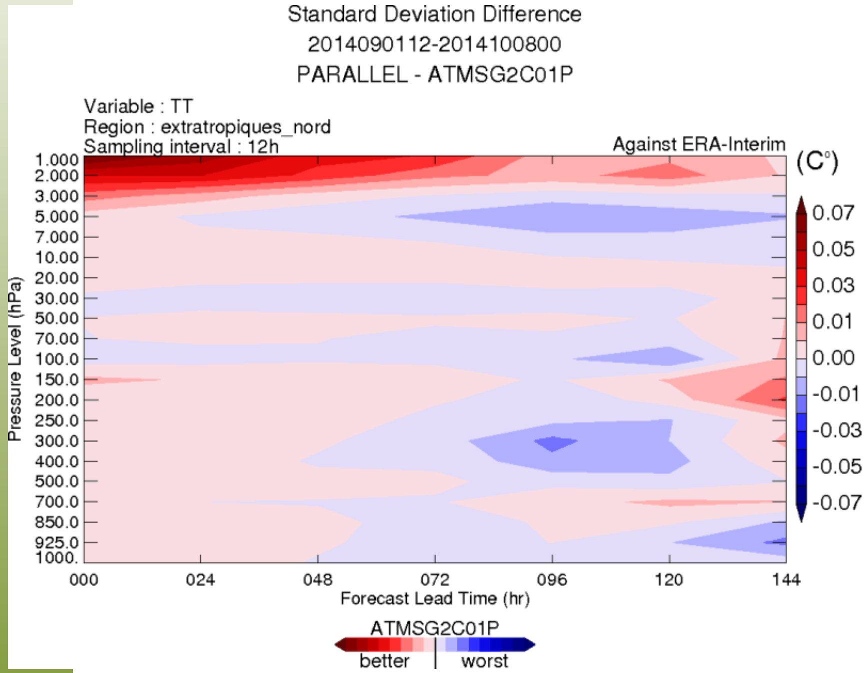
Hemisphere Sud



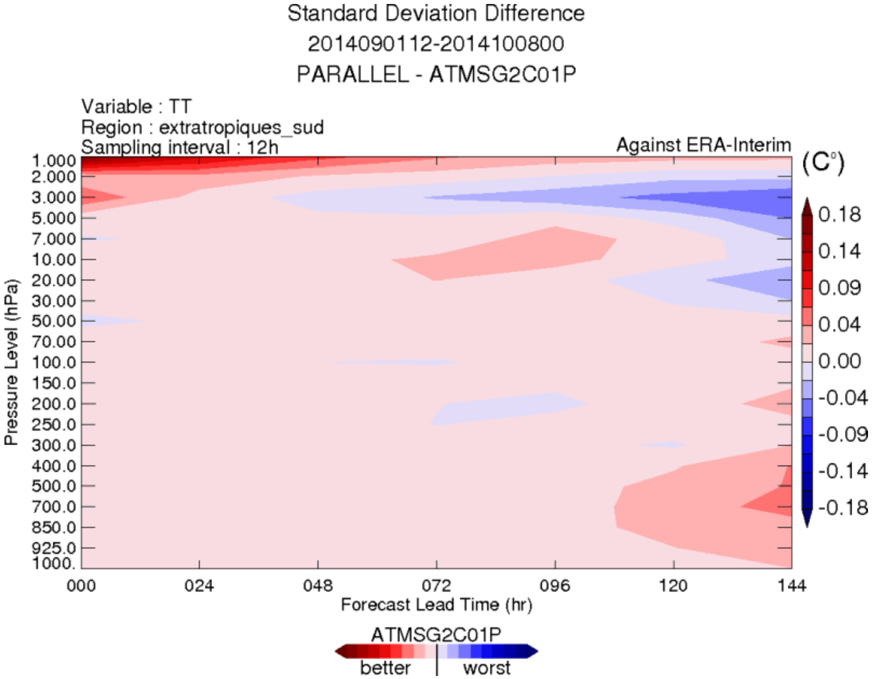
Hemisphere Nord

Std TT vs Era-Interim analyses

Ext-Nord

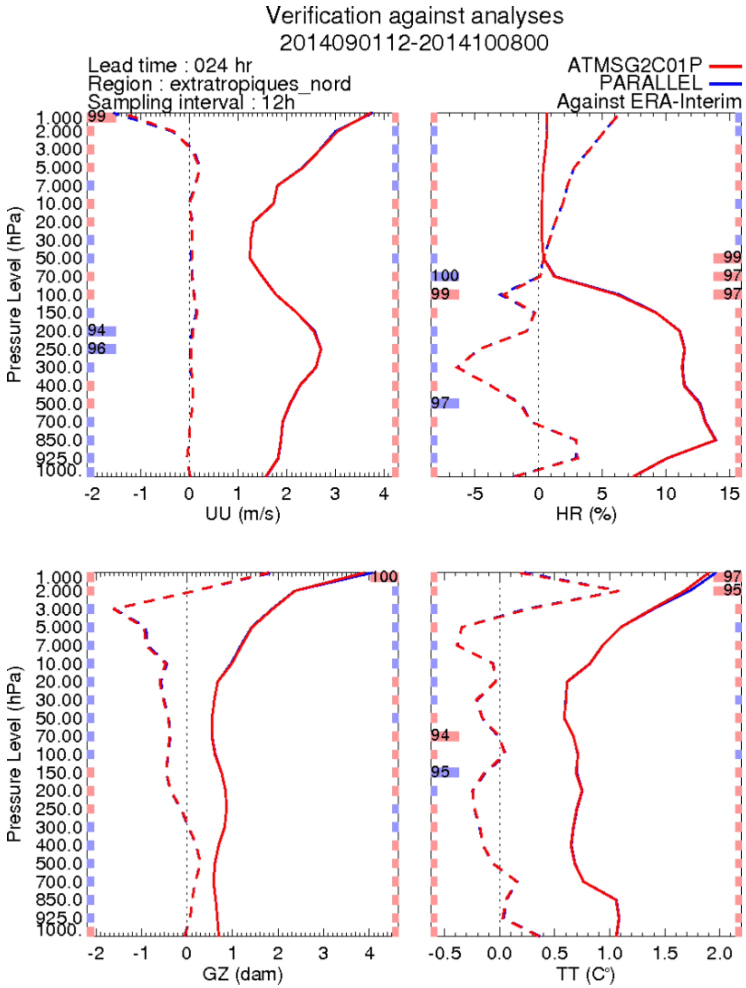


Ext-Sud

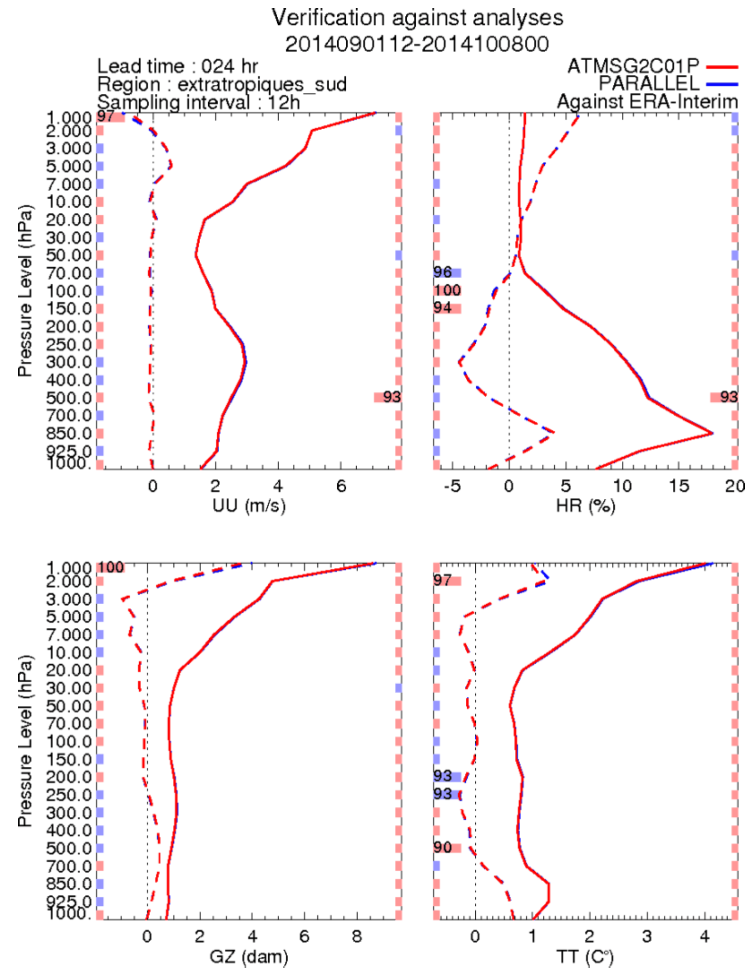


Profils 24-hr vs Era-Interim

Ext-Nord

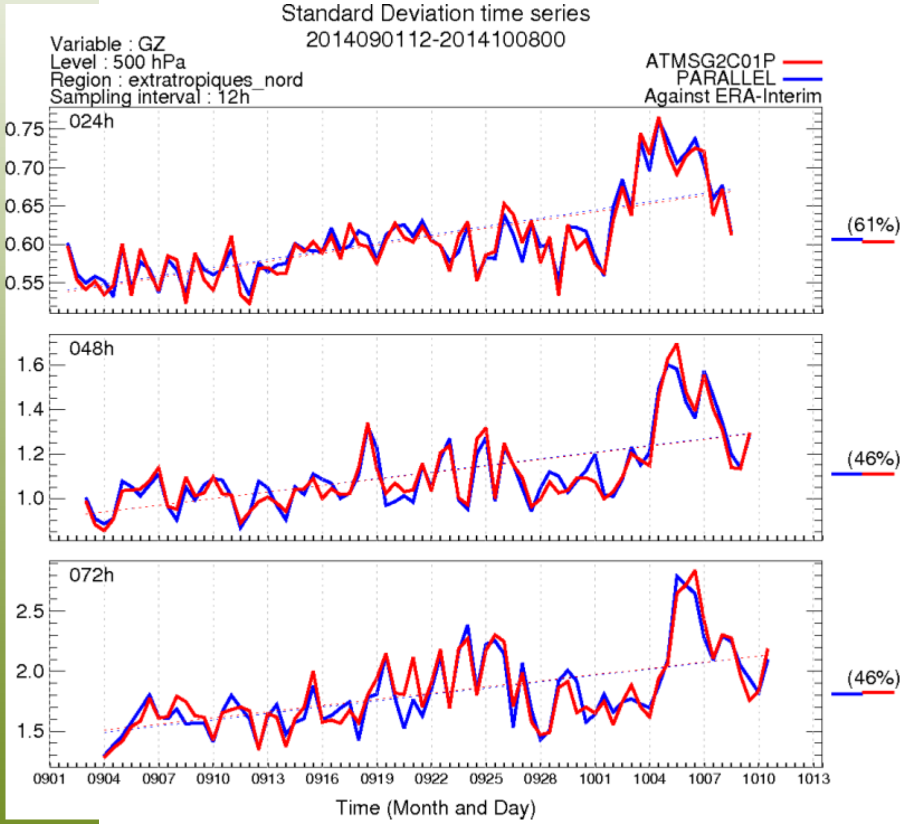


Ext-sud

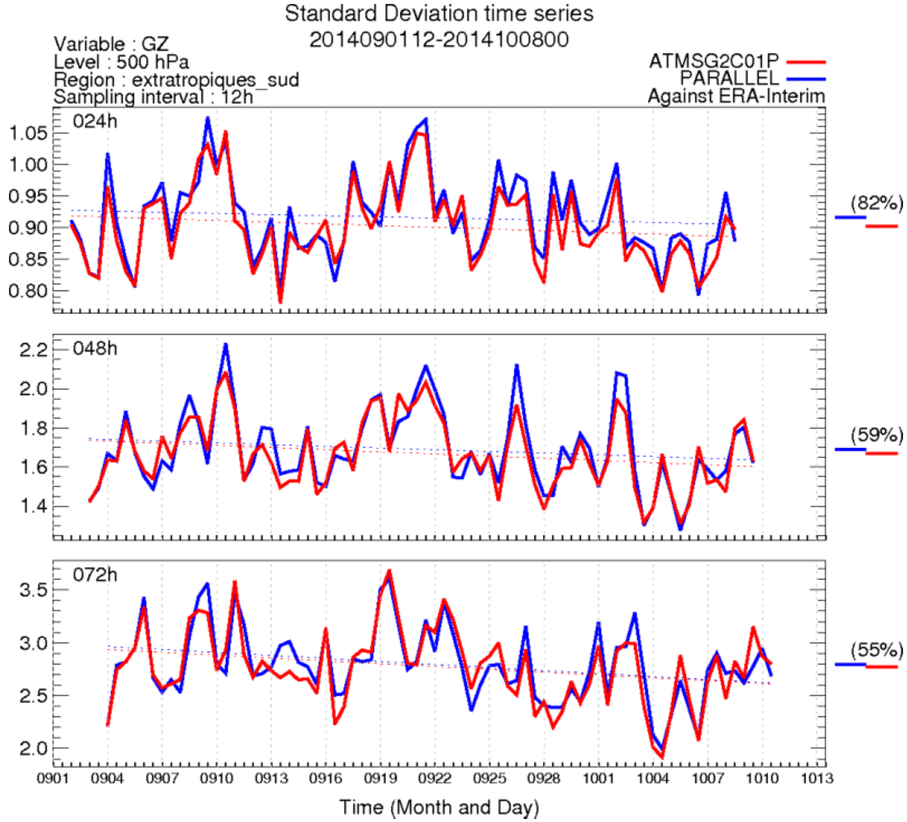


Séries temporelles std GZ 500mb 24/48/72-h vs Era-Interim

Ext-Nord



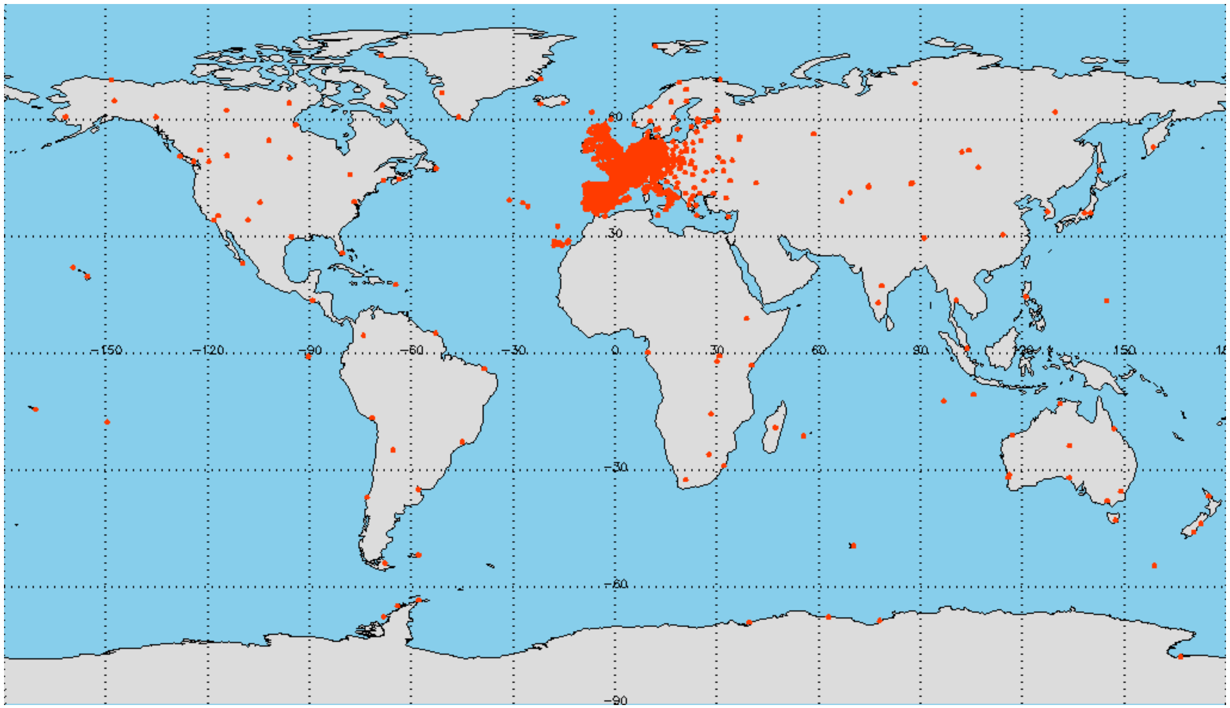
Ext-Sud



Implact plus marqué Ext-Sud

E-GVAP GPS Network

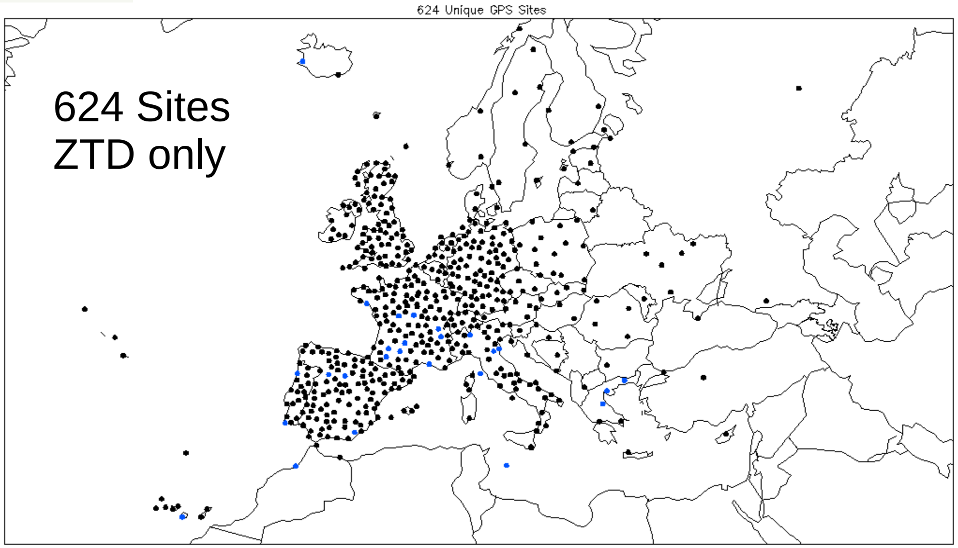
(~1500 global sites)



- **ZTD** observations every 15 minutes provided by 10 analysis centres (ACs)
- TPW also reported at some sites (used for TPW forecast verification)
- Few surface met reports (Psfc, Tsfc, Rhsfc) (< 10 stations)

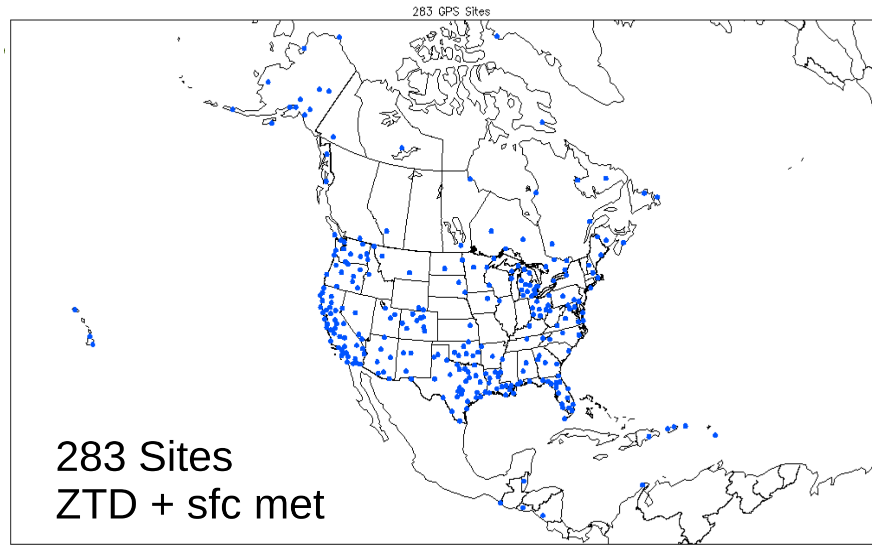
~900 sites assimilated after thinning

New



E-GVAP Network

Already assimilated

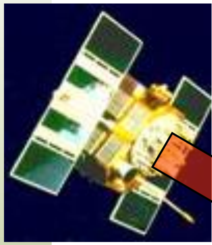


NOAA/FSL Network

- Thinning dx = 50 km
- Thinning dt = 2h

- **NEW**: ZTD **data quality scores** based on monthly monitoring O-P stats are considered in the thinning process to choose the "best" ZTD (AC) for each site where multiple solutions exist (provided by various processing centers).

Sensing Water Vapour with Ground-based GPS Receivers



zenith

Atmosphere

slant delay

map to zenith

Refractivity N induces delay in signal reception

- **density (P/T)**
- **water vapor (e) dipole moment**

$$N = k_1 \frac{P}{T} + (k_2 - k_1)\frac{e}{T} + k_3 \frac{e}{T^2}$$

$$ZTD \equiv 10^{-6} \int_{z=sfc}^{toa} N\,dz$$

ZTD at sea-level is order of 2.3 metres.

GPS Receiver

high accuracy, dual frequency

Surface Weather Station

Zenith Tropospheric Delay
ZTD = F(Ps,PW)

2.1 m 0.0 – 0.5 m

+

Pressure (Ps)
Temperature
RH

→ **Precipitable Water (PW)**

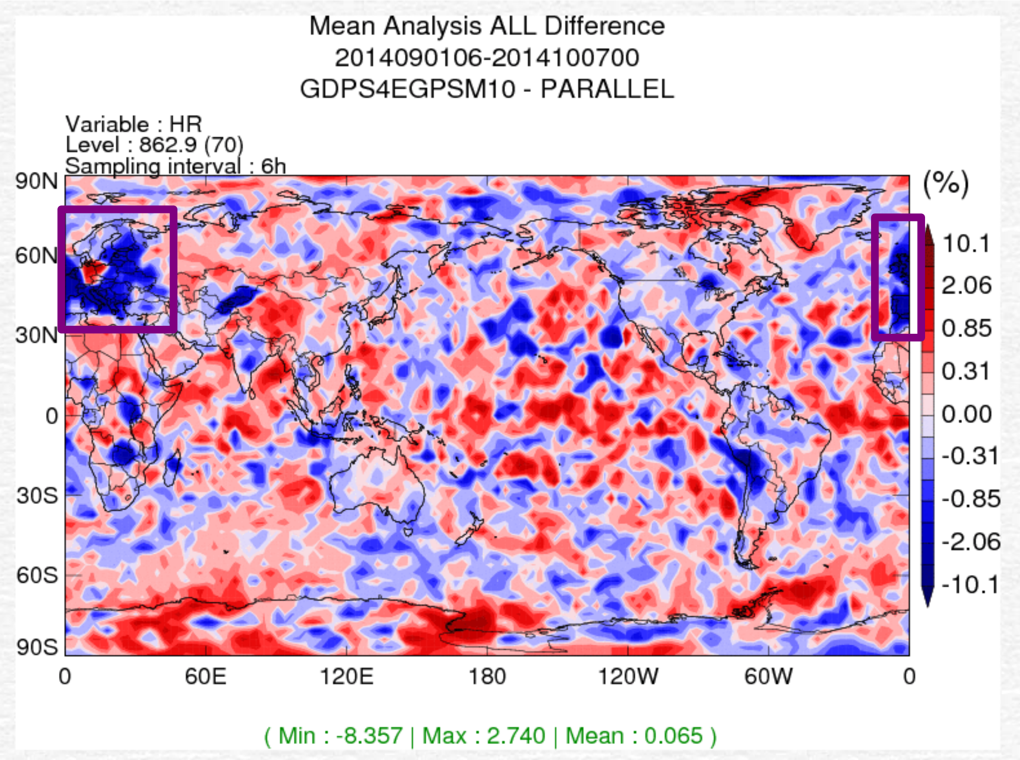
ZTD is estimated from raw GPS receiver data using geodetic processing software (e.g. GAMIT) designed for precise positioning applications

E-GVAP Data Impact Cycle

- Suite = GDPS4EGP**SM10** (same as ATMS suite but without ATMS data)
- Control = GDPS 4.0 parallel run (PAR)
- Period = 6 weeks; 1 September to 10 October 2014
- Suite adds E-GVAP network ZTD observations (Europe, globe)
- PAR 10-day forecasts generated from PAR G2 “analyses”

- Verifications include:
- **ARCAD** (http://iweb/~armamac/GLOBAL/parallel_contre_gdps4egpsm10/scores_arcad_ua.html)
- **VERDICT** (http://iweb/~armamac/VERDICT_EnVar_gbgps/):
- Forecasts: vs **OWN** (1000-100 hPa, 5-day), vs **ECMWF** (1000-200 hPa, 10 day)
- **GPS TPW** observations (http://iweb/~armamac/verif_gps/verif_interface_rdps.html)
- 5-day (120h) forecasts over Europe

Mean Difference in Analysis RH

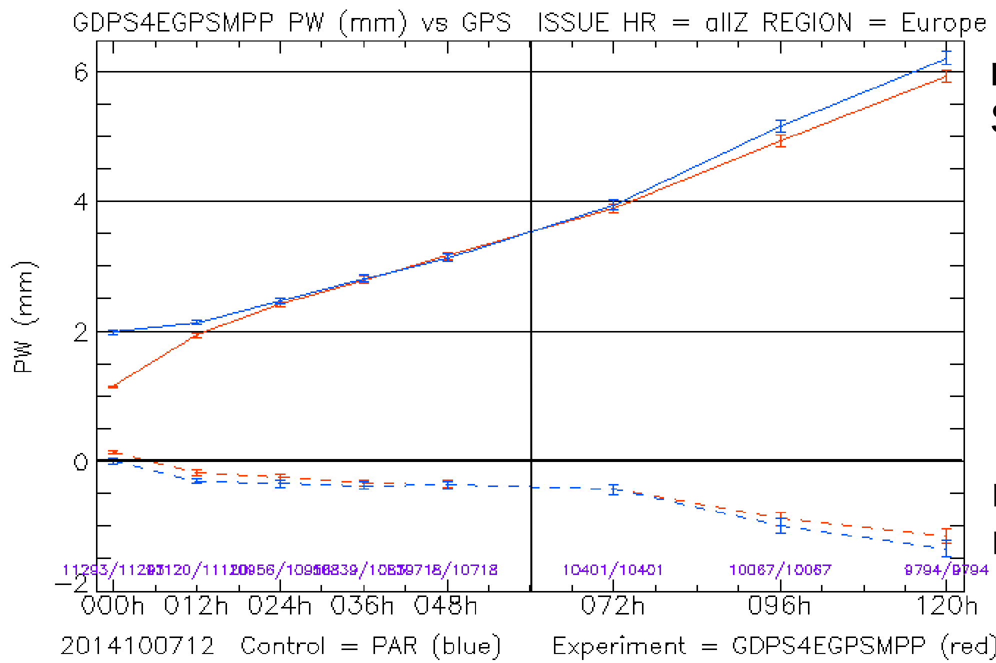


- Analysis is generally drier over Europe region except over Germany where analysis is more humid
- ZTD obs over Germany are mainly from analysis centre GFZ which uses different strategy for computing ZTD
- As we don't apply bias corrections, this leads to mean positive RH difference over Germany

Verification of forecast **TPW** with GB-GPS PW observations (**Europe**)

ndata = 10,000

(subset of network reporting TPW)



reduction in Std(O-F)

reduction in model moist bias

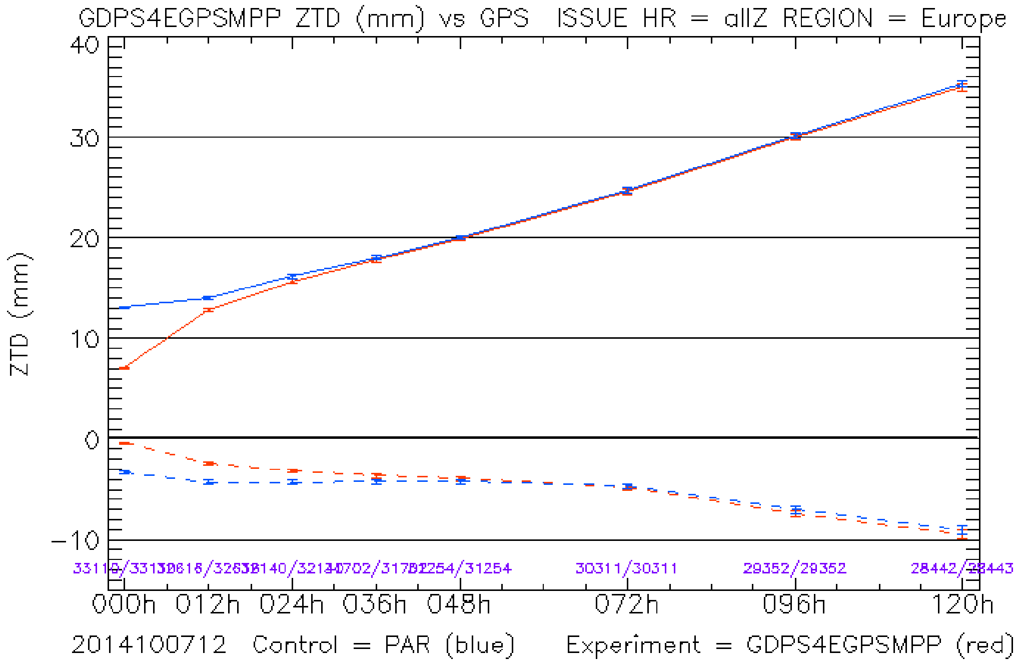
Positive impact of E-GVAP obs as expected (diminishing over 00-48h)

Increasing positive impact after 72h is unexpected but agrees with ARCAD “ES” results

Verification of forecast **ZTD** with GB-GPS observations (**Europe**)

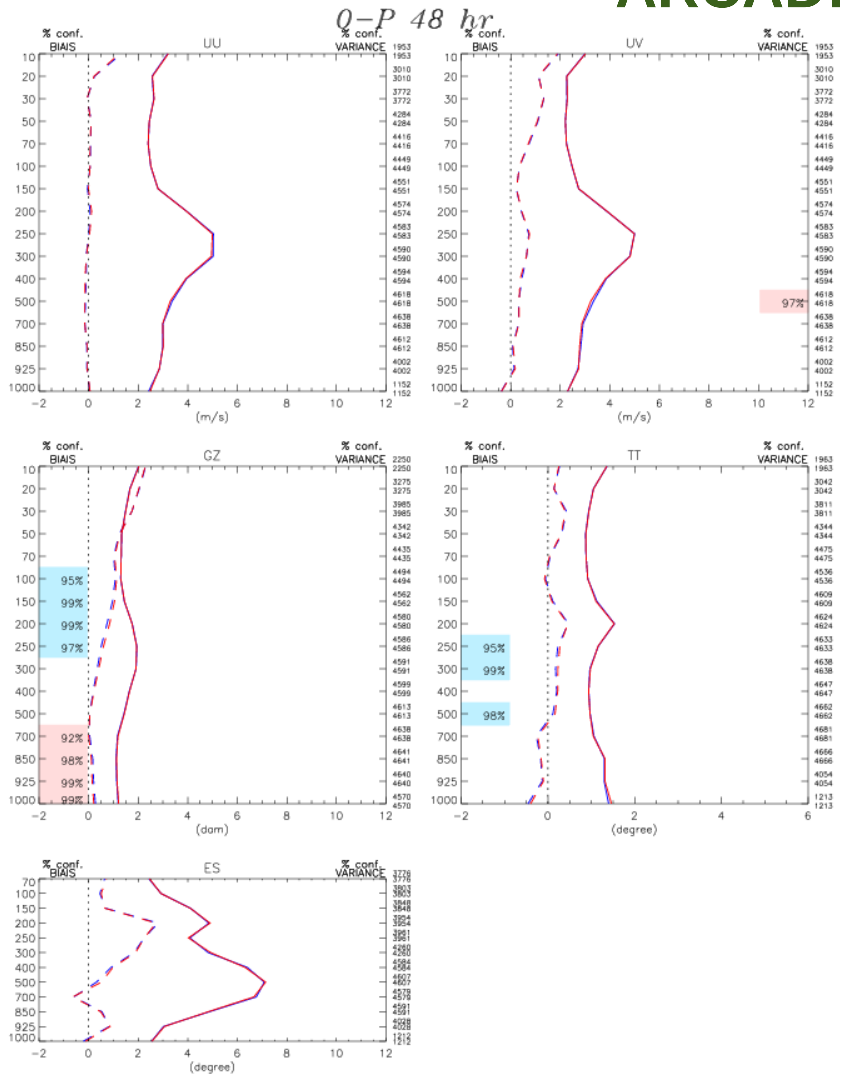
ndata = 30,000

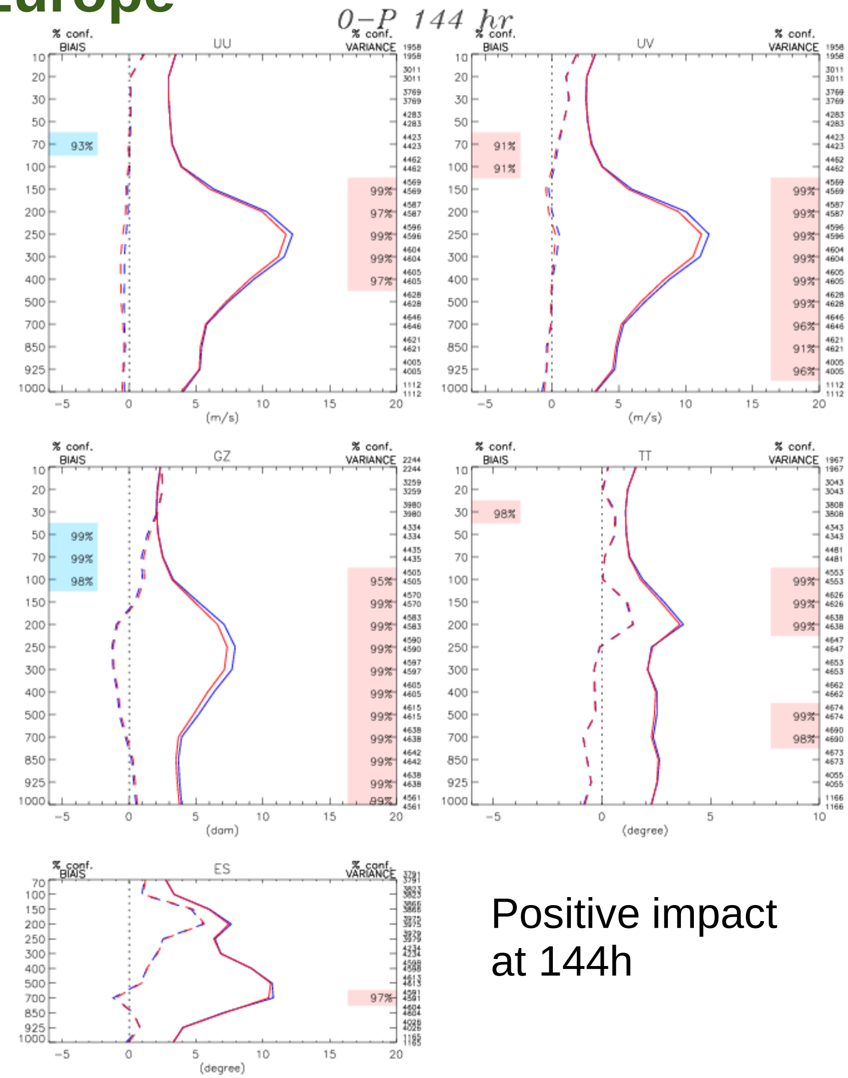
Entire network



ZTD = *F*(Psfc) + *F*(TPW)

ARCAD: Europe





Positive impact at 144h

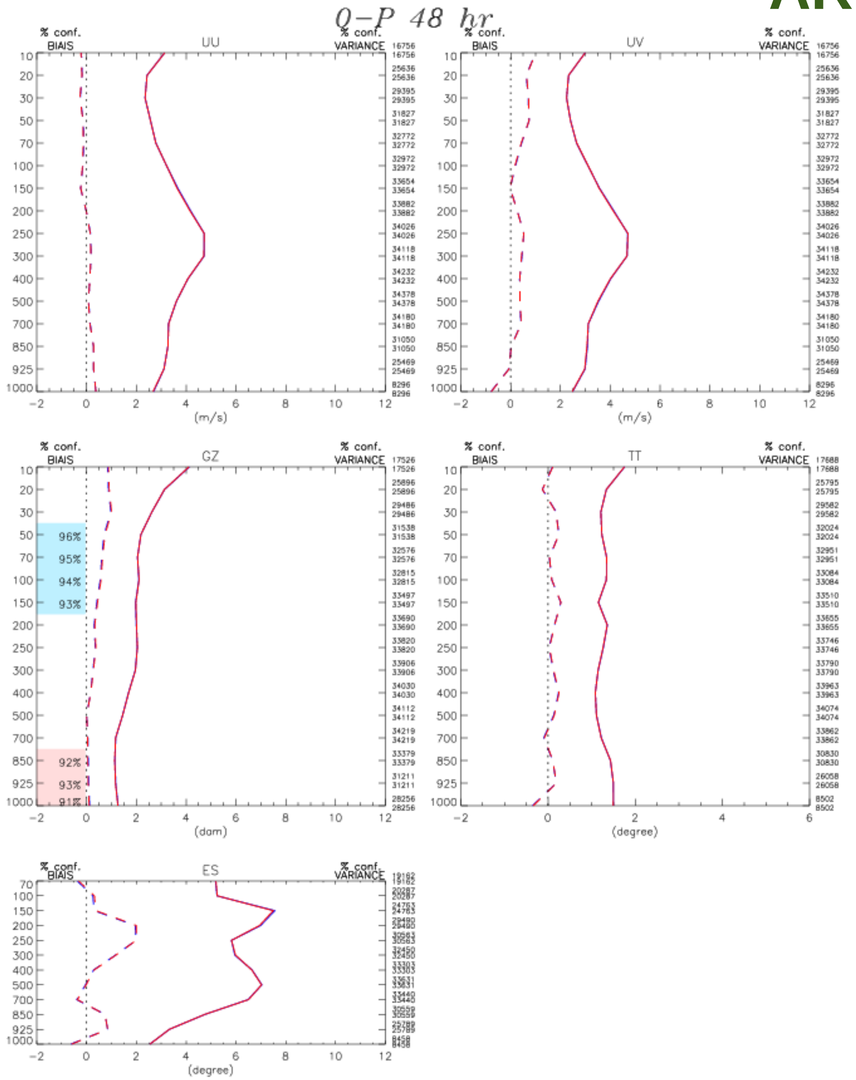
Type : O–P 48 hr
Region : Europe
Lat–lon: (25N, 10W) (70N, 28E)
Stat. communes

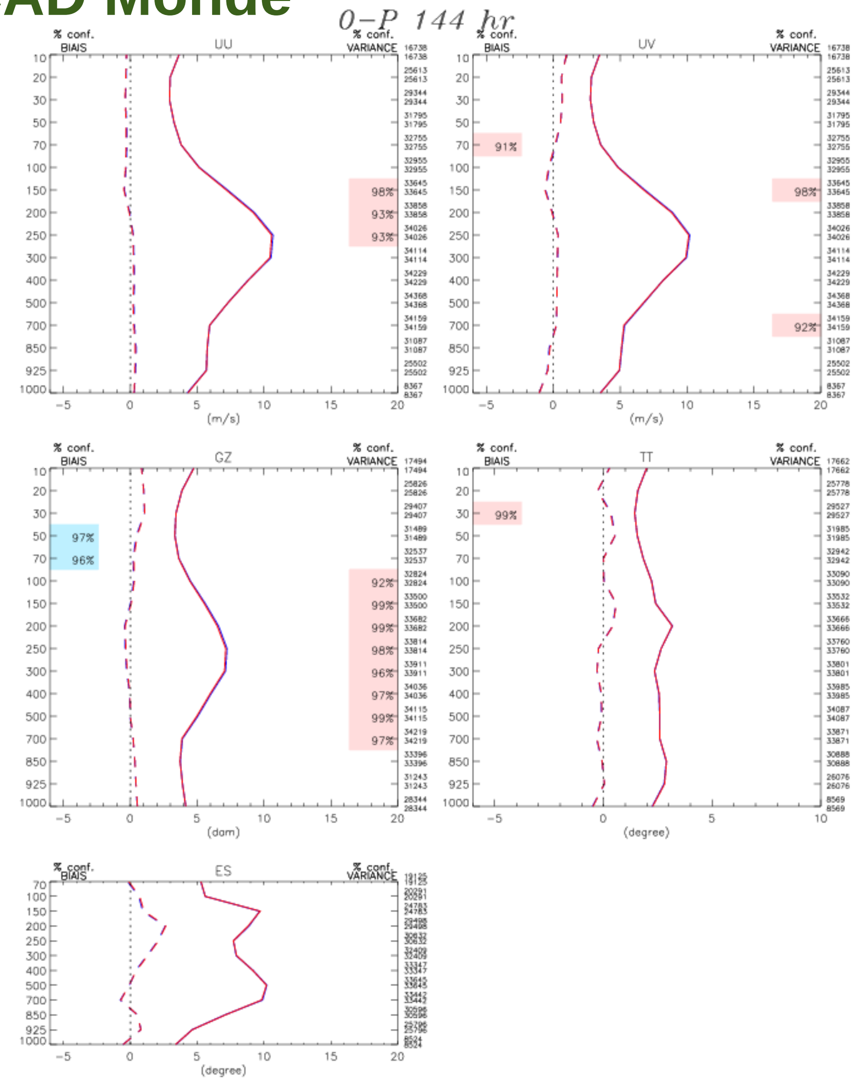
- E–T m_ua140901_141007_240_coloc_ua_parallel.ua_gdps4egpsm10 (73)
- BIAIS m_ua140901_141007_240_coloc_ua_parallel.ua_gdps4egpsm10
- E–T m_ua140901_141007_240_coloc_ua_gdps4egpsm10.ua_parallel (73)
- BIAIS m_ua140901_141007_240_coloc_ua_gdps4egpsm10.ua_parallel

Type : O–P 144 hr
Region : Europe
Lat–lon: (25N, 10W) (70N, 28E)
Stat. communes

- E–T m_ua140901_141007_240_coloc_ua_parallel.ua_gdps4egpsm10 (73)
- BIAIS m_ua140901_141007_240_coloc_ua_parallel.ua_gdps4egpsm10
- E–T m_ua140901_141007_240_coloc_ua_gdps4egpsm10.ua_parallel (73)
- BIAIS m_ua140901_141007_240_coloc_ua_gdps4egpsm10.ua_parallel

ARCAD Monde



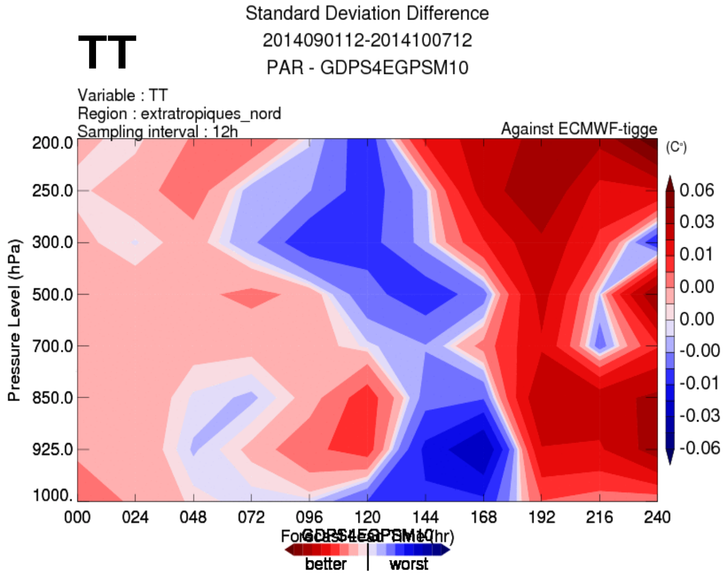


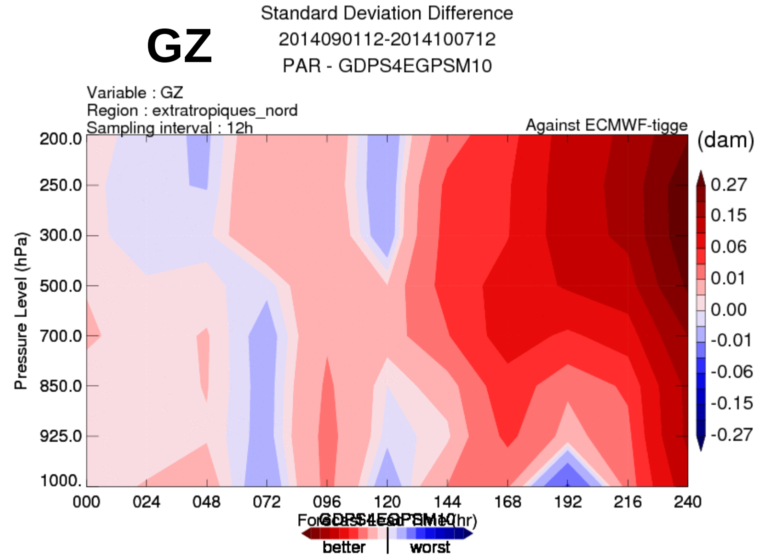
Type : O-P 48 hr
E-T m_ua140901_141007_240_coloc_ua_parallel.ua_gdps4egpsm10 (73)Region : Monde
BIAIS m_ua140901_141007_240_coloc_ua_parallel.ua_gdps4egpsm10 Lat-lon: (90S, 180W) (90N, 180E)
E-T m_ua140901_141007_240_coloc_ua_gdps4egpsm10.ua_parallel (73)Stat. communes
BIAIS m_ua140901_141007_240_coloc_ua_gdps4egpsm10.ua_parallel

Type : O-P 144 hr
E-T m_ua140901_141007_240_coloc_ua_parallel.ua_gdps4egpsm10 (73)Region : Monde
BIAIS m_ua140901_141007_240_coloc_ua_parallel.ua_gdps4egpsm10 Lat-lon: (90S, 180W) (90N, 180E)
E-T m_ua140901_141007_240_coloc_ua_gdps4egpsm10.ua_parallel (73)Stat. communes
BIAIS m_ua140901_141007_240_coloc_ua_gdps4egpsm10.ua_parallel

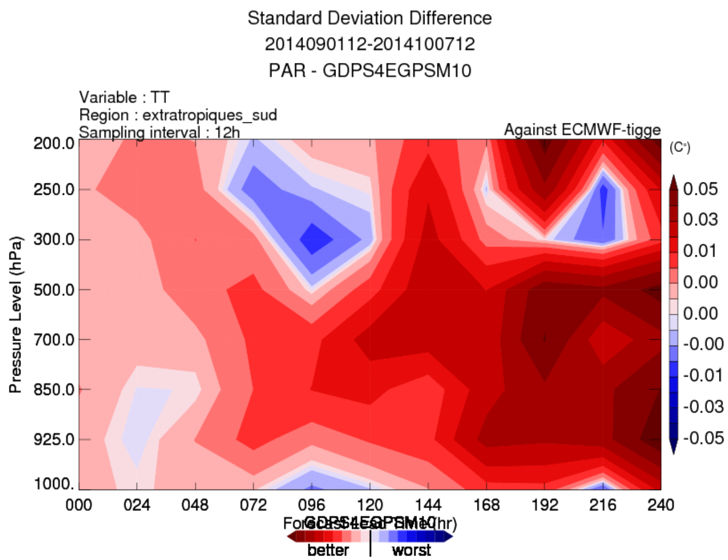
STD digfferences against ECMWF analyses

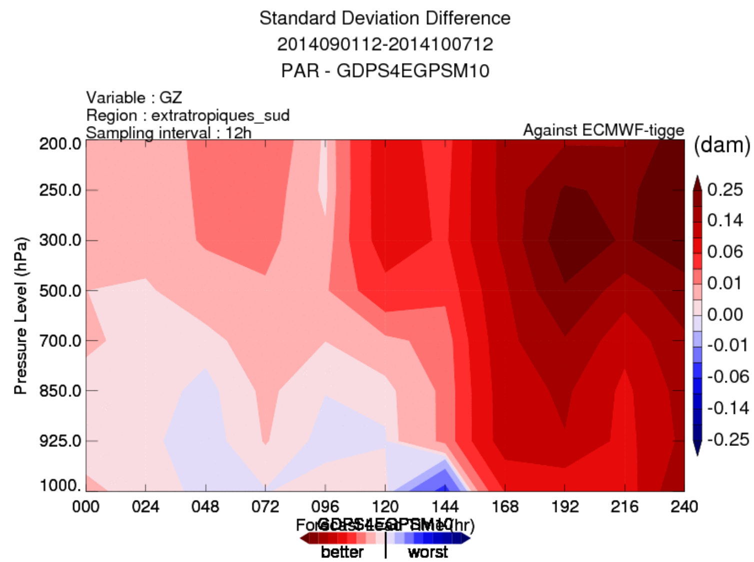
NH



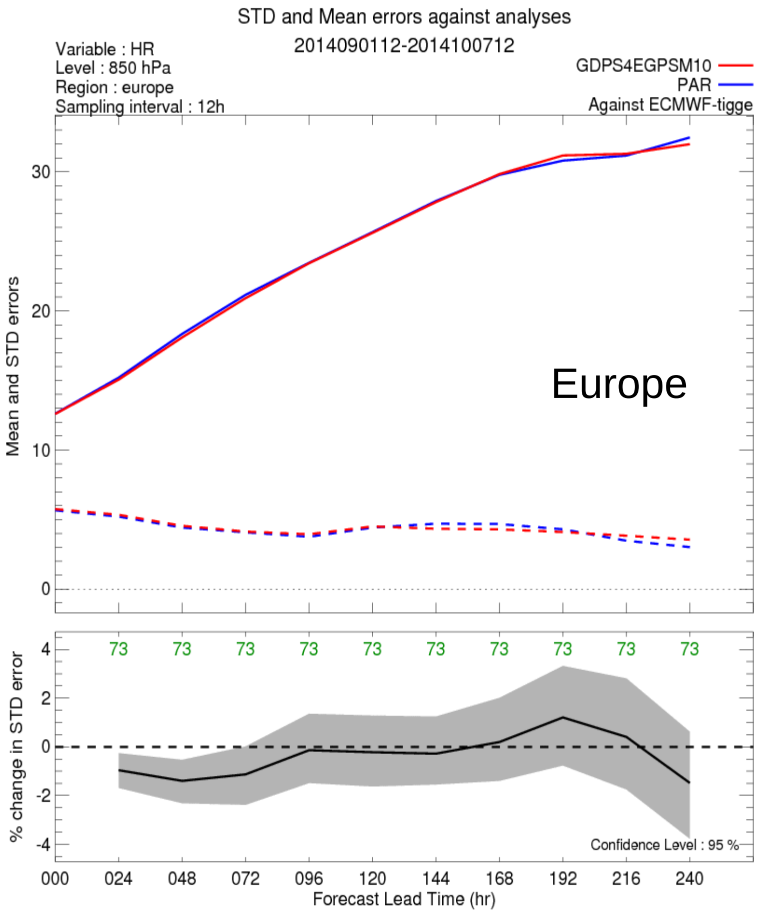


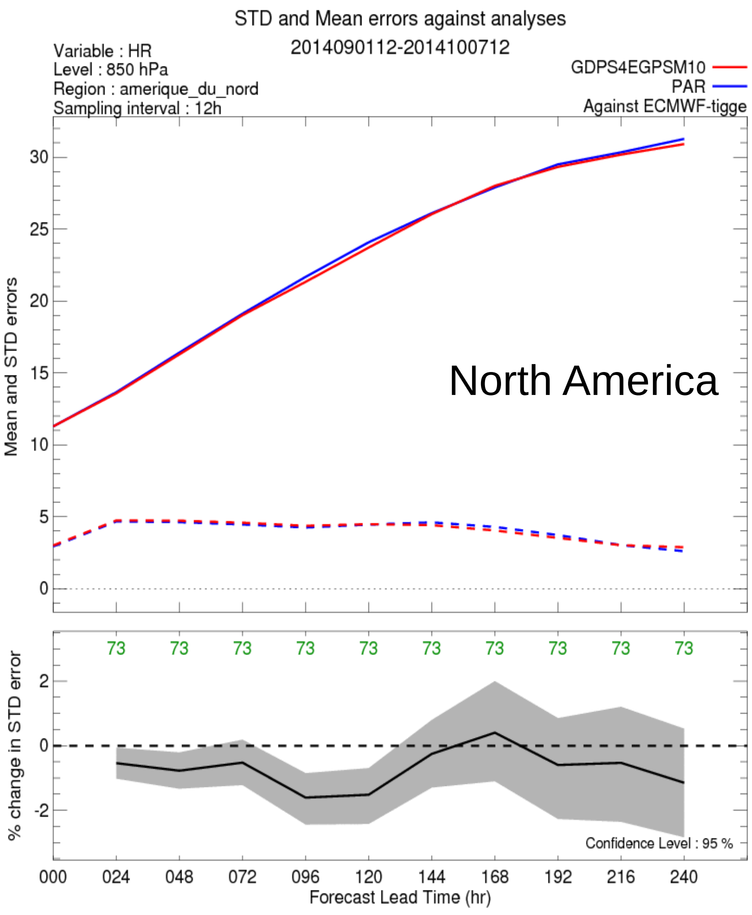
SH





850 hPa RH vs ECMWF analyses





Inter-channel error correlation (IEC)

- Variational data assimilation is based on the minimization of the typical cost function:

$$J_{\mathrm{var}}(\mathbf{x}) = \frac{1}{2}\left\{ \underbrace{(\mathbf{x}-\mathbf{x_b})^{t}\mathbf{B}^{-1}(\mathbf{x}-\mathbf{x_b})}_{\text{Background term}} + \underbrace{(\mathbf{H}(\mathbf{x})-\mathbf{y})^{t}\mathbf{R}^{-1}(\mathbf{H}(\mathbf{x})-\mathbf{y})}_{\text{Observation term}} \right\}$$

- **Issue: R** matrix was up to now diagonal because:

  - not well known

  - inverse R^{-1} need to be well conditioned, and it varies at each point depending on cloud conditions

- IEC can be significant, notably for water vapor channels

Desroziers diagnostic to get IEC

- The approach was introduced in Desroziers et al. 2005. It allows for a simple evaluation of the **R** matrix using assimilation experiments by-products :

$$\tilde{\mathbf{R}} = \left\langle \left(\mathbf{y}_i - \mathbf{H}(\mathbf{x_a})\right)\left(\mathbf{y}_j - \mathbf{H}(\mathbf{x_b})\right)^t \right\rangle$$

- Bormann et al. demonstrated that this method gives similar results as other methods
- No adjustable parameter

→ IEC easily derived from (O-P) and (O-A) stats

Desroziers diagnostic: possible limitations

- It is based on several assumptions:
  - Unbiased observations (*radiances observations are bias corrected with a necessarily imperfect approach*).
  - Uncorrelated Background and Observation errors (*this approximation is fundamental to separate the cost function in two independents parts. However, the work of Gorin et al. 2011 demonstrated that it may not be always valid for radiances*)
  - Well specified background error covariance matrix **B**. *(our **B** matrix is imperfect. It was nevertheless significantly improved with Ensemble variational approach. Work is still ongoing in this domain)*

Desroziers diagnostic application

- The resulting Desroziers matrix was symmetrized:

$$\tilde{\mathbf{R}}_{sym} = \frac{1}{2}\left(\tilde{\mathbf{R}} + \tilde{\mathbf{R}}^{t}\right)$$

- For convenience, we use the decomposition of **R** in correlation **C** and variances σ^2:

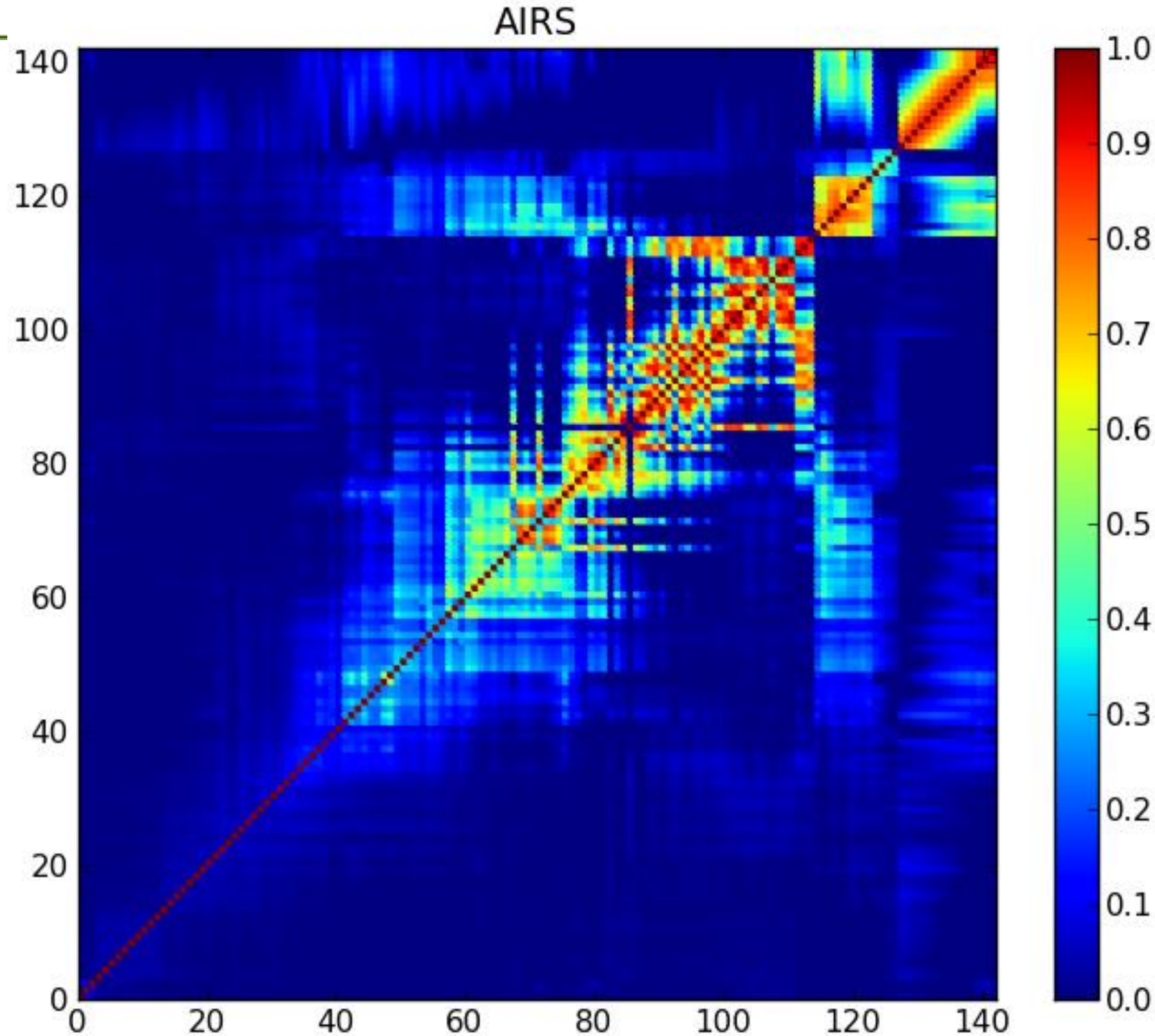
$$\tilde{\mathbf{R}}_{sym} = diag(\boldsymbol{\sigma})\mathbf{C}diag(\boldsymbol{\sigma}) \qquad (\tilde{\mathbf{R}}_{ij} = \sigma_i \sigma_j \mathbf{C}_{ij})$$

  - Diag ($\boldsymbol{\sigma}$) still inflated, set to 1.6 std(O-P) for all channels

Sample diagnosed correlations

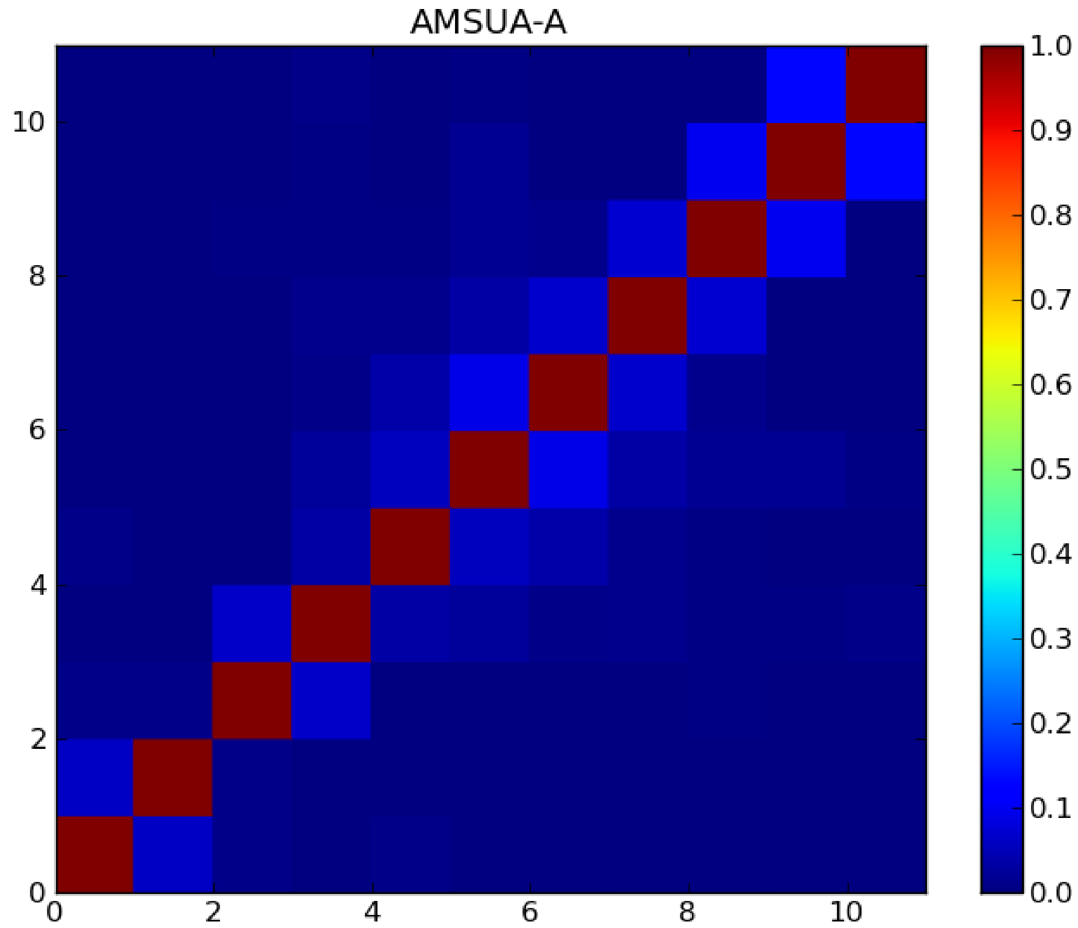
Correlation structure of the symmetrized R for the 142 AIRS channels selected for assimilation

It was checked that the R matrix is positive definite

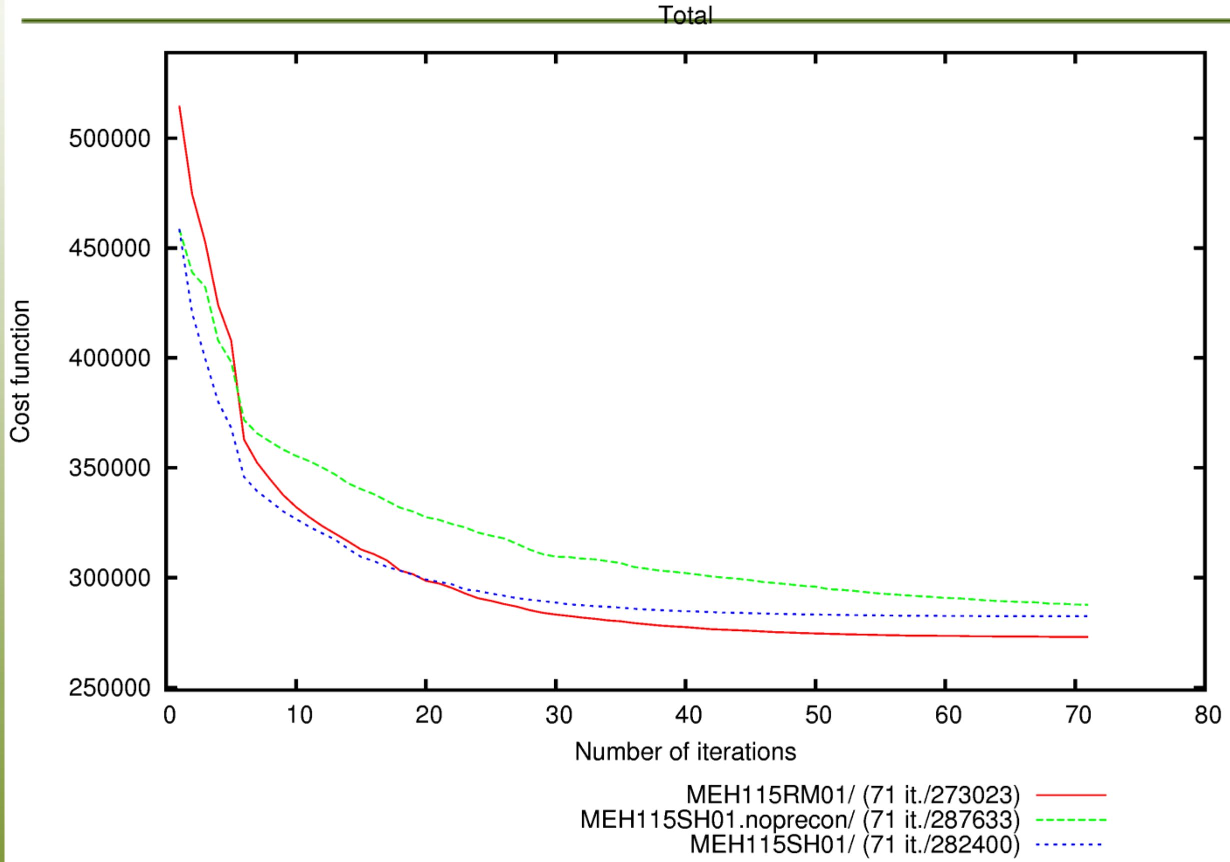


Sample diagnosed correlations

Correlation structure of the symmetrized R for the 11 AMSU-A channels selected for assimilation



Cost function minimization



Full R matrix
and No preconditioning

With preconditioning:
- Diagonal R
- Full R matrix

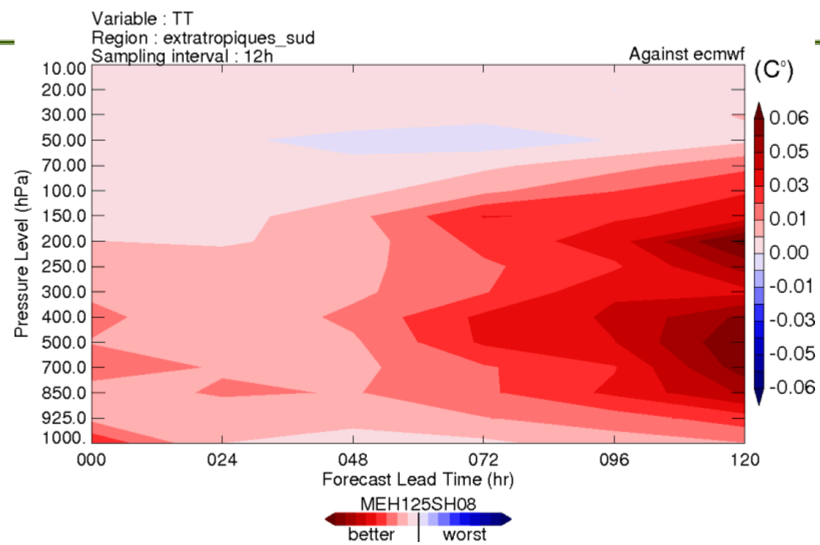
Full matrix: Desroziers error correlation is used, retaining operational errors on diagonal

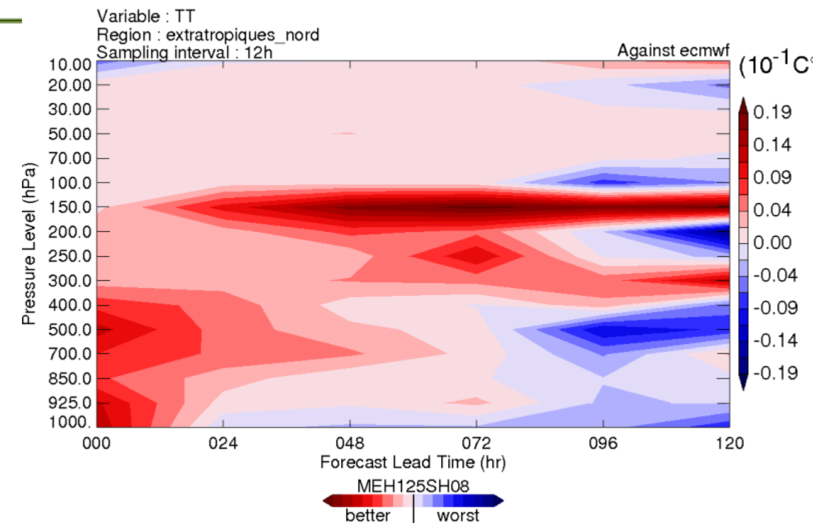
Std difference TT

Ext-Sud

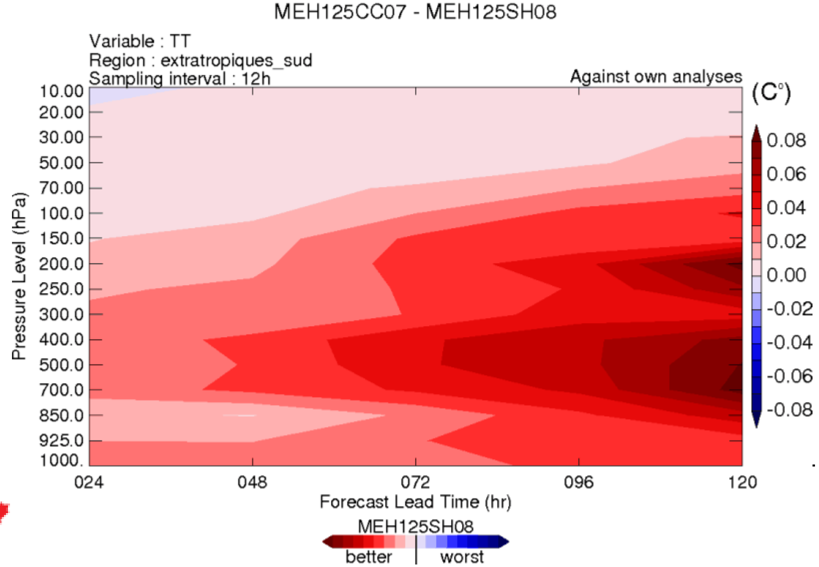
Ext-Nord

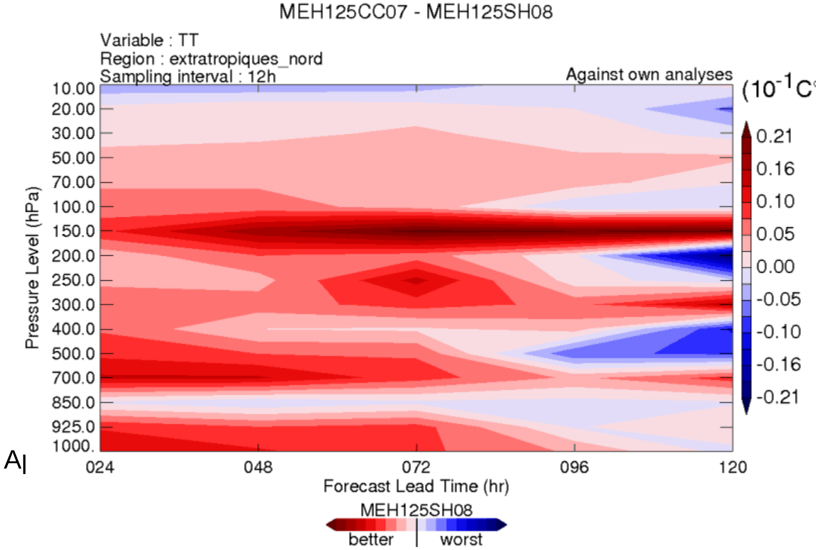
Vs ECMWF





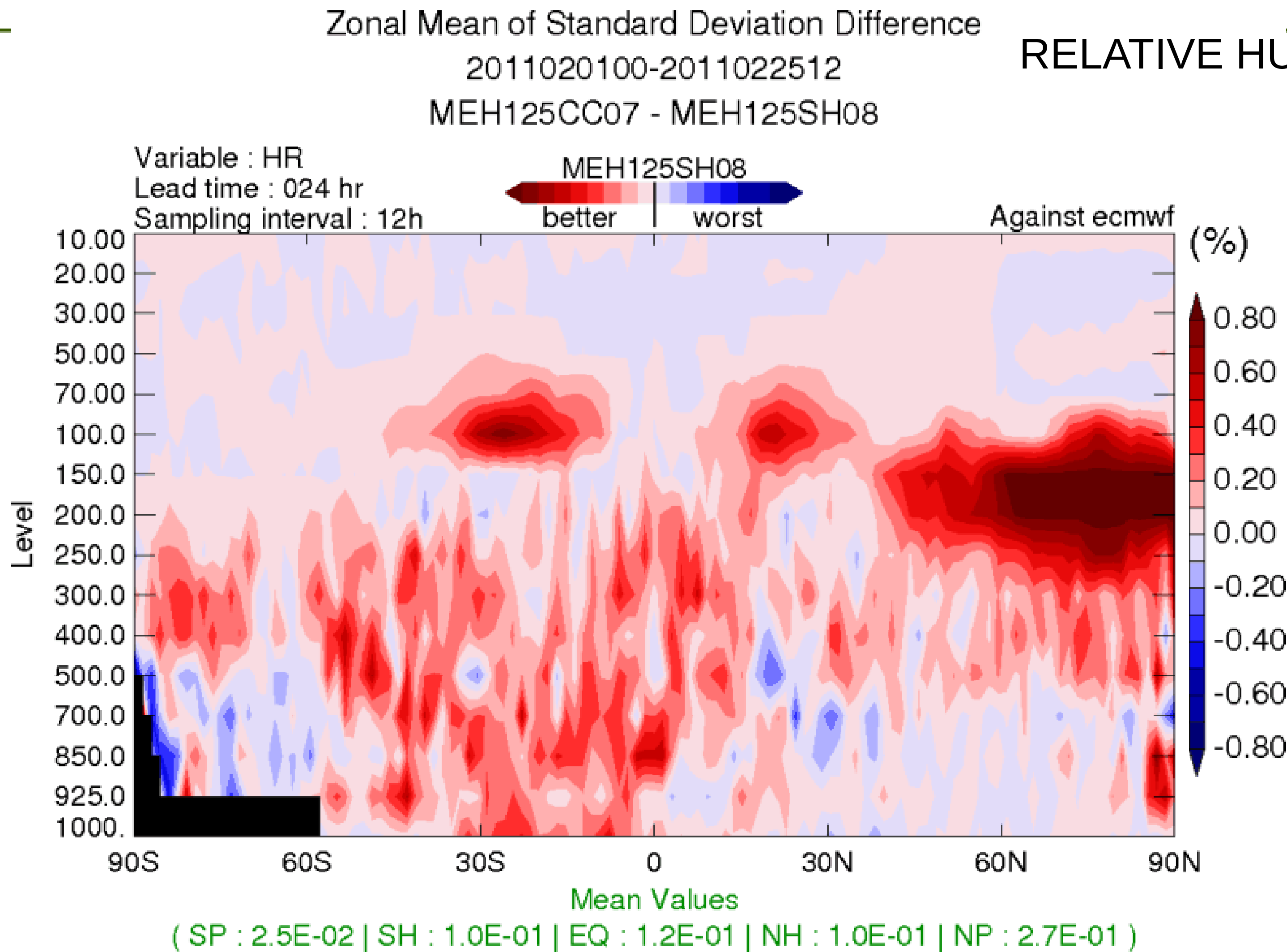
Vs own





24 hour forecast scores against ECMWF analyses

RELATIVE HUMIDITY



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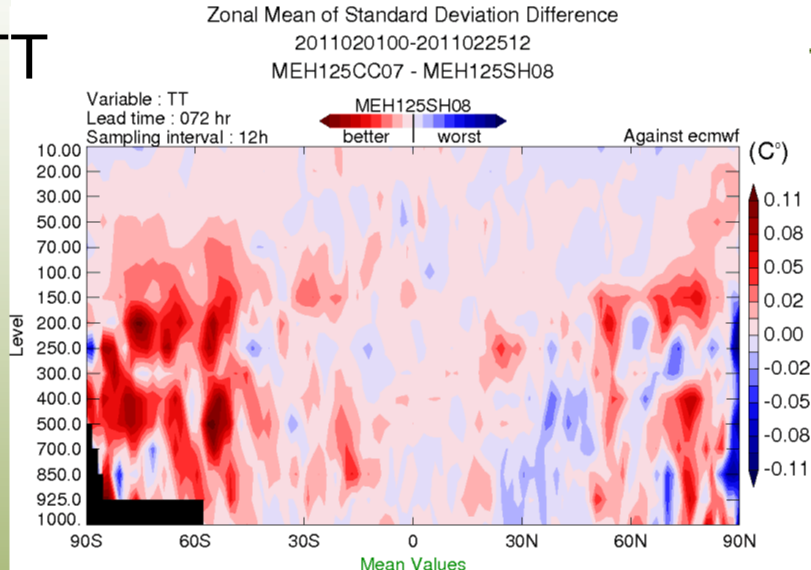
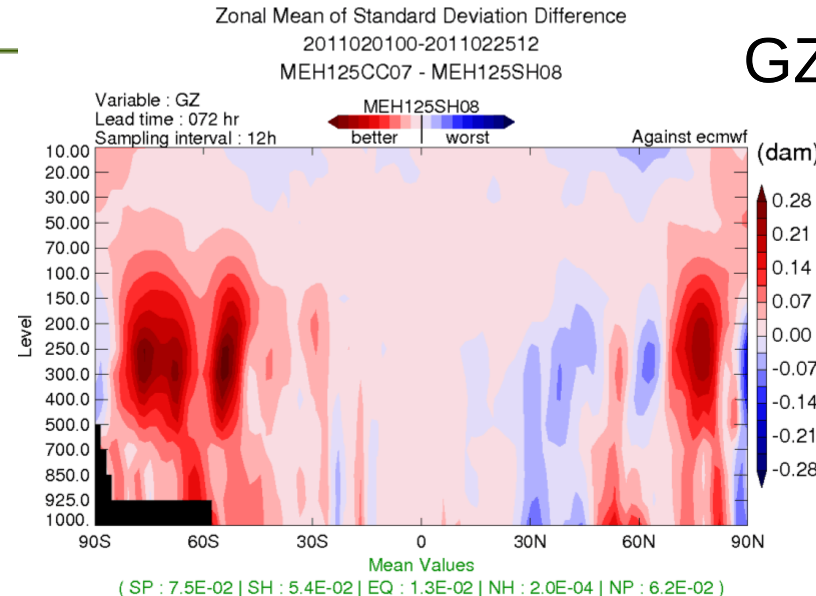
72 hours forecast scores against ECMWF analyses

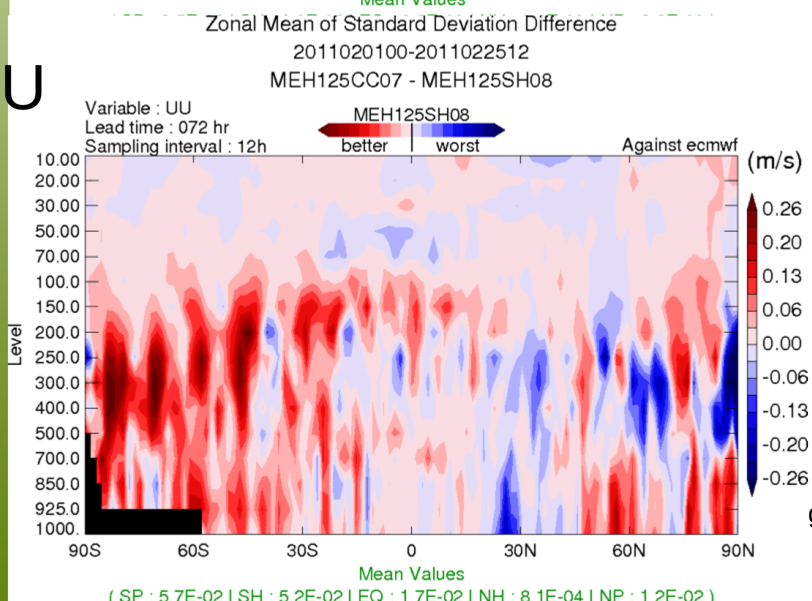
TT



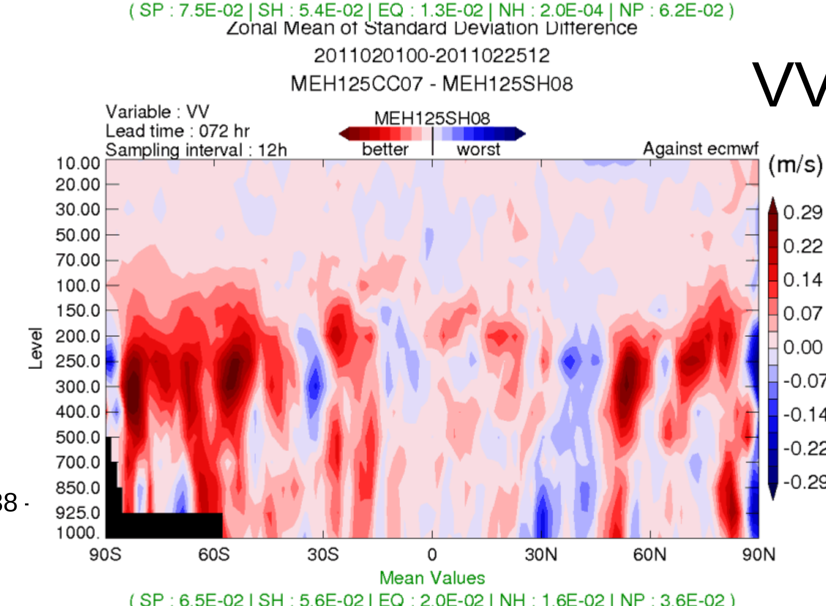
GZ



UU

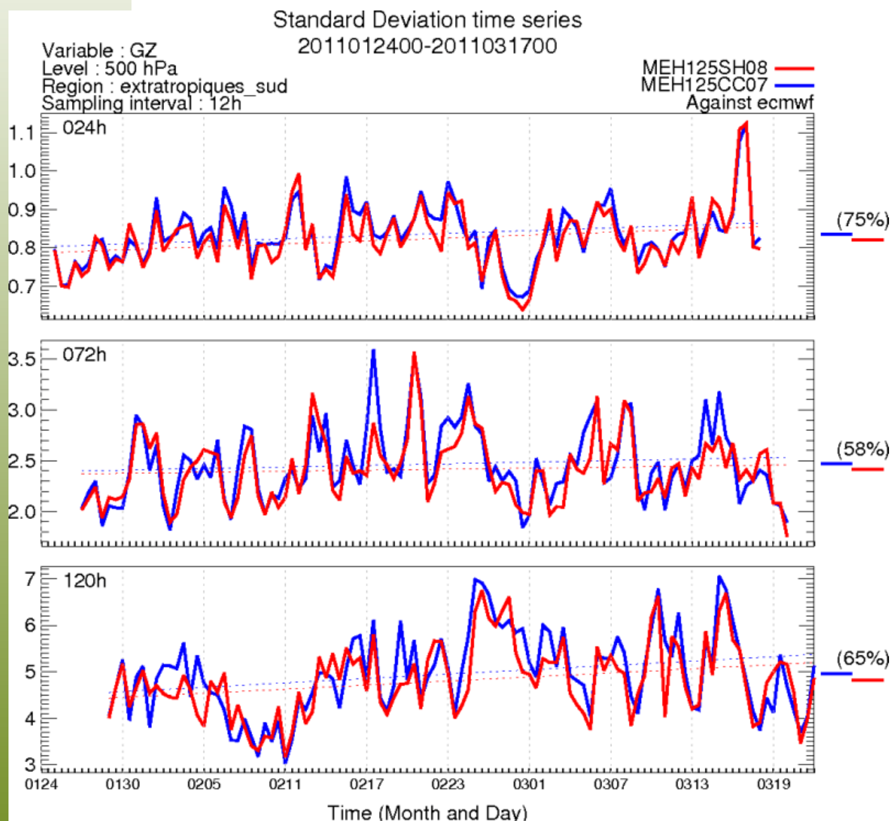


VV

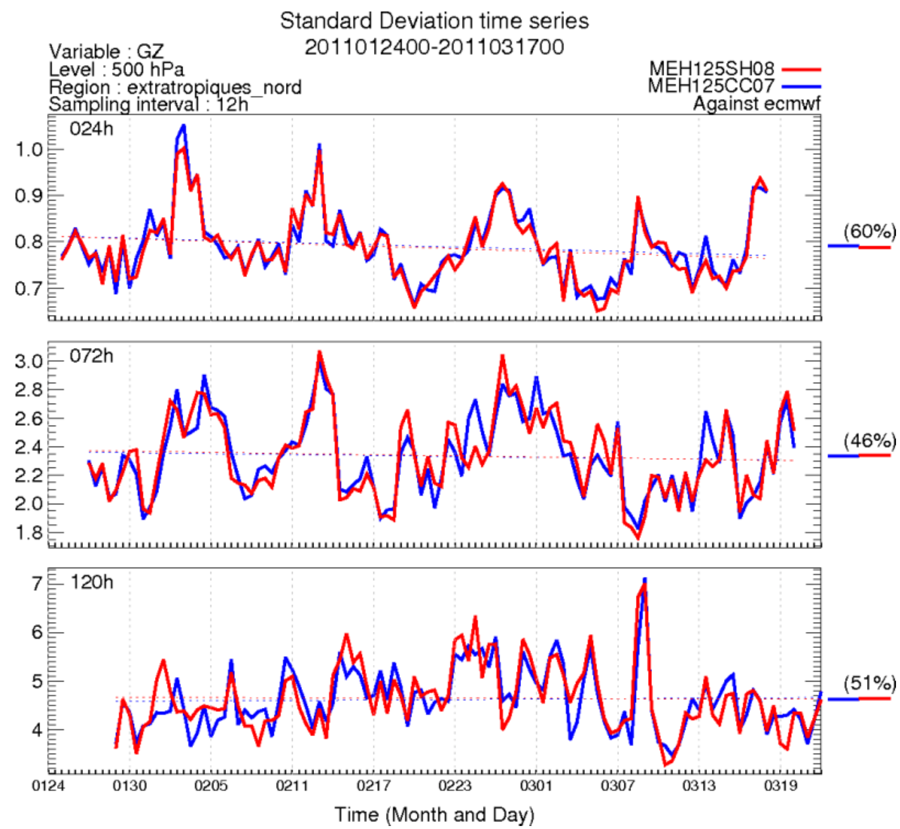


Séries temporelles: STD GZ 500mb vs ECMWF

EXT-Sud

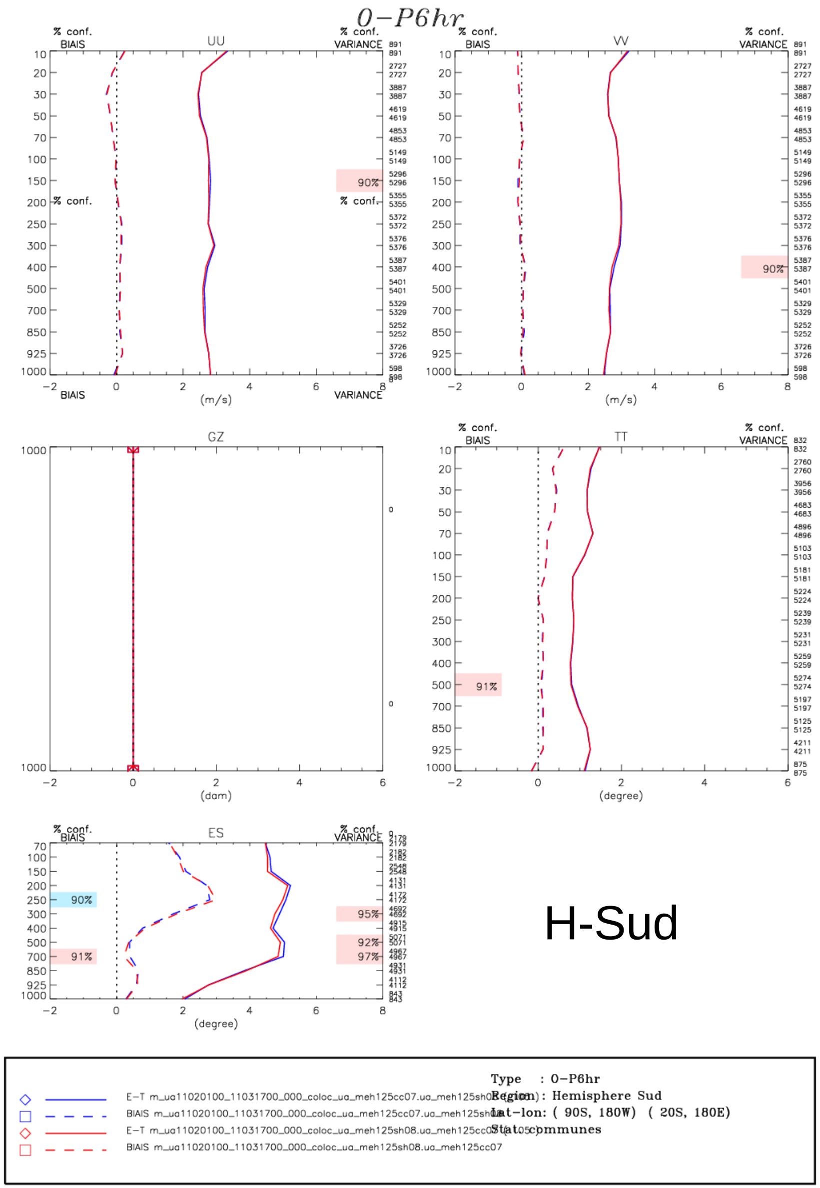


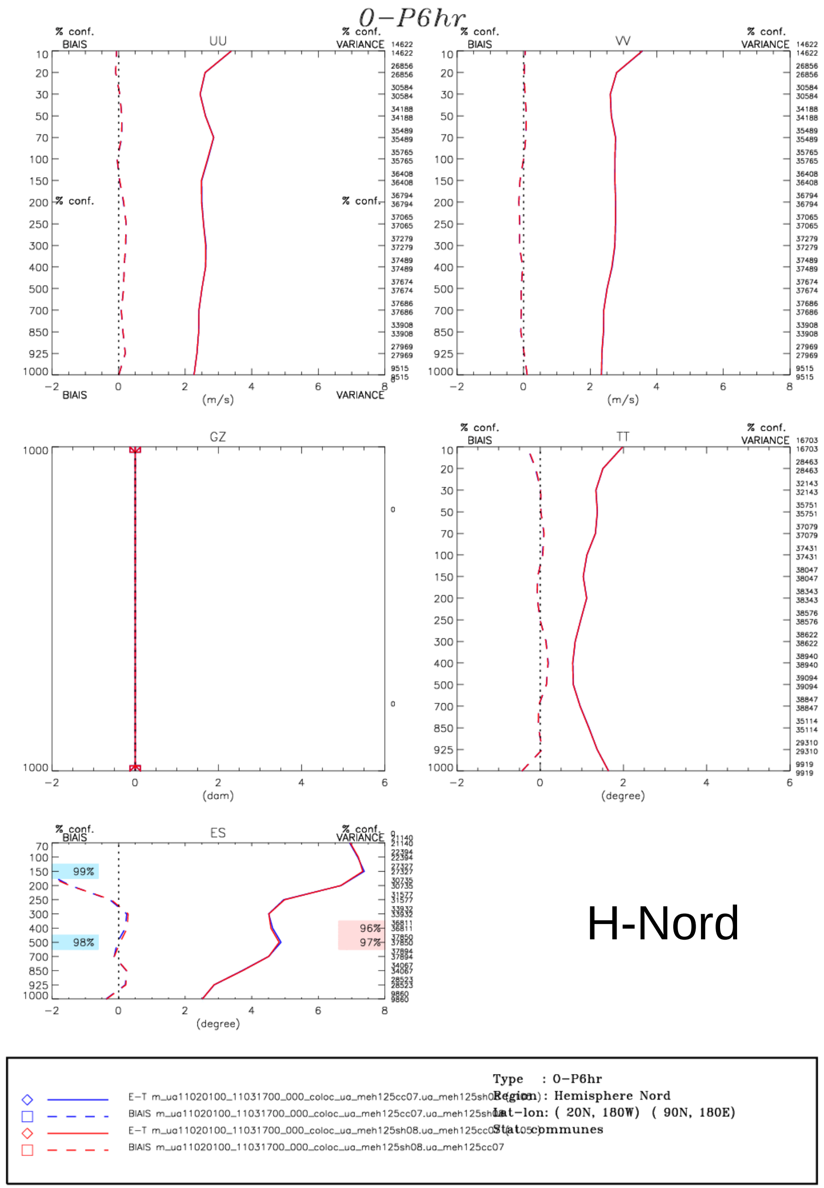
EXT-Nord



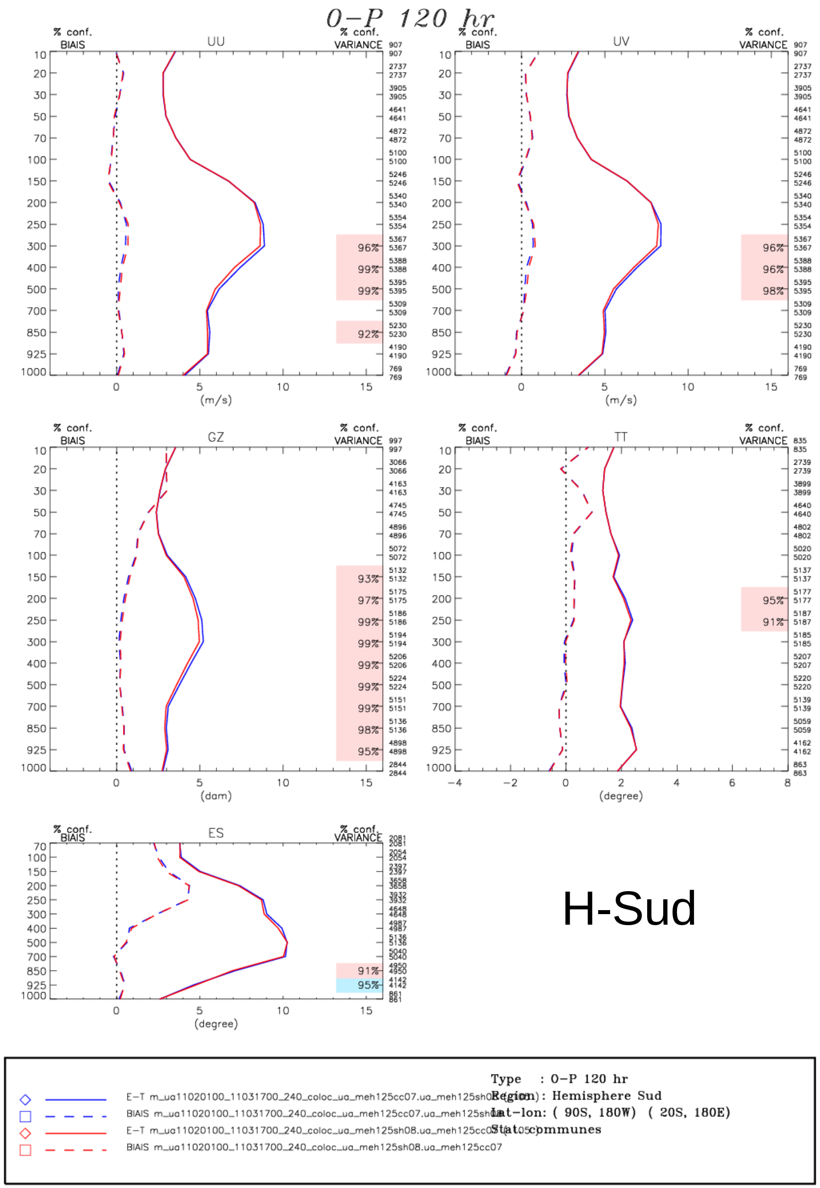
Impact positif plus marqué H-Sud

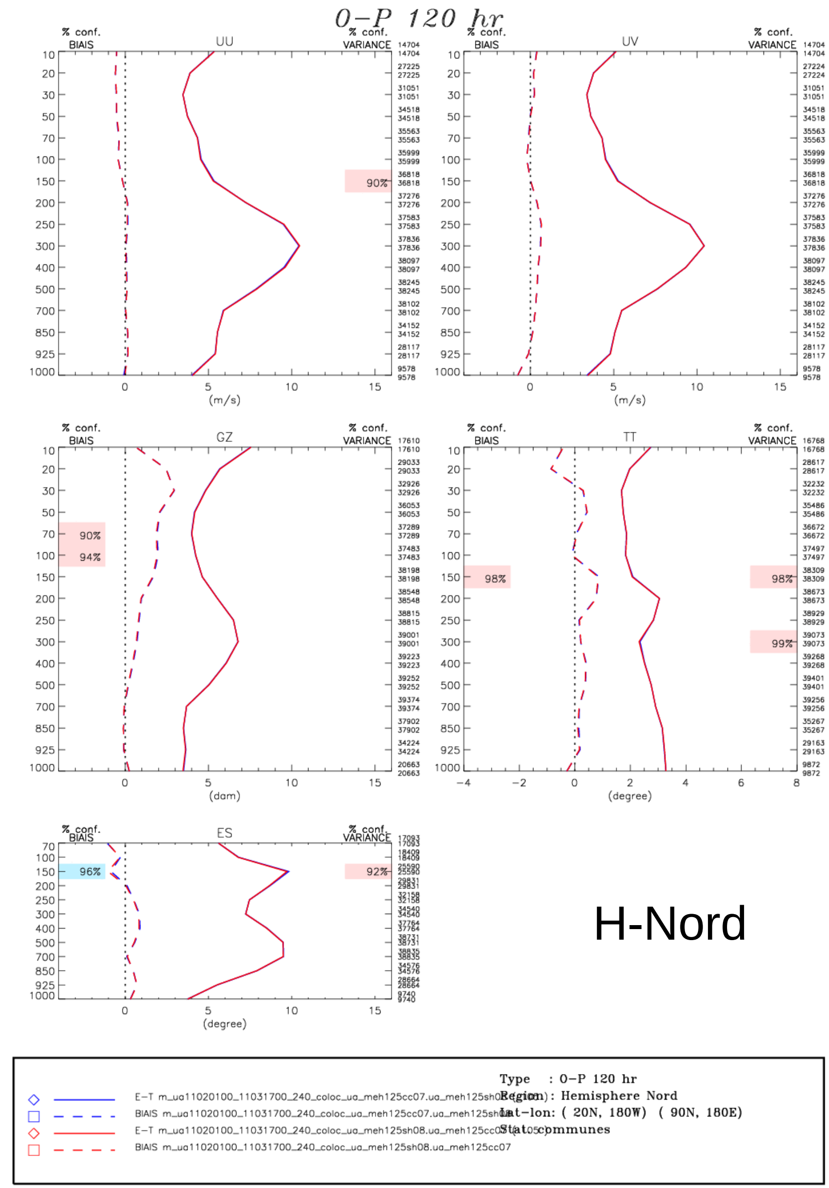
Resultats Arcad O-P 6hrs





Resultats Arcad
O-F 120hrs





References (inter-channel error correlations)

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- Bormann, N. and Bauer, P. (2010), Estimates of spatial and interchannel observation-error characteristics for current sounder radiances for numerical weather prediction. I: Methods and application to ATOVS data. *Q.J.R. Meteorol. Soc.*, **136**: 1036–1050.
- Bormann, N., Collard, A. and Bauer, P. (2010), Estimates of spatial and interchannel observation-error characteristics for current sounder radiances for numerical weather prediction. II: Application to AIRS and IASI data. *Q.J.R. Meteorol. Soc.*, **136**: 1051–1063.
- Desroziers, G., Berre, L., Chapnik, B. and Poli, P. (2005), Diagnosis of observation, background and analysis-error statistics in observation space. *Q.J.R. Meteorol. Soc.*, **131**: 3385–3396.
- Garand, Louis, Sylvain Heilliette, Mark Buehner, 2007: Interchannel Error Correlation Associated with AIRS Radiance Observations: Inference and Impact in Data Assimilation. *J. Appl. Meteor. Climatol.*, **46**, 714–725.
- Gorin, Vadim E., Mikhail D. Tsyrulnikov, 2011: Estimation of Multivariate Observation-Error Statistics for AMSU-A Data. *Mon. Wea. Rev.*, **139**, 3765–3780.

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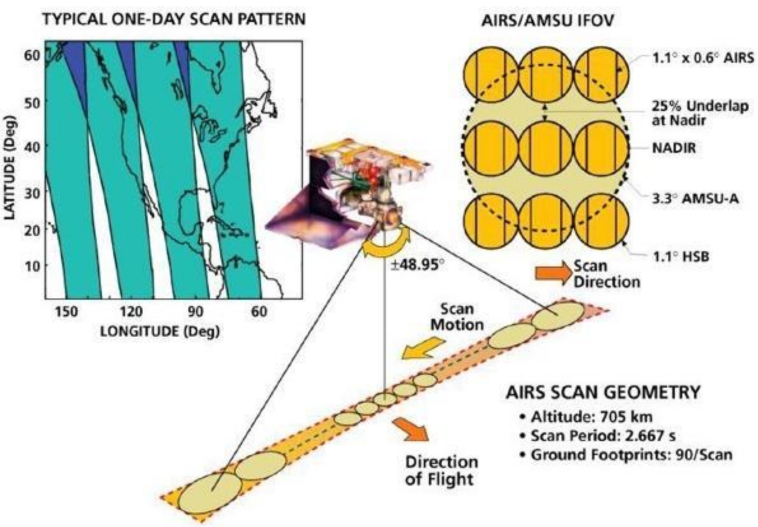
Assimilation of NPP/CrIS radiances at EC

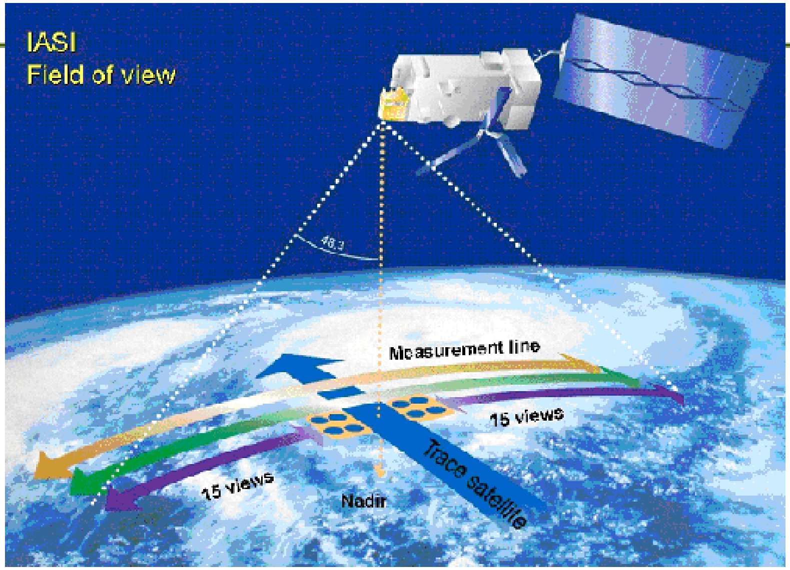
S. Heilliette, L. Garand

What is CrIS ?

- CrIS stands for Cross-track Infrared Sounder
- Instrument very similar to the multispectral infrared sounder AIRS and IASI already assimilated at EC
- With ATMS it is the main NWP payload of the NPP (NPOESS Preparatory Project) operational American satellite that was launched on 28th October 2011.

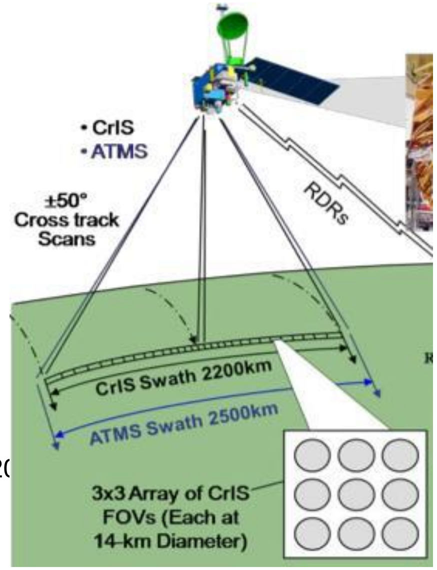
CrIS versus AIRS and IASI: observation geometry





AIRS

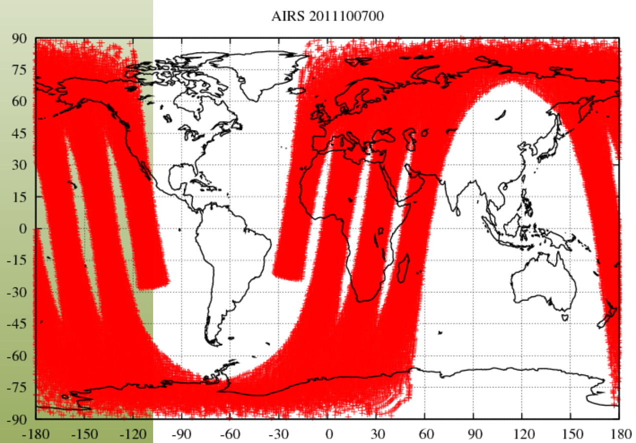
IASI

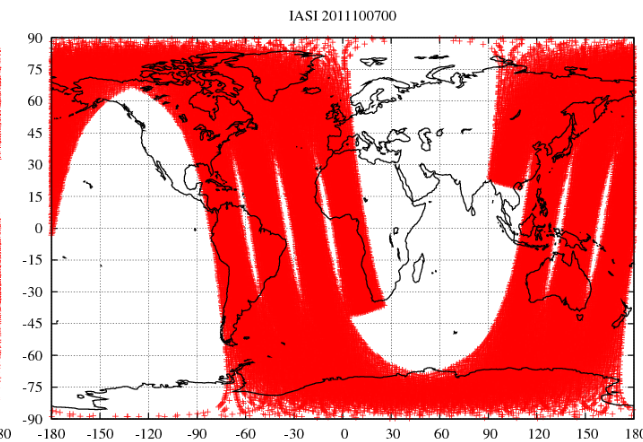


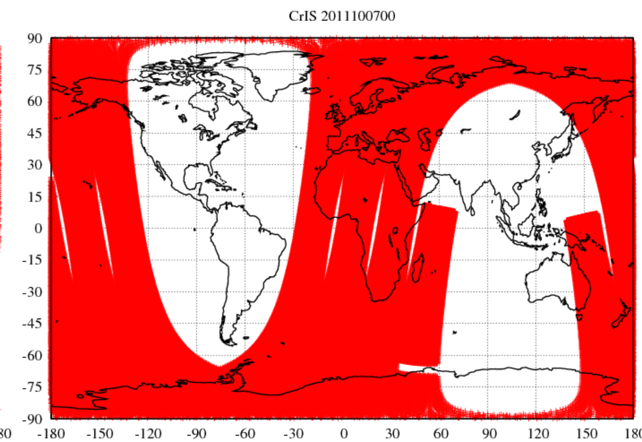
CrIS

CrIS versus AIRS and IASI: orbits

Cris and AIRS overlap







AIRS	**IASI**	**CrIS**
sun-synchronous polar orbit, mean equator crossing time **01.30 pm**, ascending node	sun-synchronous polar orbit, mean equator crossing time **9.30 pm**, ascending node	sun-synchronous polar orbit, mean equator crossing time **1.30** pm, ascending node

CrIS versus AIRS and IASI: spectral characteristics

instrument	AIRS	IASI	CrIS
# of channels	2378	8461	1305
# of channels received at CMC	281 (324)	616 (314)	1305 (399)
Spectral resolution	Resolving power $\lambda/\Delta\lambda$ =1300	0.5 cm^{-1} apodised	0.625 cm^{-1} apodised in band 1 1.25 cm^{-1} apodised in band 2 2.5 cm^{-1} apodised in band 3
Spectral coverage	3 spectral bands: [650 cm^{-1};1137 cm^{-1}] [1217 cm^{-1};1614 cm^{-1}] [2181 cm^{-1};2665 cm^{-1}]	3 spectral bands, no gap: [645 cm^{-1};1210 cm^{-1}] [1210.25 cm^{-1};2000 cm^{-1}] [2000.25 cm^{-1};2760 cm^{-1}]	3 spectral bands: [650 cm^{-1};1095 cm^{-1}] [1210 cm^{-1};1750 cm^{-1}] [2155 cm^{-1};2550 cm^{-1}]
Technology	Grating Spectrometer	Michelson like interferometer	Michelson like interferometer

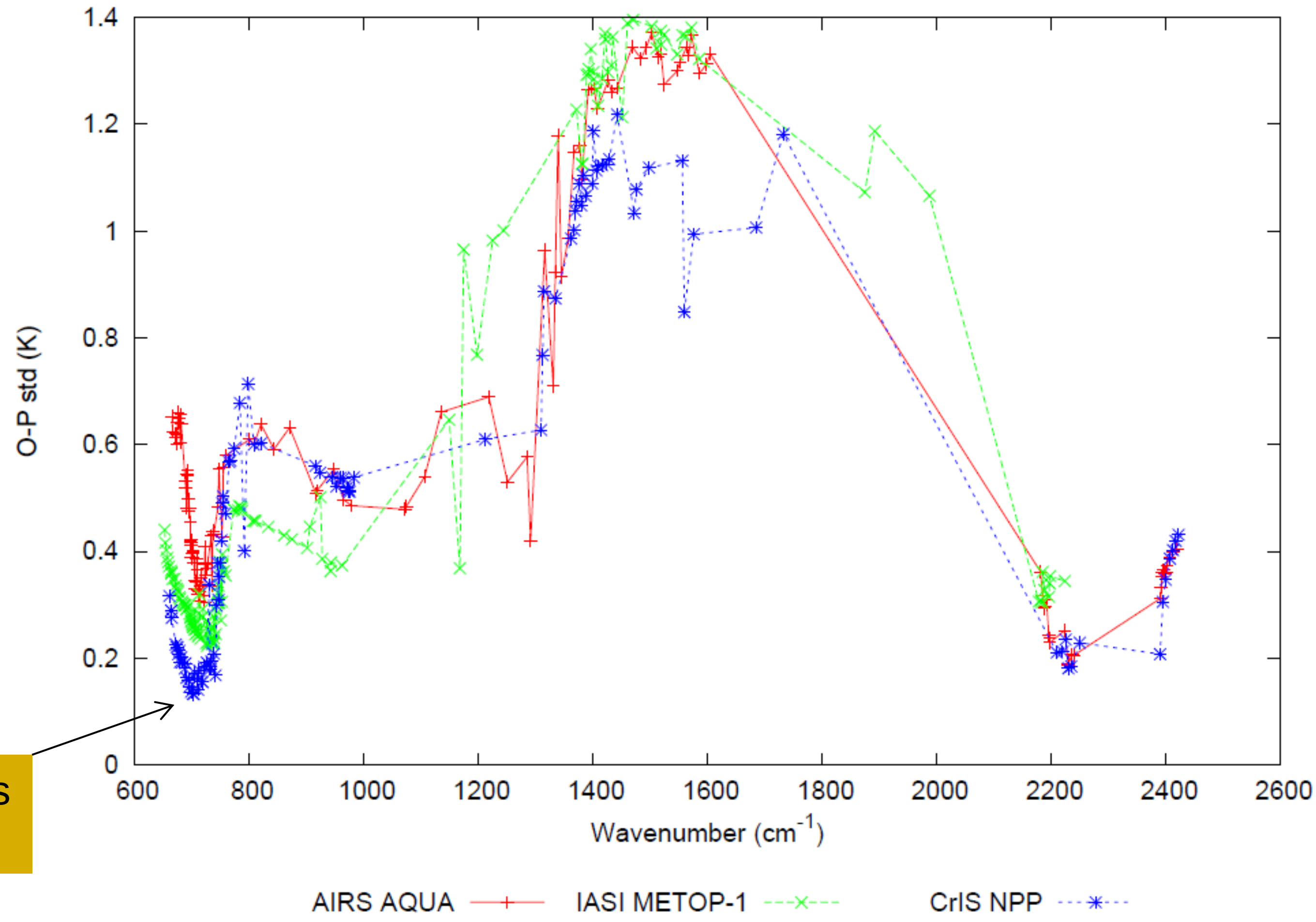
Evaluation CrIS

- Le cycle d'assimilation a été fait sur la période du 1er septembre 2014 au 8 octobre 2014 (5 semaines)

- 103 canaux similaires à ceux déjà assimiles pour AIRS et IASI ont été sélectionnés

- Cette première expérience n'inclut pas les corrélations inter-canaux

Std (O-P) comparaison avec autres senseurs

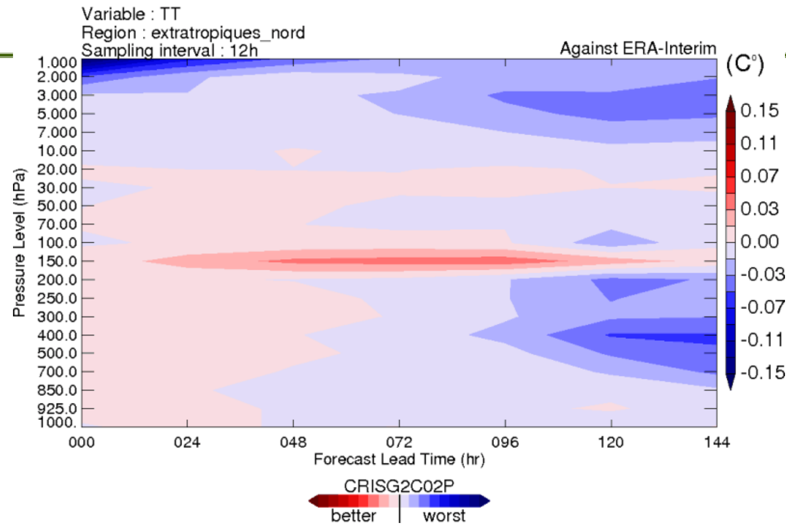


Bruit Cris plus faible

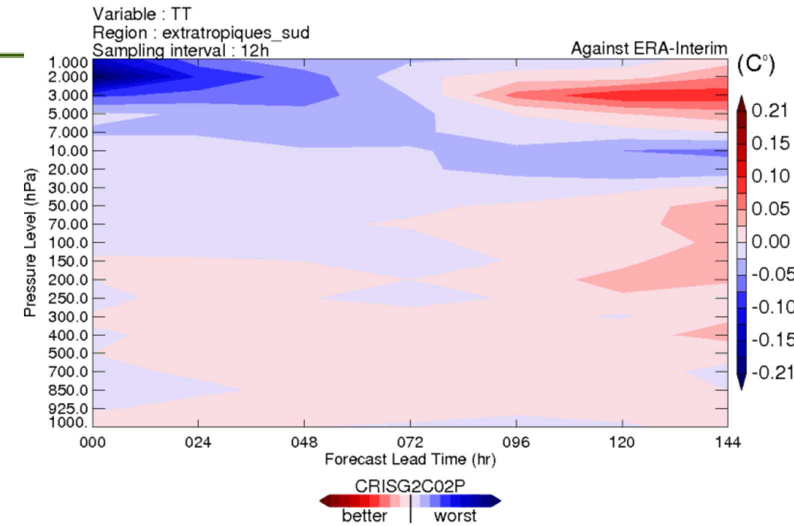
Verdict TT NH SH vs Era-Interim

TT

Standard Deviation Difference
2014090112-2014100800
PARALLEL - CRISG2C02P

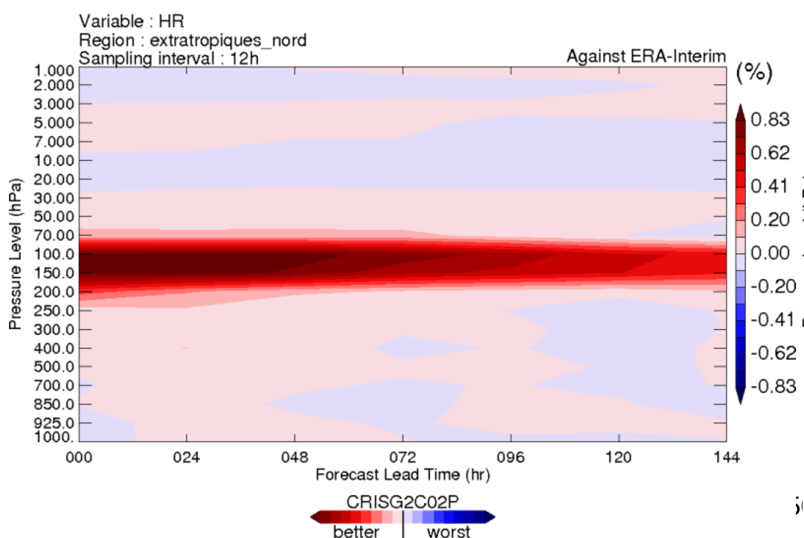


Standard Deviation Difference
2014090112-2014100800
PARALLEL - CRISG2C02P

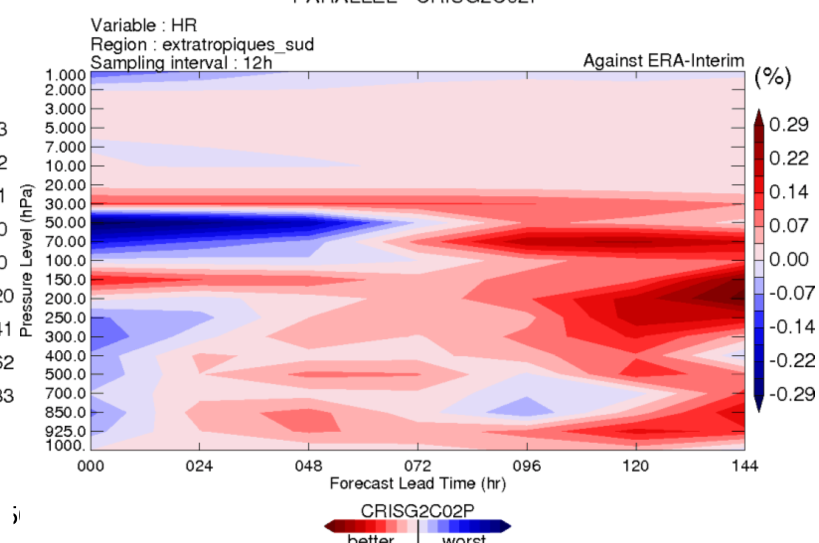


HR

2014090112-2014100800
PARALLEL - CRISG2C02P

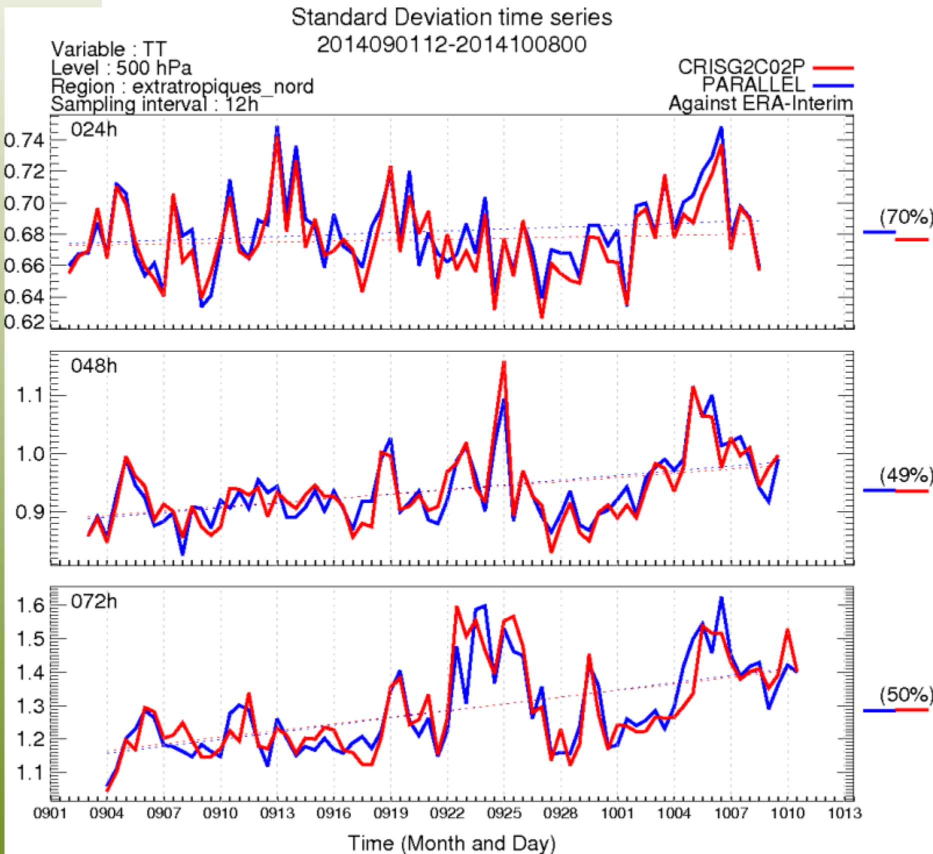


2014090112-2014100800
PARALLEL - CRISG2C02P

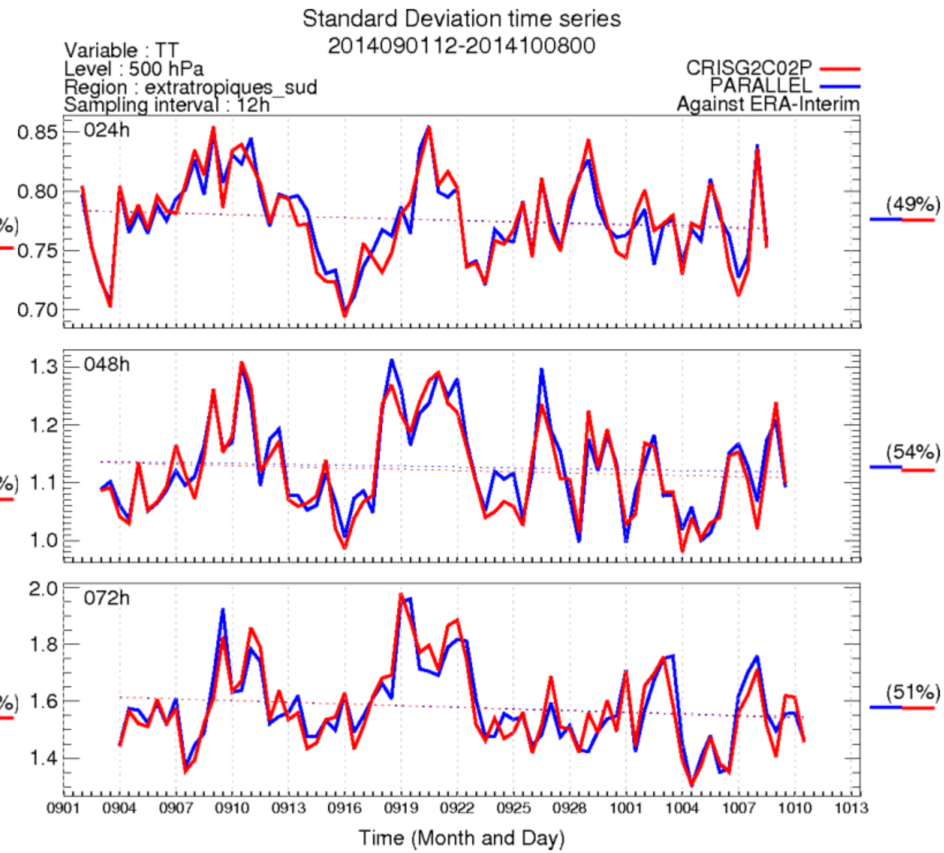


Séries temporelles TT -500 hPa vs Era-Interim

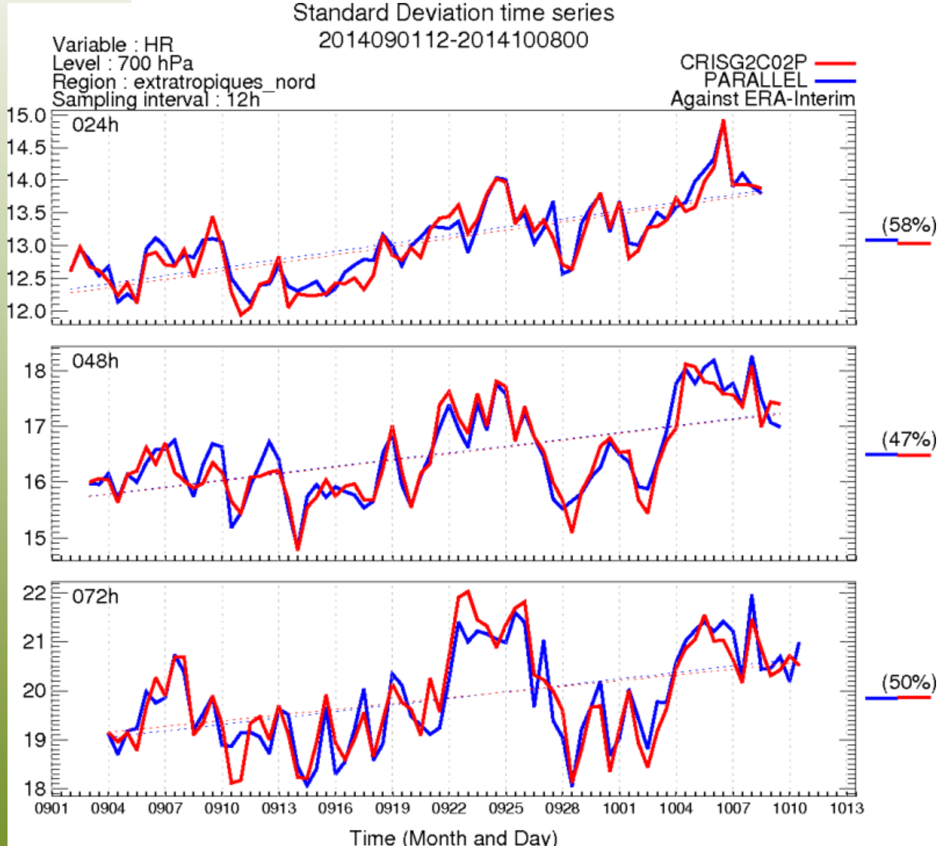
NH

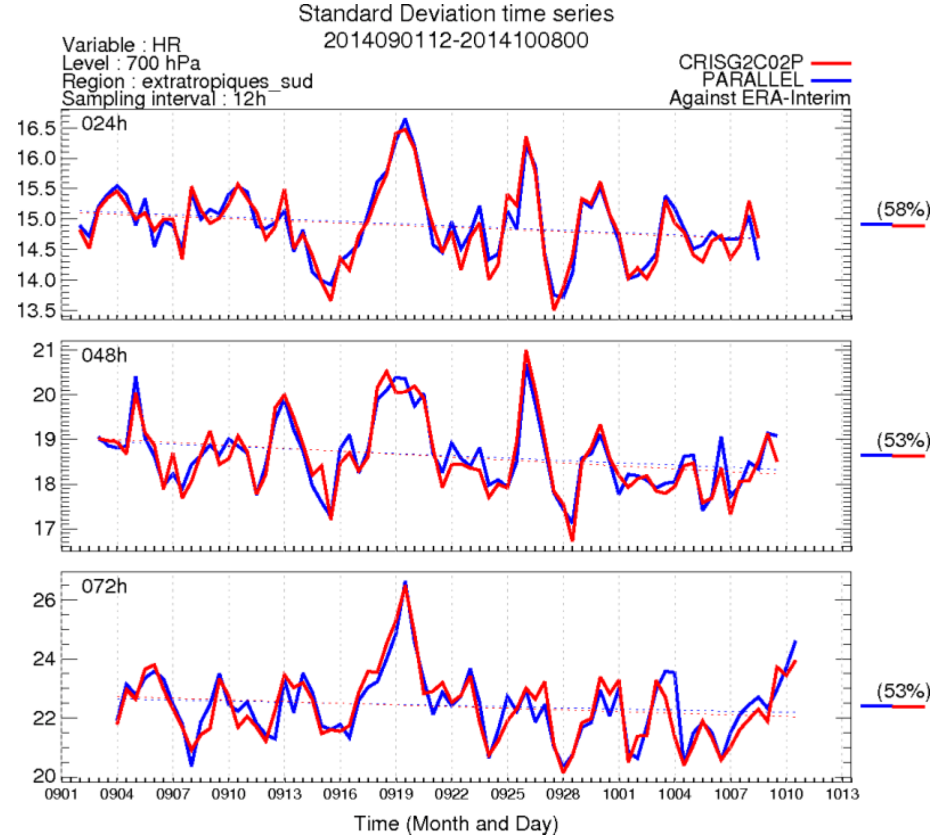


SH



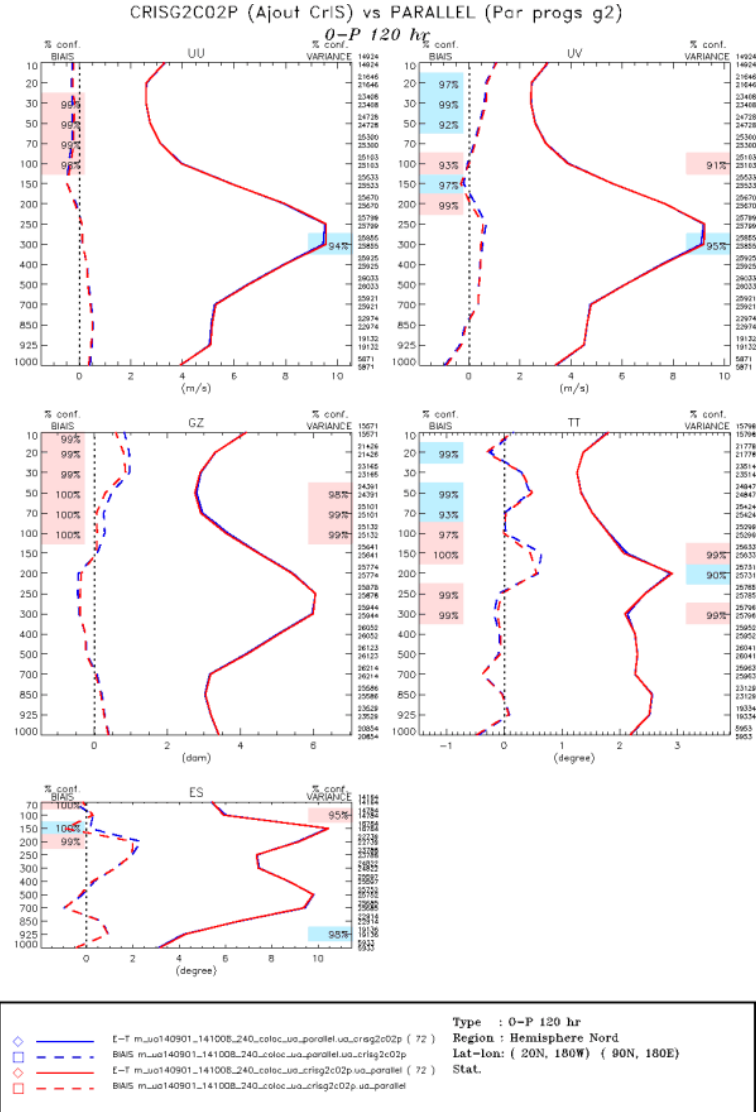
Séries temporelles HR 700 hPa vs Era-Interim



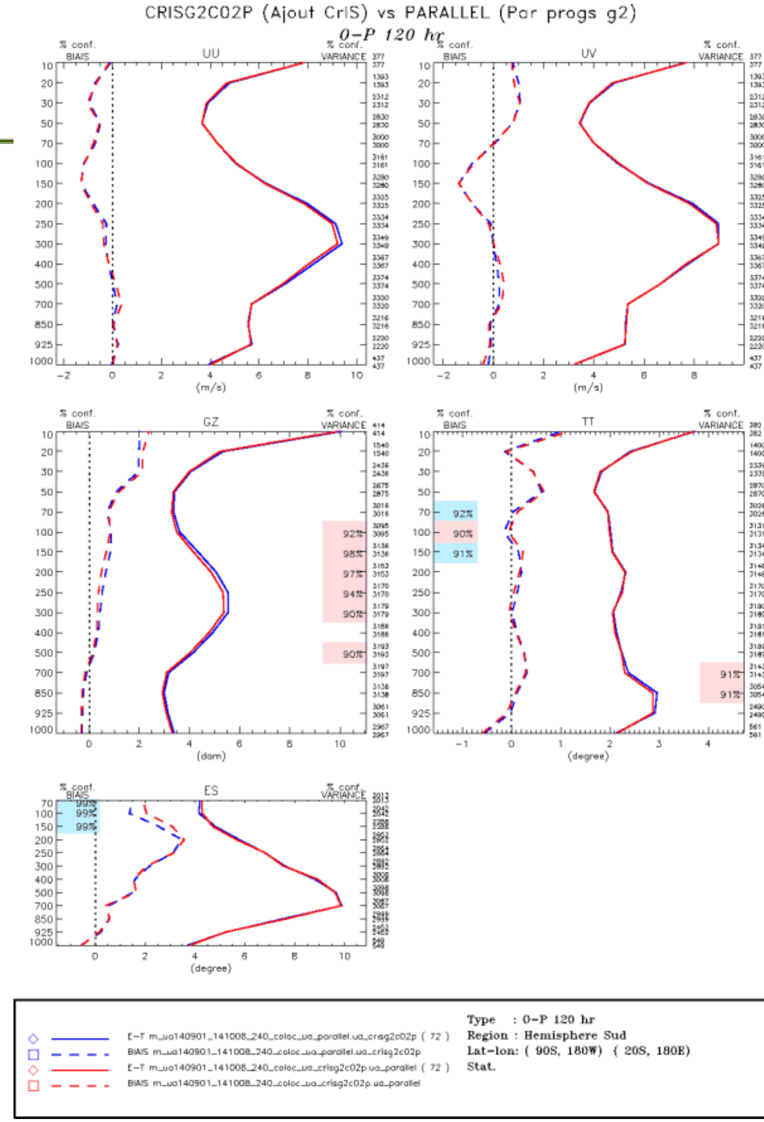


Validation vs radiosondes

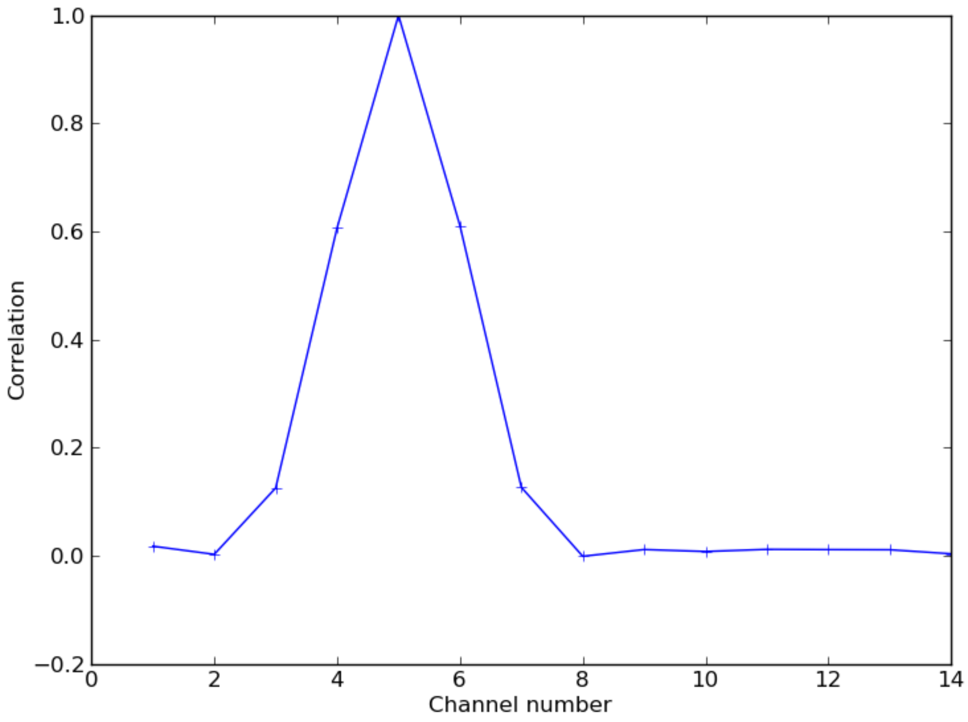
EXT-Nord



Ext-Sud



Correlation d'erreur inter-canaux typique pour un canal versus voisins (canal de température dans la bande 15 microns)



IEC = ~0.6 pour voisin immédiat

Présentement, nous ne considérons pas les voisins immédiats mais pourrions le faire dans le futur

Impact combiné des nouvelles observations et changements EnVar

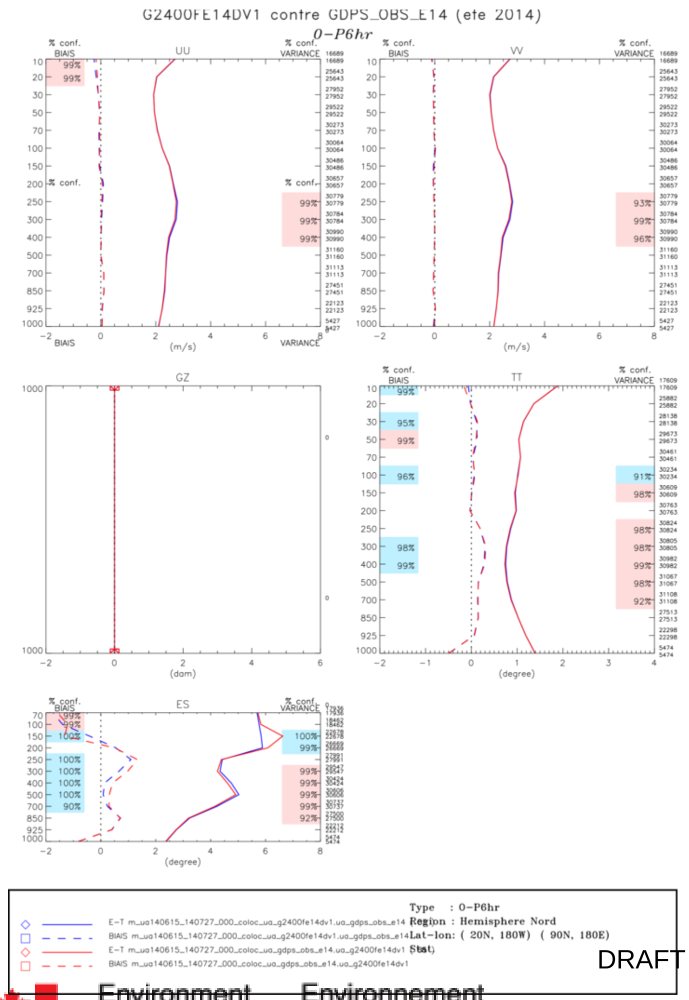
- ATMS (17 canaux)
- Cris (103 canaux)
- Corrélation intercanaux
- GPS-sol (620 stations)
- Modifs EnVar

- Période de 6 semaines 15 juin au 27 juillet 2014

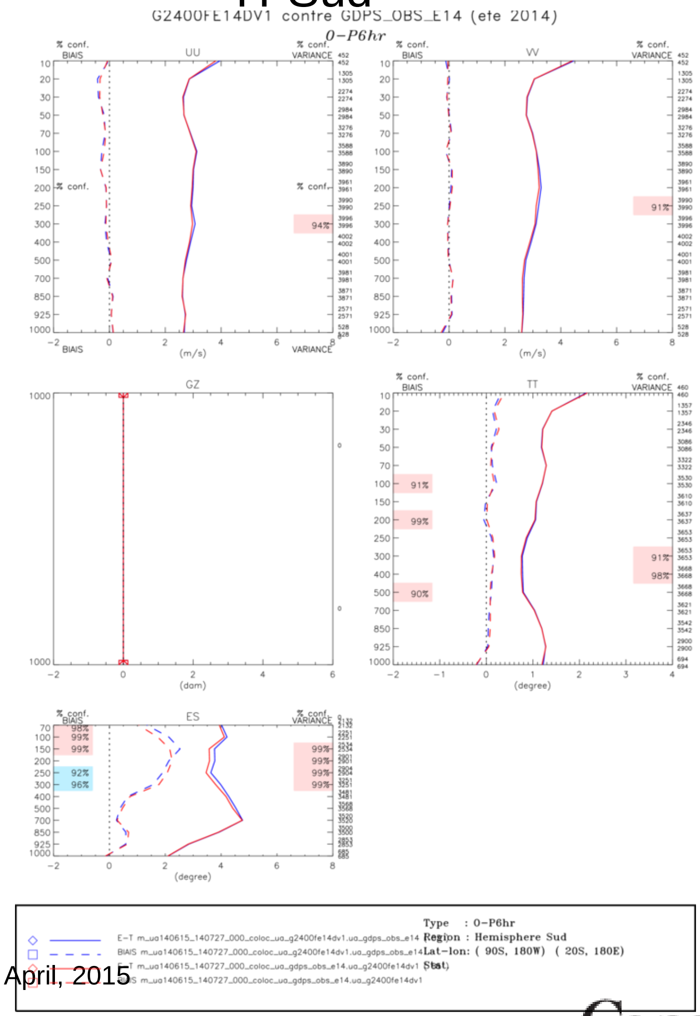
Impact des nouvelles données à 6-h

5 semaines été 2014 vs OPE, radiosondages

H-Nord



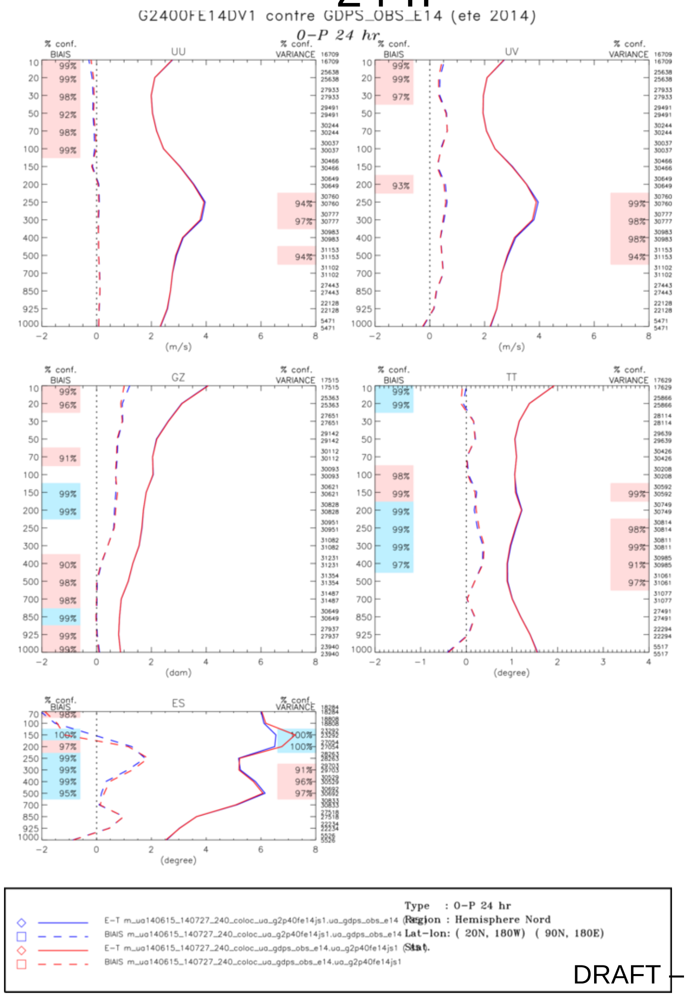
H-Sud



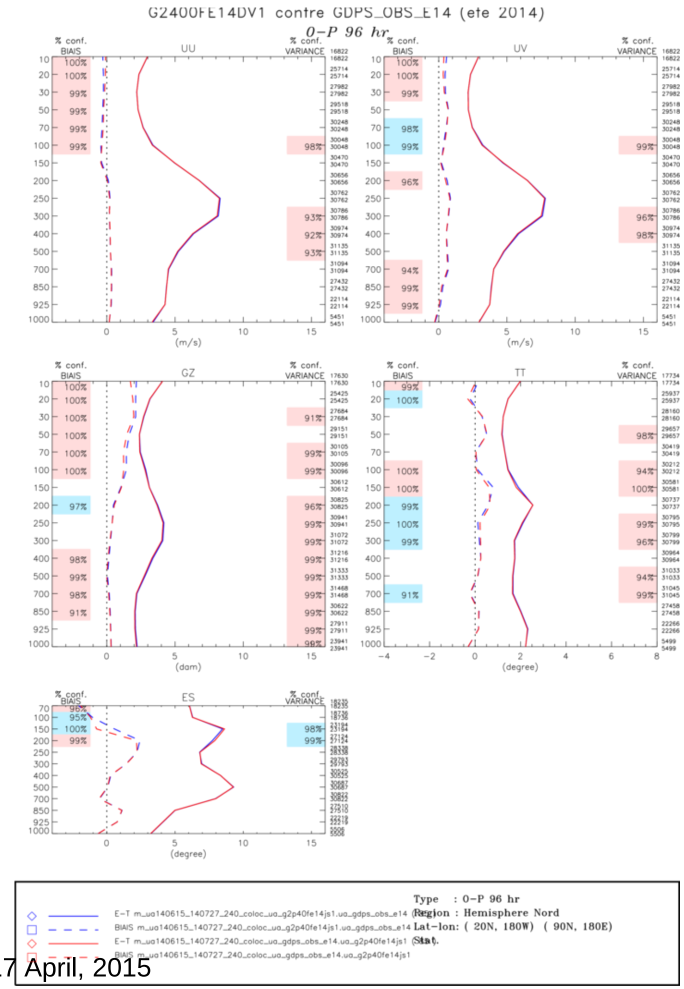
Impact H-Nord 24-h et 96-h

5 semaines été 2014 vs OPE, radiosondages

24-h

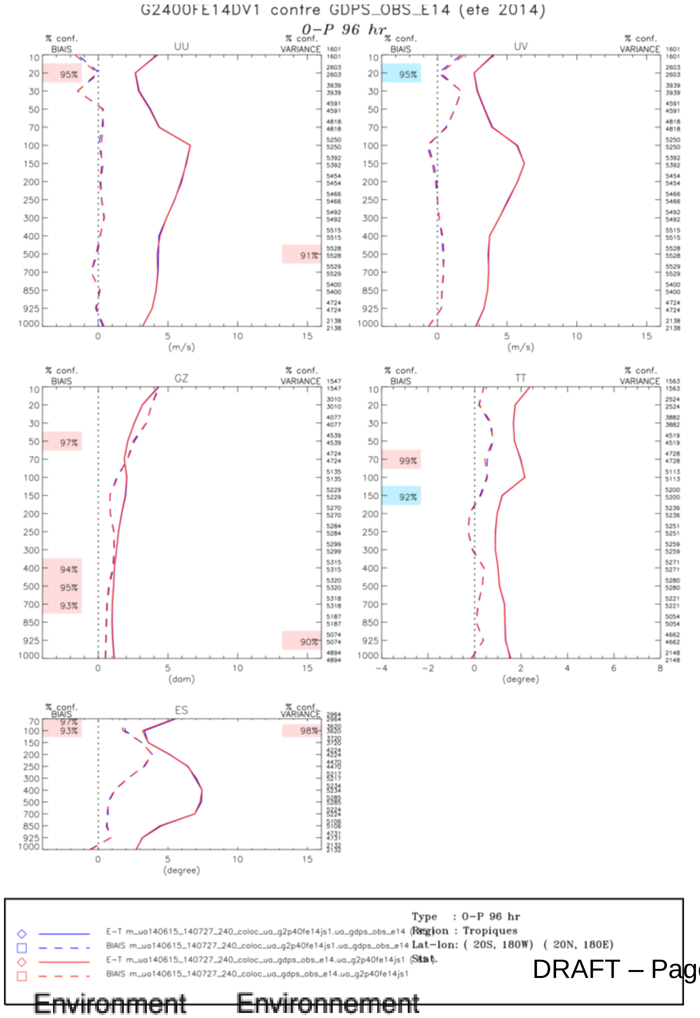


96-h

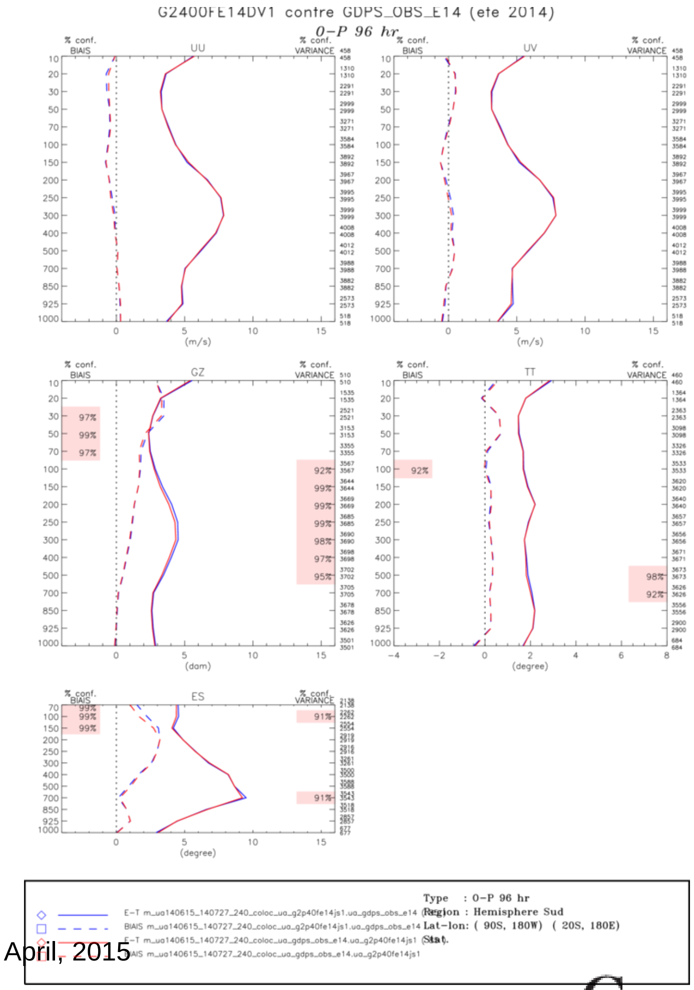


Impact 96-h TRO et H-Sud

TRO



H-Sud



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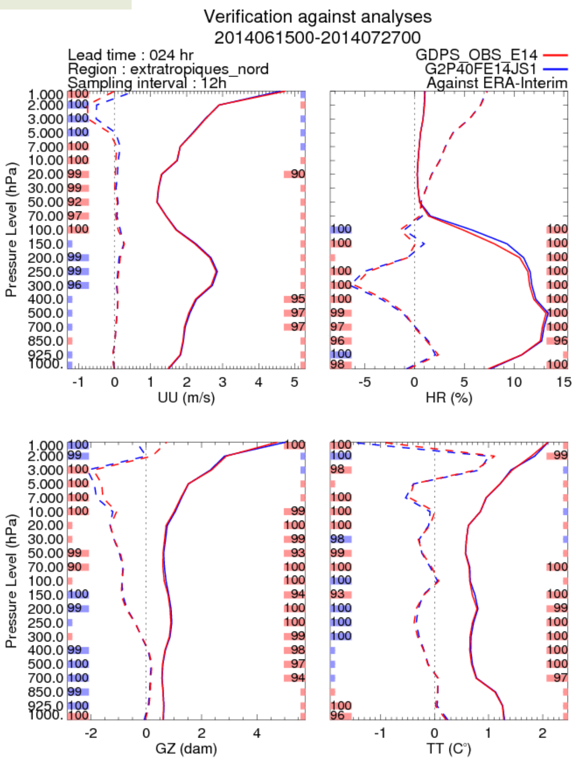
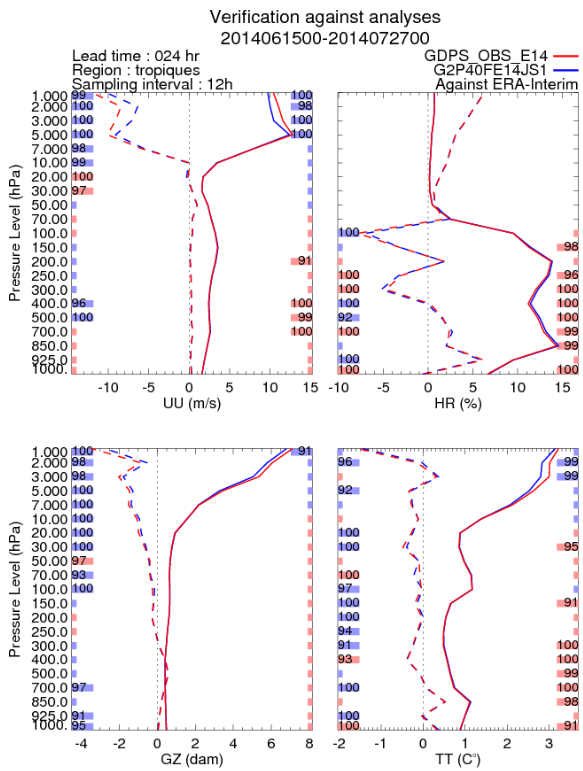
24-h vs Era-Interim

EXP
CNTL

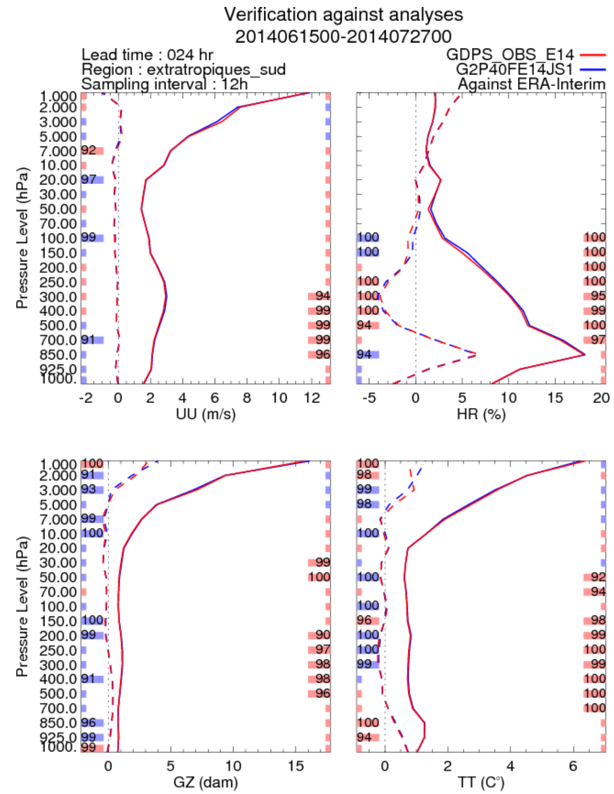
EXT-Nord



TRO



EXT-Sud

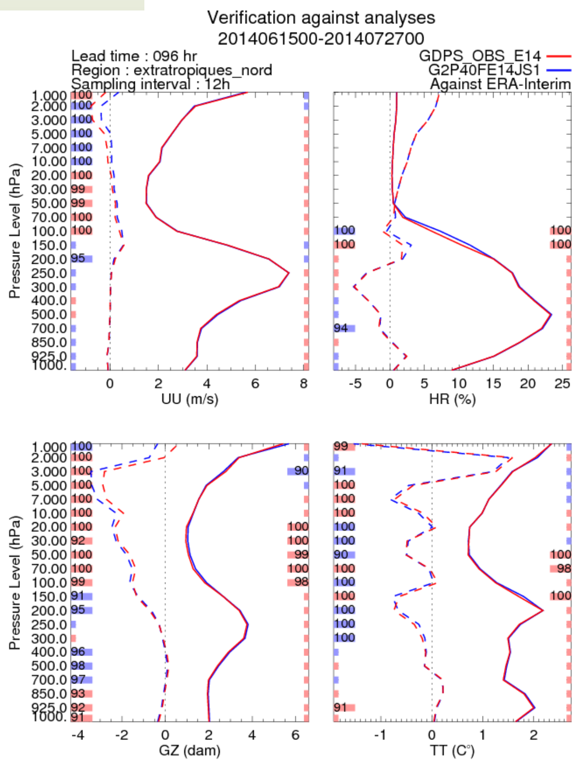


Impact significatif 100-800 hPa

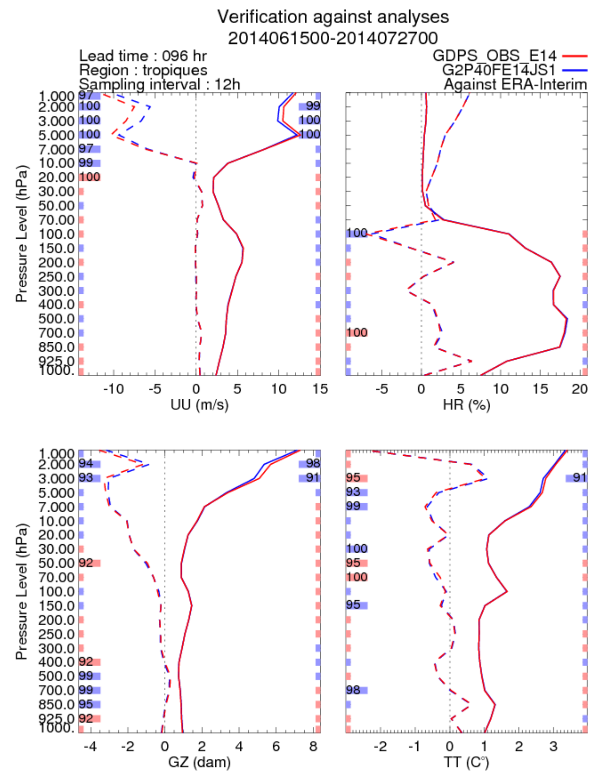
96-h vs Era-Interim

EXP
CNTL

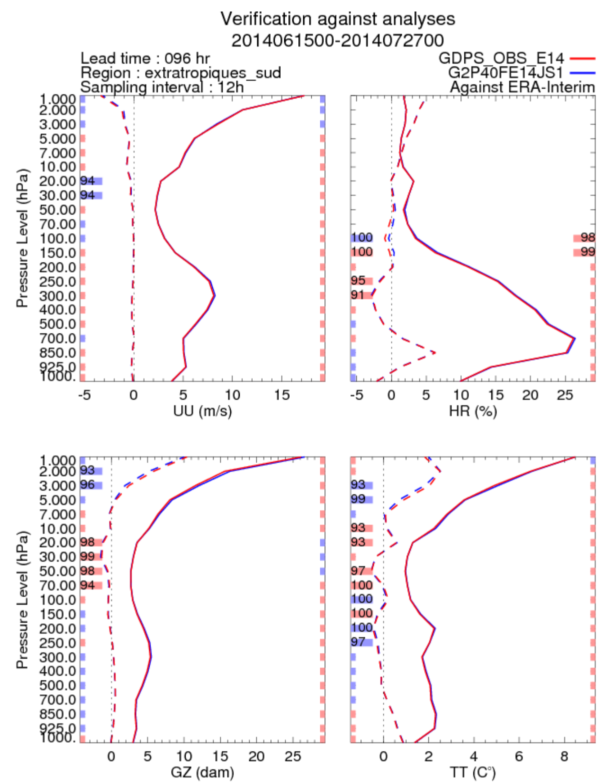
Ext-Nord



TRO



EXT-Sud

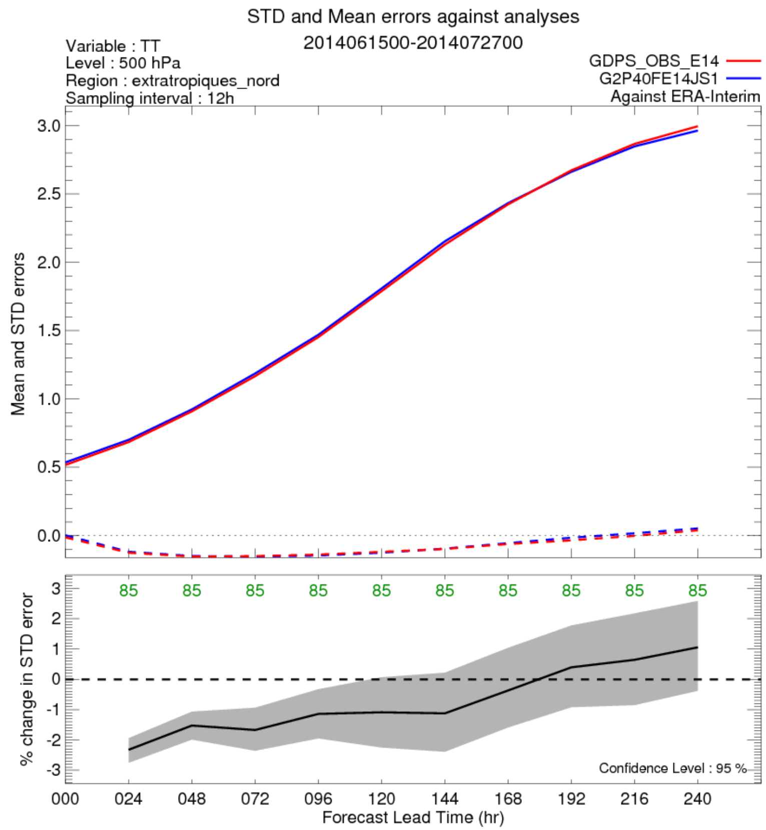


Impact positif moins prononcé qu'à 24-h

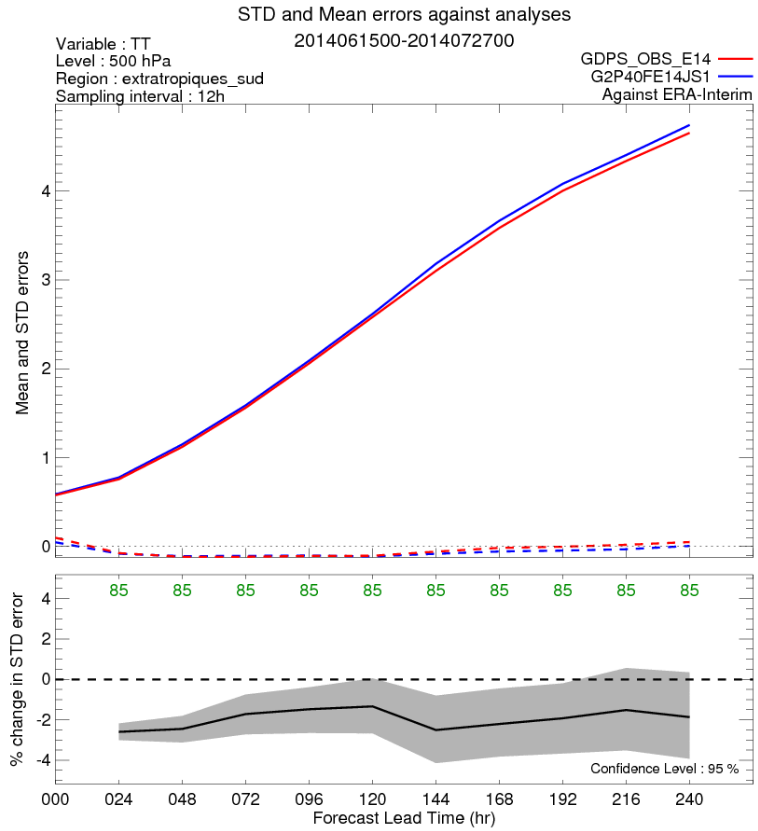
STD TT 500 hPa vs Era-Interim

EXP
CNTL

EXT-Nord



EXT-Sud



Reduction de 1-2 % des STD jours 2 à 5

Séries temp. GZ 500hPa vs ERA-Interim

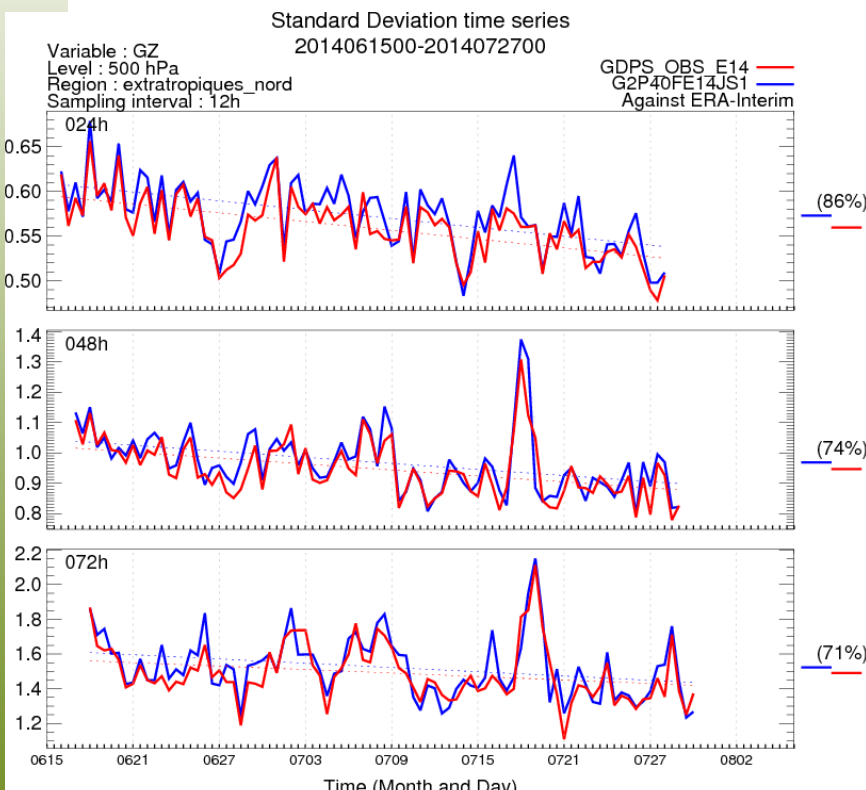
24-h, 48-h, 72h

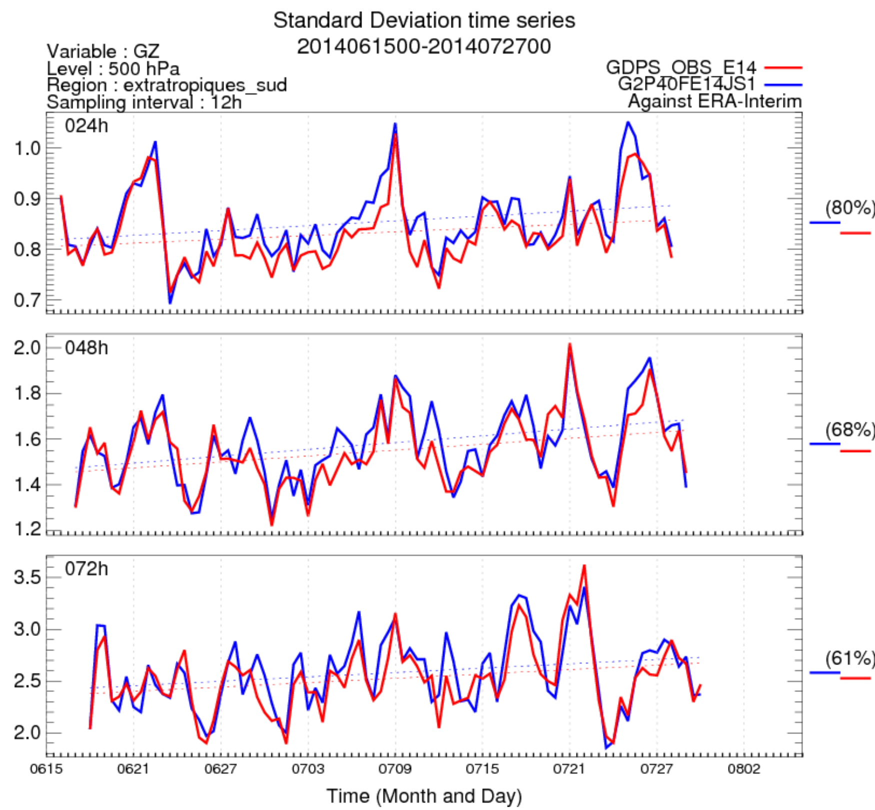
EXT-Nord

EXT-Sud

EXP

CNTL





Impact positif équivalent H-Nord et H-Sud

Impact attendu dans le SGPD pour passe parallèle à proposer à CPOP

Tous les changements combinés:

- Nouvelles données
- Corrélation d'erreur inter-canaux
- Changements EnVar
- Changements EnKF
- Changements au modèle

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Évaluation des cycles finaux du nouveau Système Global de Prévision Déterministe

SGPD500

17 avril 2015

QUI

- **Chef de Projet:**
  André Plante , Simon Pellerin

- **Intégrateurs:**
  Ervig Lapalme, Josée Morneau, Xingxiu Deng

- **Observations:**
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- **Cycles:**
  Yves Chartier, Michel Van Eeckhout, Jean-François Deschêsnes
  Martin Charron, Ron Mctaggart-Cowan, André Plante, Mark Buehner

- **Progs:**
  Juan Sebastian Fontecilla, Michel Roch

- **Vérification:**
  Cécilien Charrette, Marcel Vallée, François Lemay, Michel Roch

Sommaire

- **Description des cycles**
- **Vérification en atmosphère libre**
  - **Contre radio-sondages**
  - **Contre analyses**
- **Vérification en surface**
- **Vérification des précipitations**
- **En résumé**

Les cycles finaux

Cycle hiver 2011: EnVar - incréments sur grille verticale décalée (nouvelles stat. d'erreur)
- correction biais dynamique radiances avec tables aux 6hrs
- corrélation intercanaux

EnKf - diffusion sur thêta sur tous les membres + modifs analyse strato

YY25km - blending + améliorations semi-lag

134 progs 240hrs

24/01/2011 — **31/03/2011**

Cycle été 2014: EnVar - incréments sur grille verticale décalée (nouvelles stat. d'erreur)
- correction biais dynamique radiances avec tables aux 6hrs
- corrélation intercanaux
- CrIS + ATMS + GPS RO (TANDEM/GRACEB) + GB-GPS

EnKf - diffusion sur thêta sur tous les membres + modifs analyse strato
- ATMS + GPS RO (TANDEM/GRACEB)

YY25km - blending + améliorations semi-lag

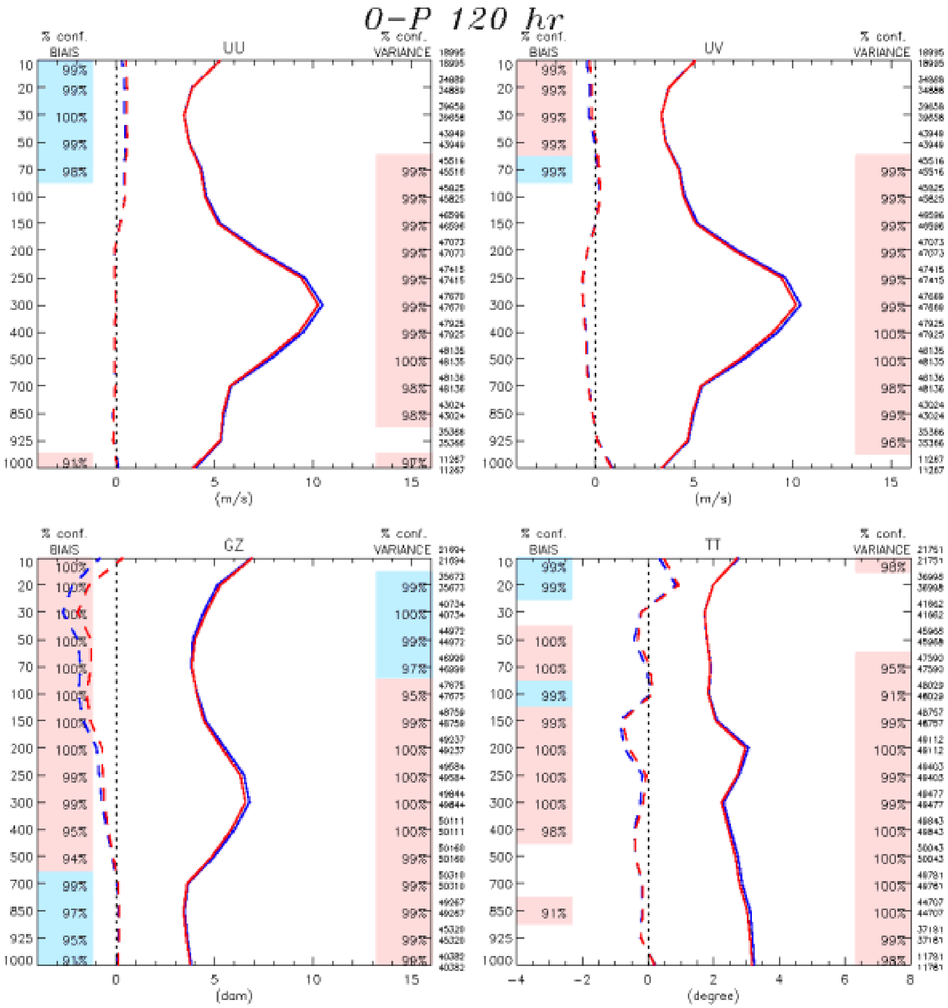
156 progs 240hrs

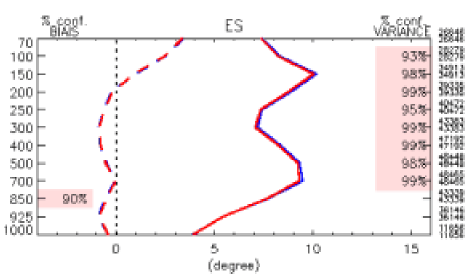
15/06/2014 — **31/08/2014**

Scores contre Radio-sondage

Profils d'erreur

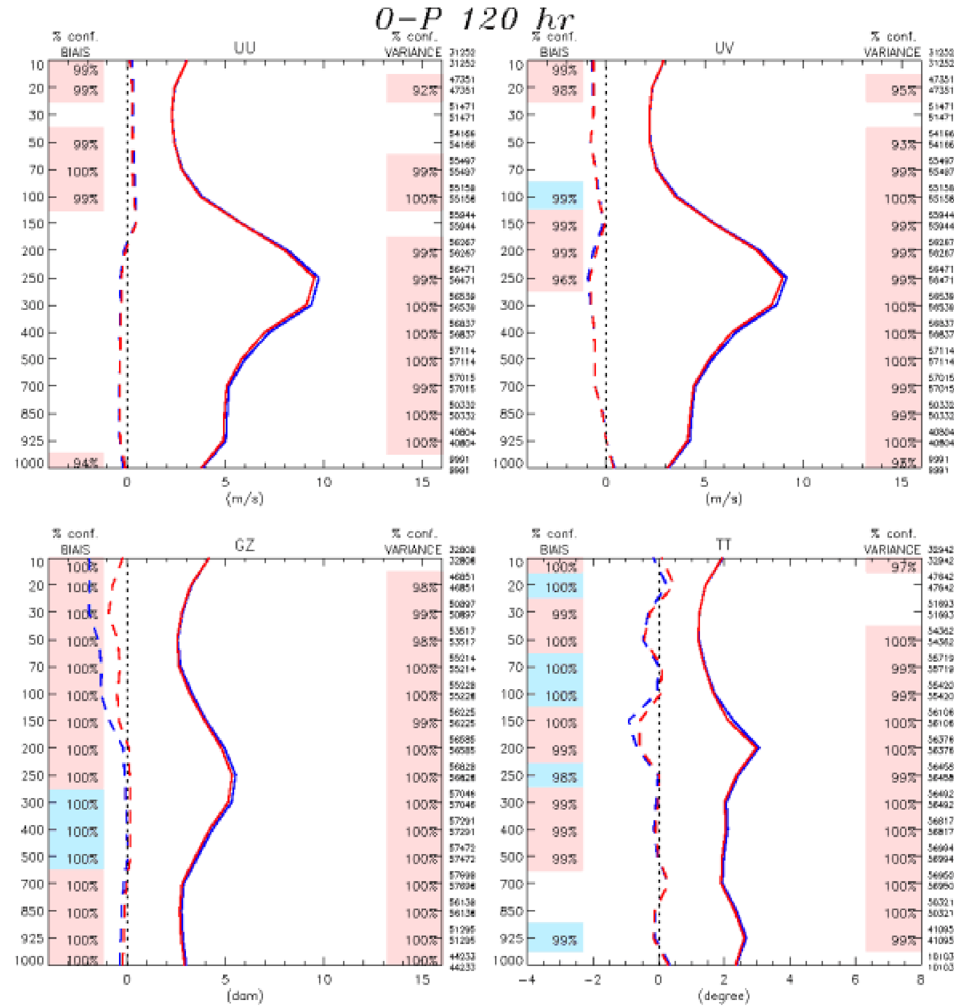
Hiver 2011

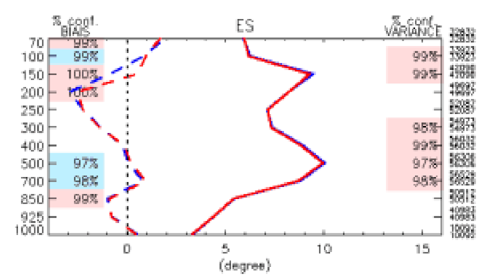




Hémisphère Nord

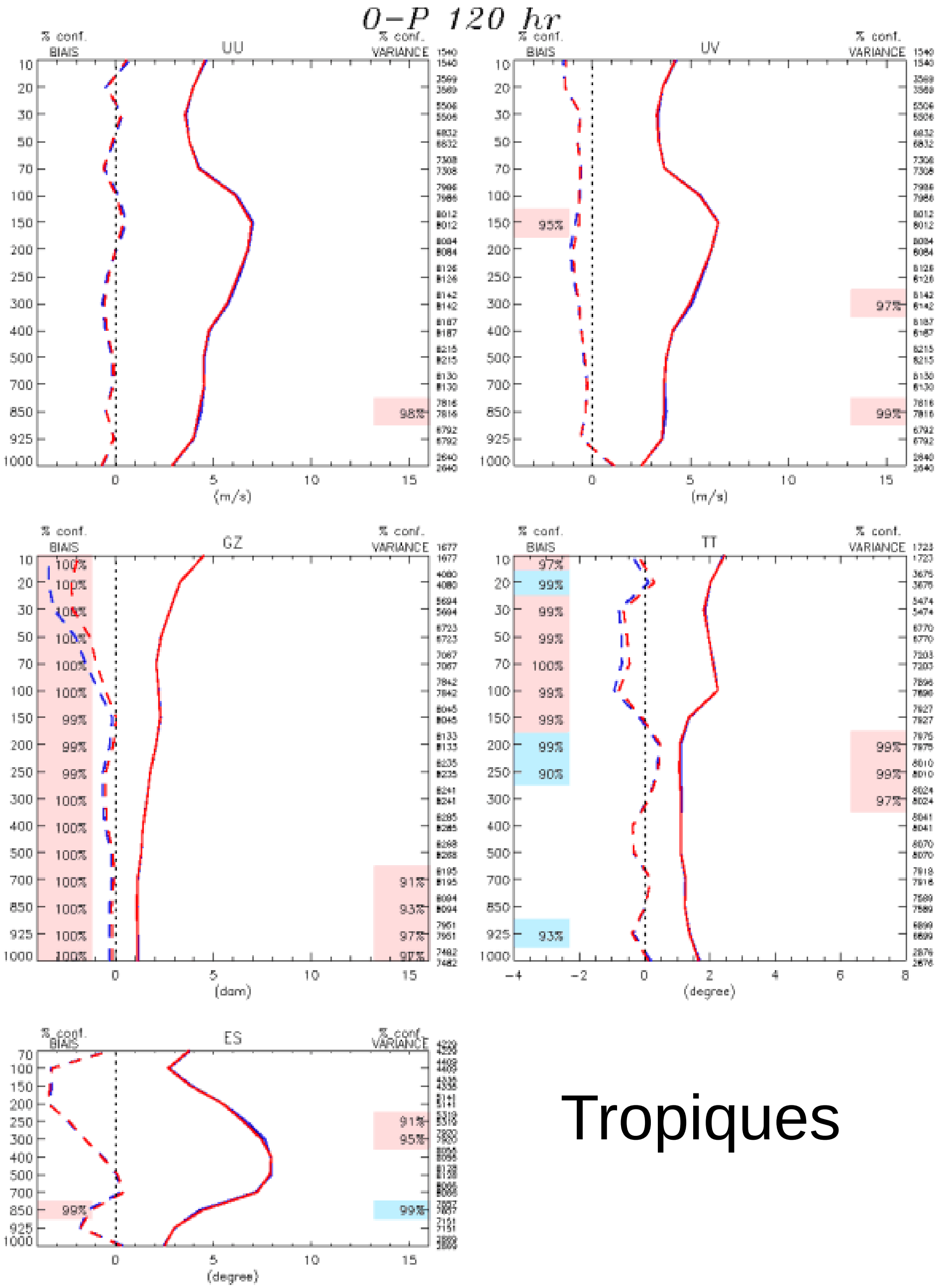
Été 2014





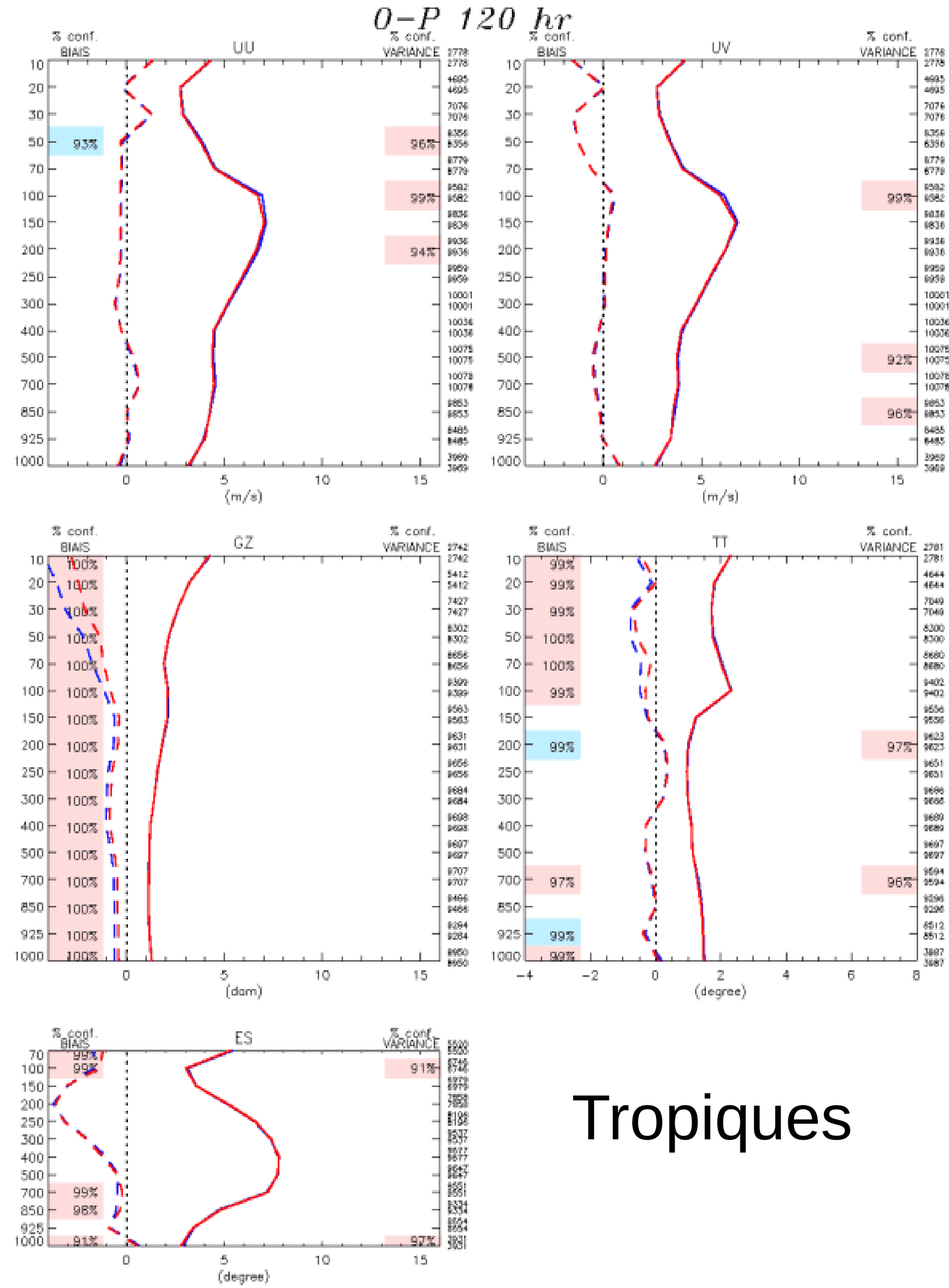
Hémisphère Nord

Hiver 2011



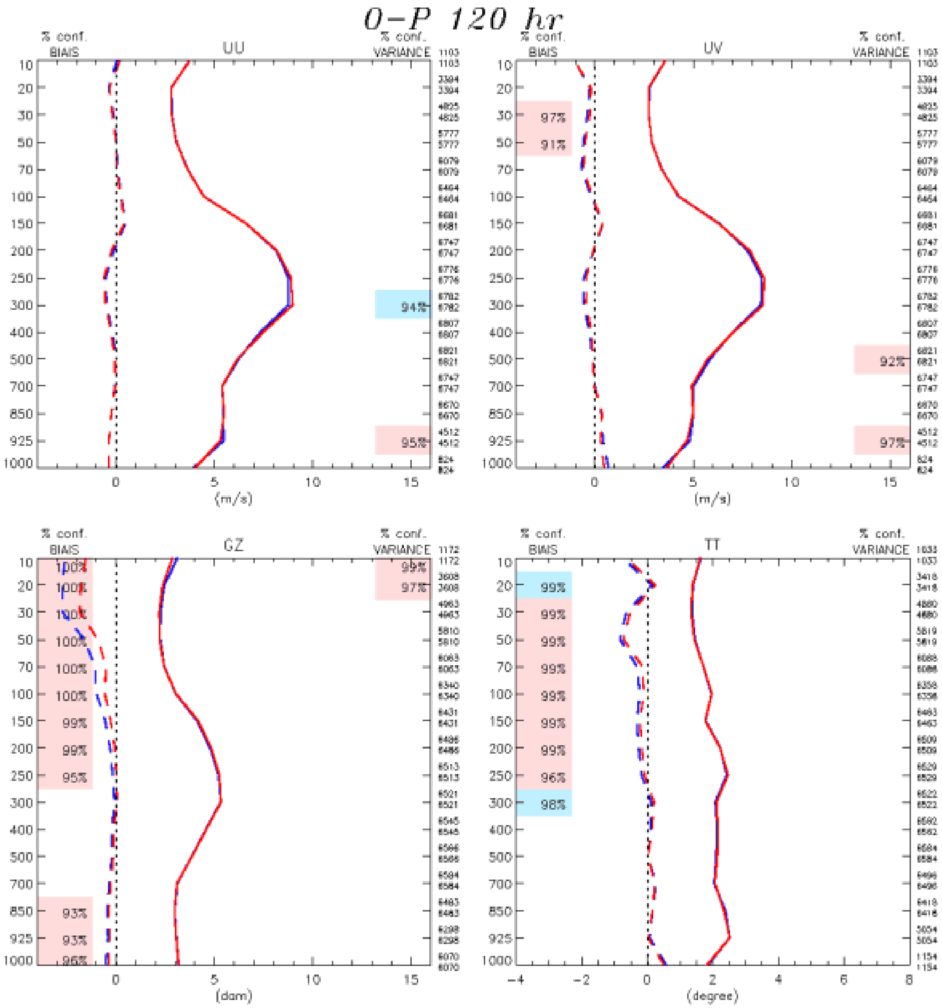
Tropiques

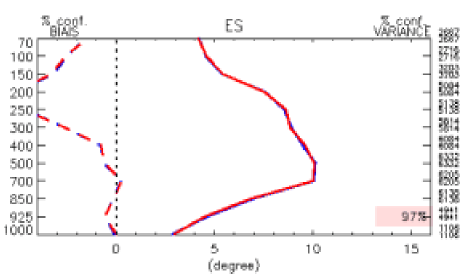
Été 2014



Tropiques

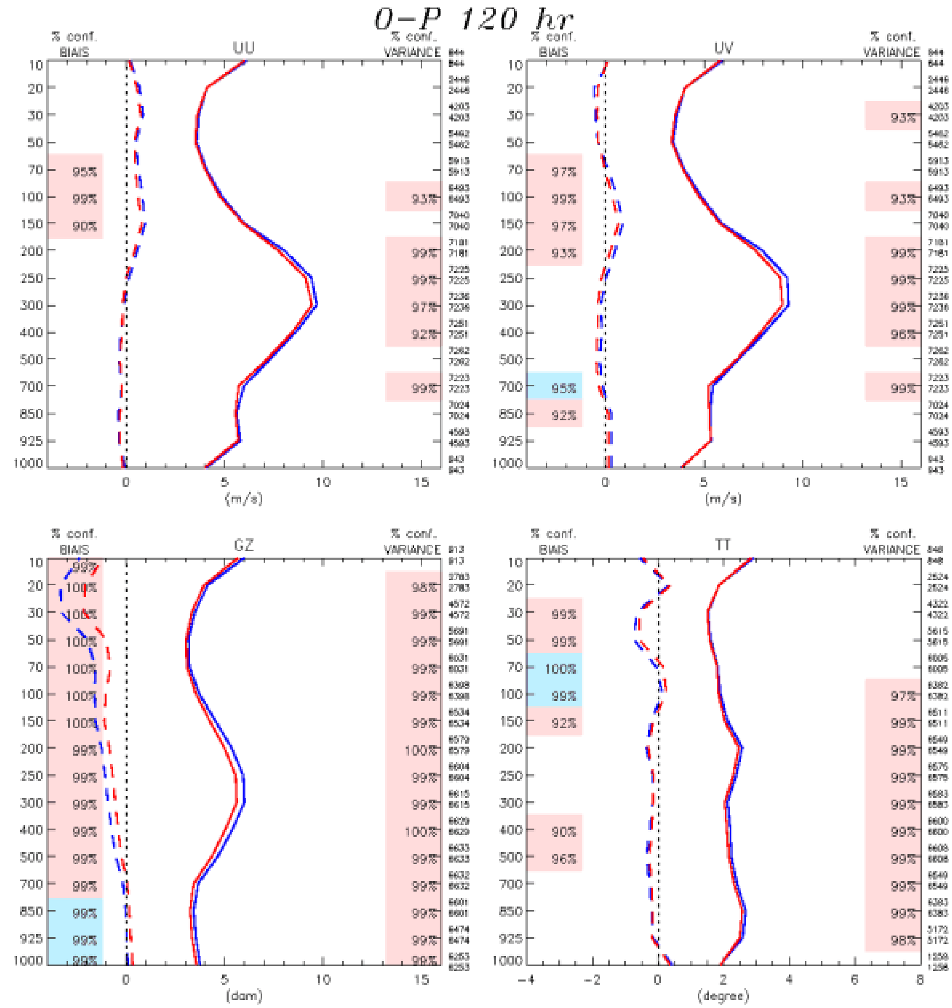
Hiver 2011

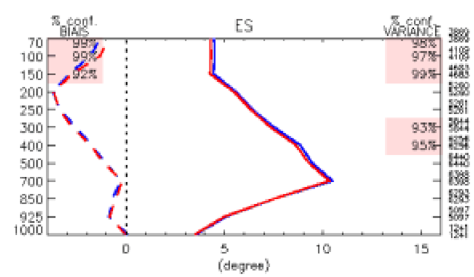




Hémisphère Sud

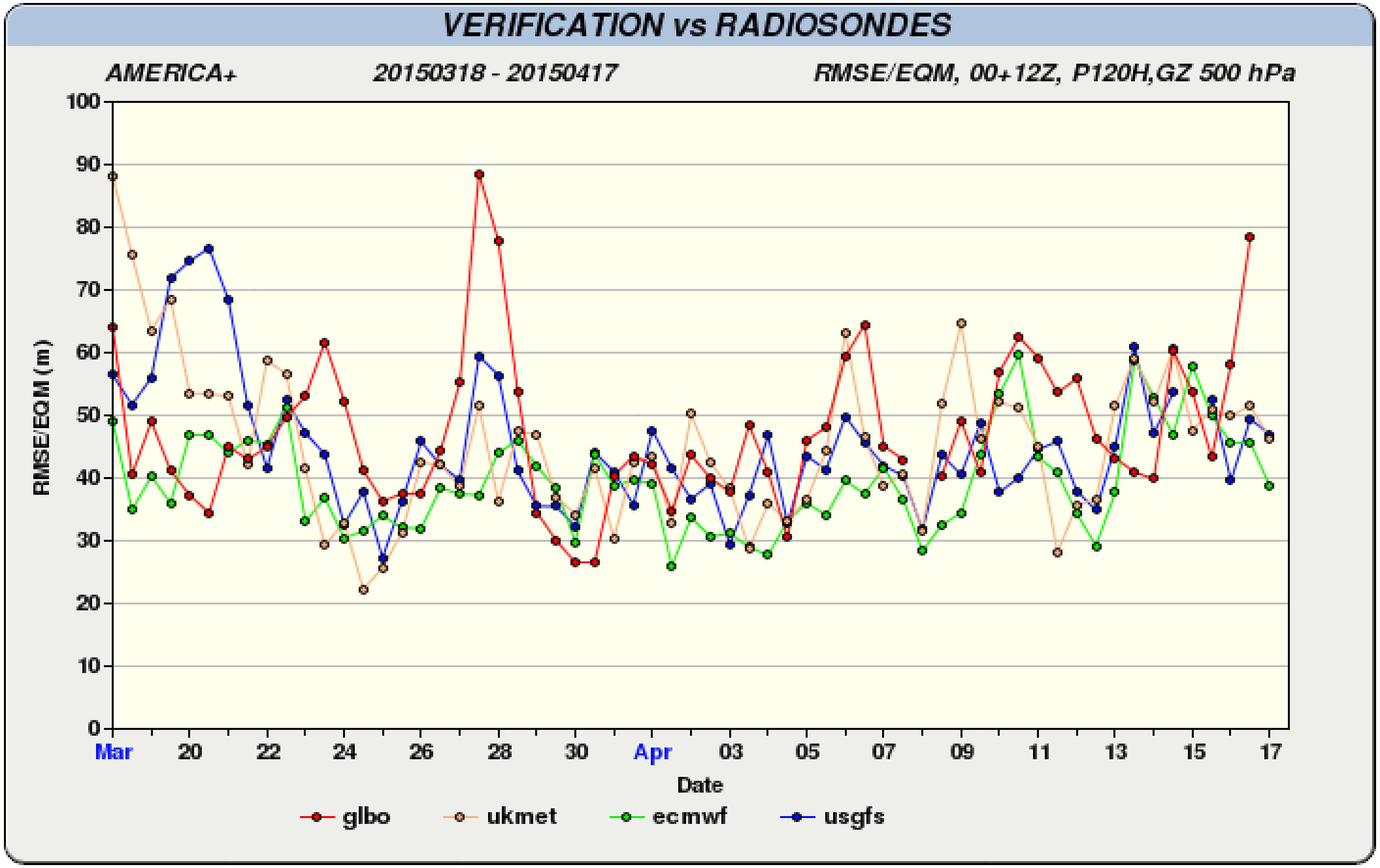
Été 2014





Hémisphère Sud

Scores du dernier mois Amérique du Nord GZ 500hPa échéance 120hrs

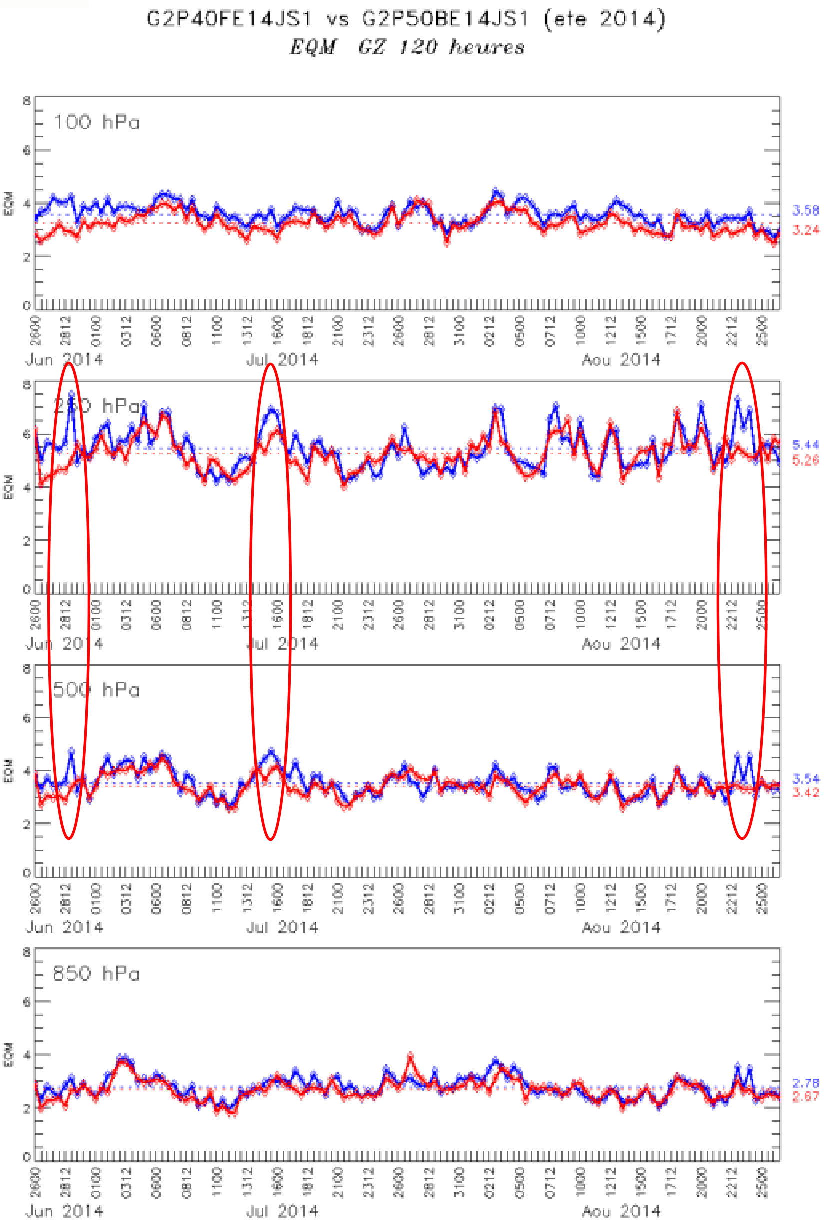


Environment Canada Environnement Canada

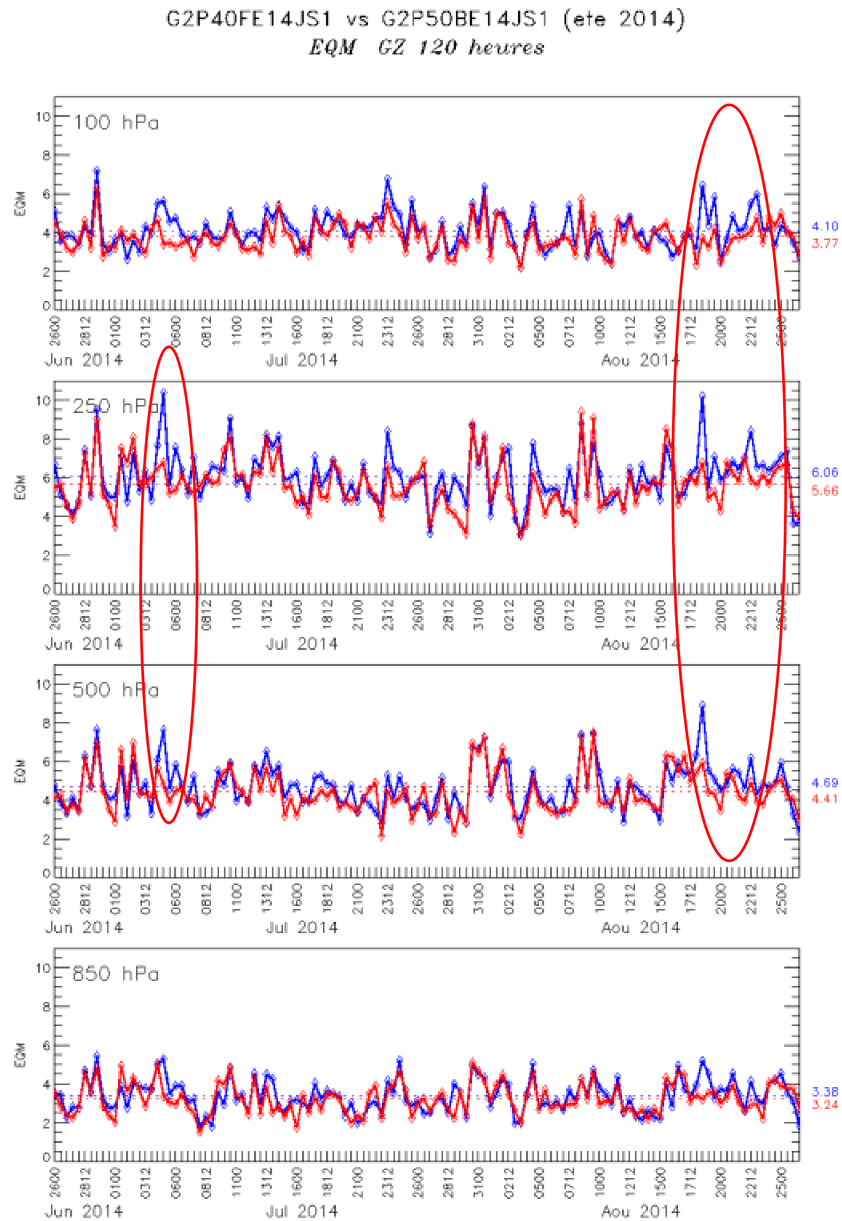
Canada

Cycle final été 2014 – Séries temporelles

Hémisphère Nord



Hémisphère Sud

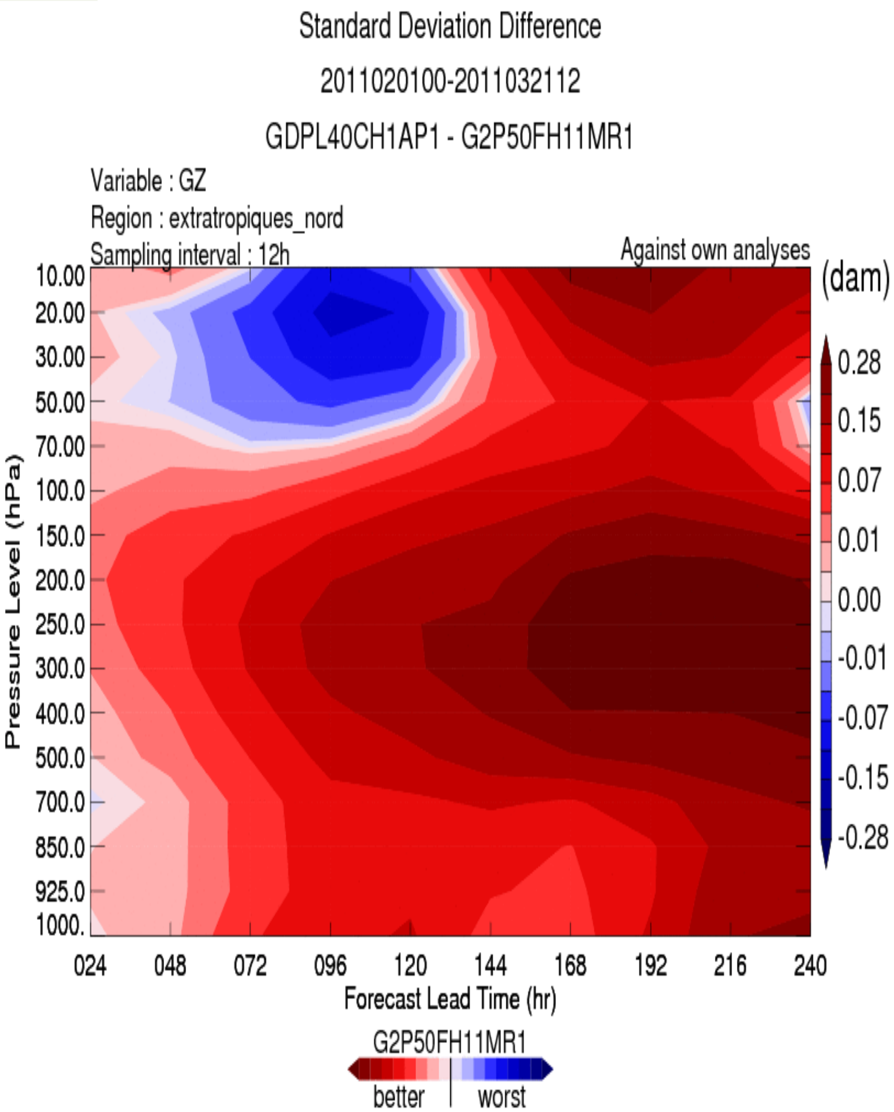


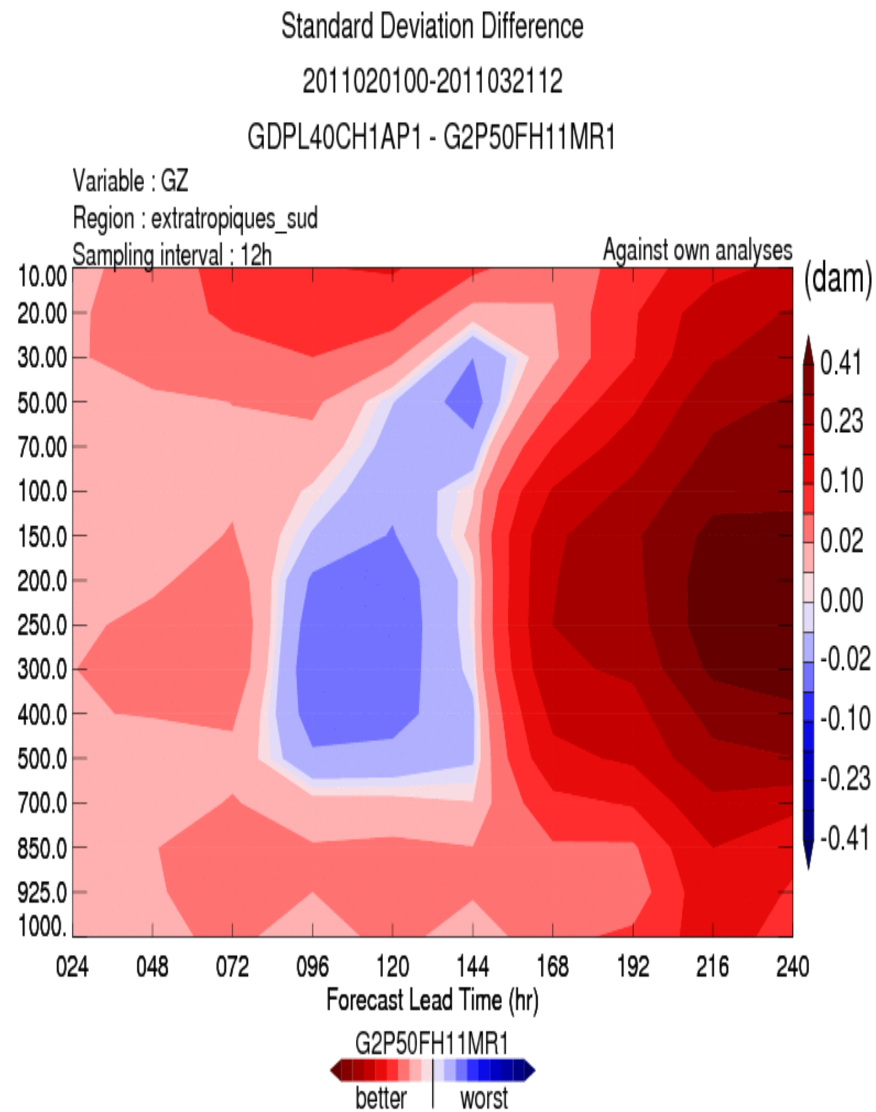
Scores contre Analyse

VERDICT

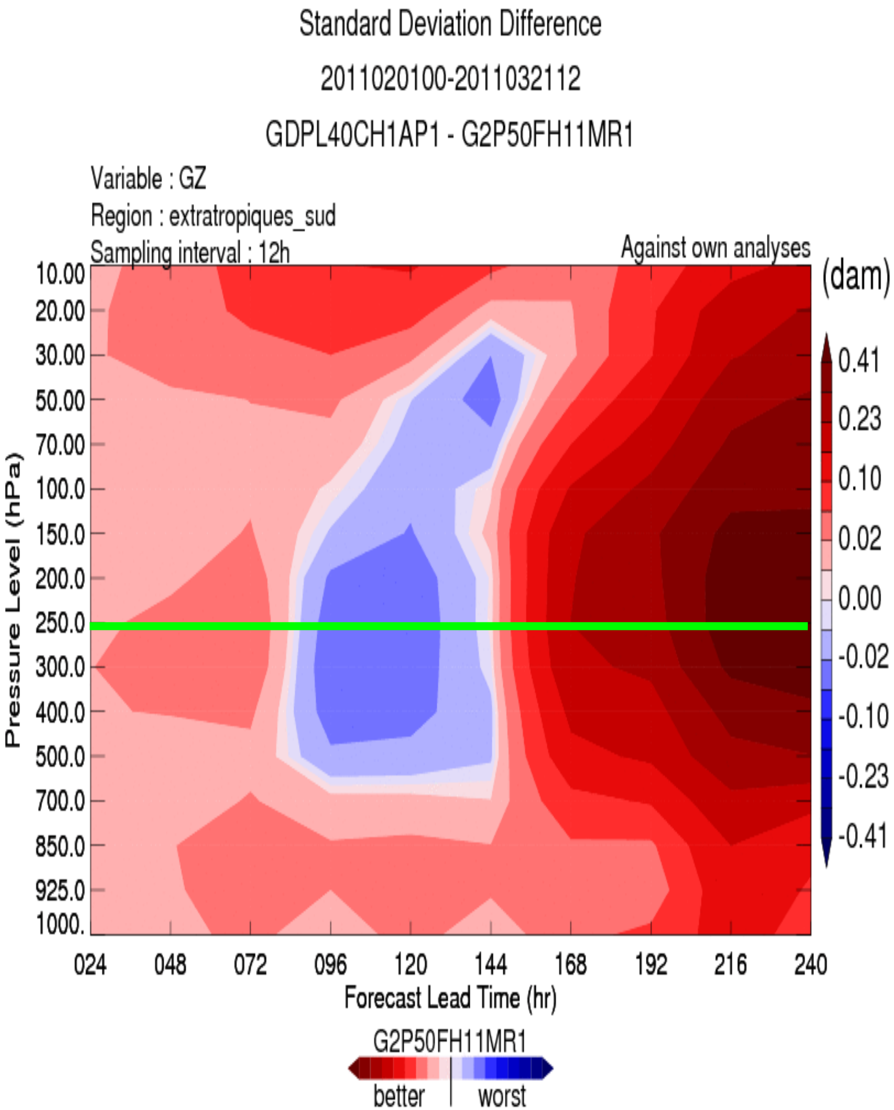
Cécilien Charette

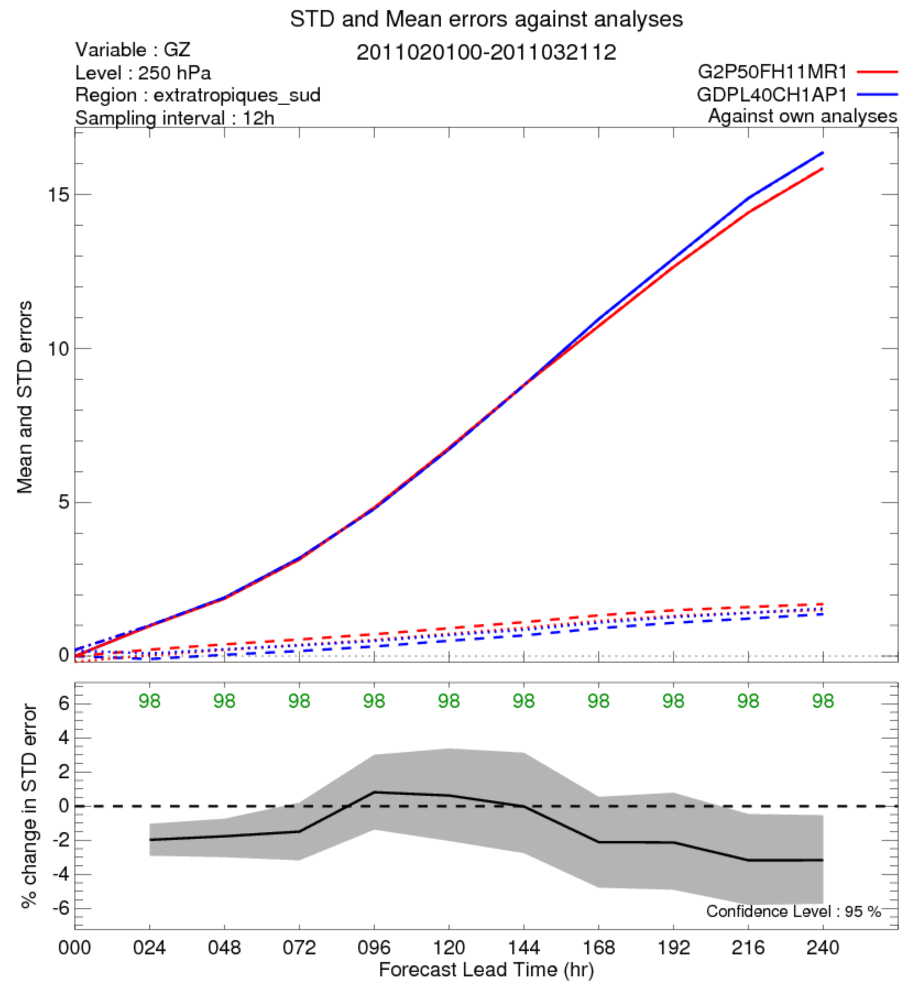
Différence de l'écart type de l'erreur de GZ vs analyses respectives: Hiver



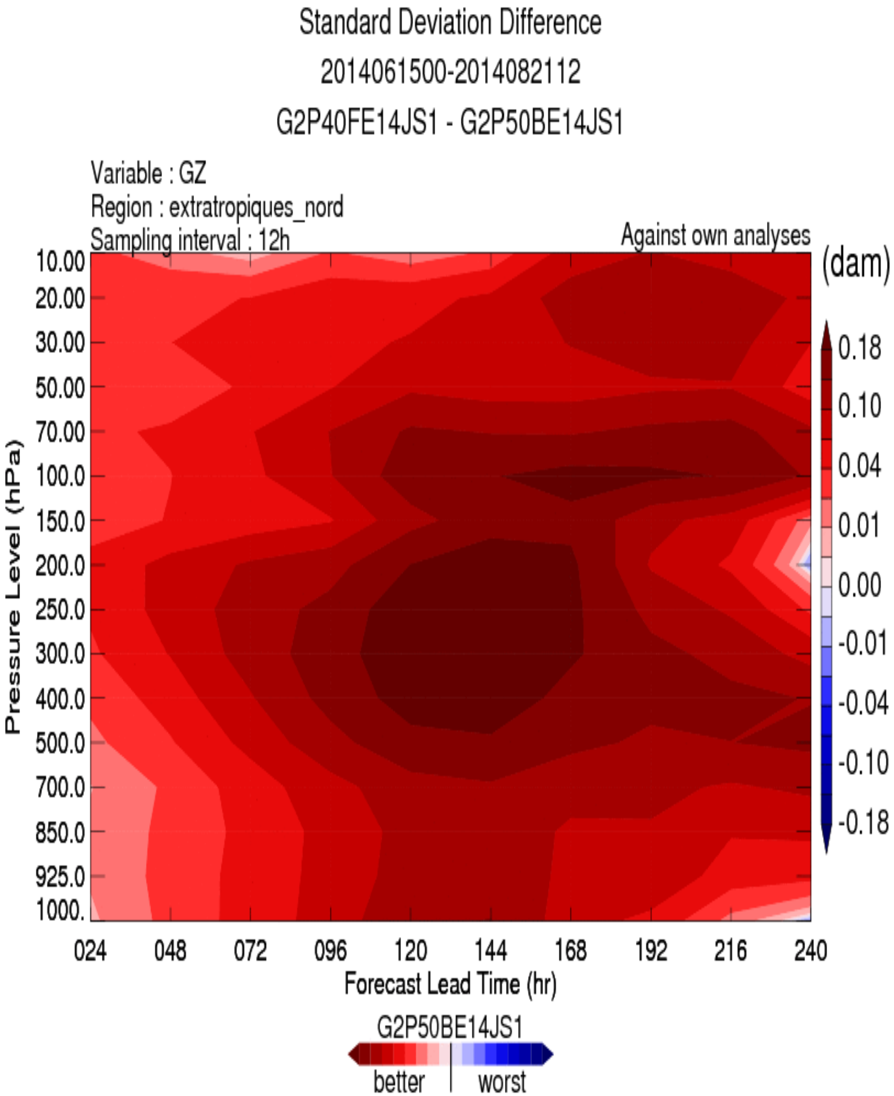


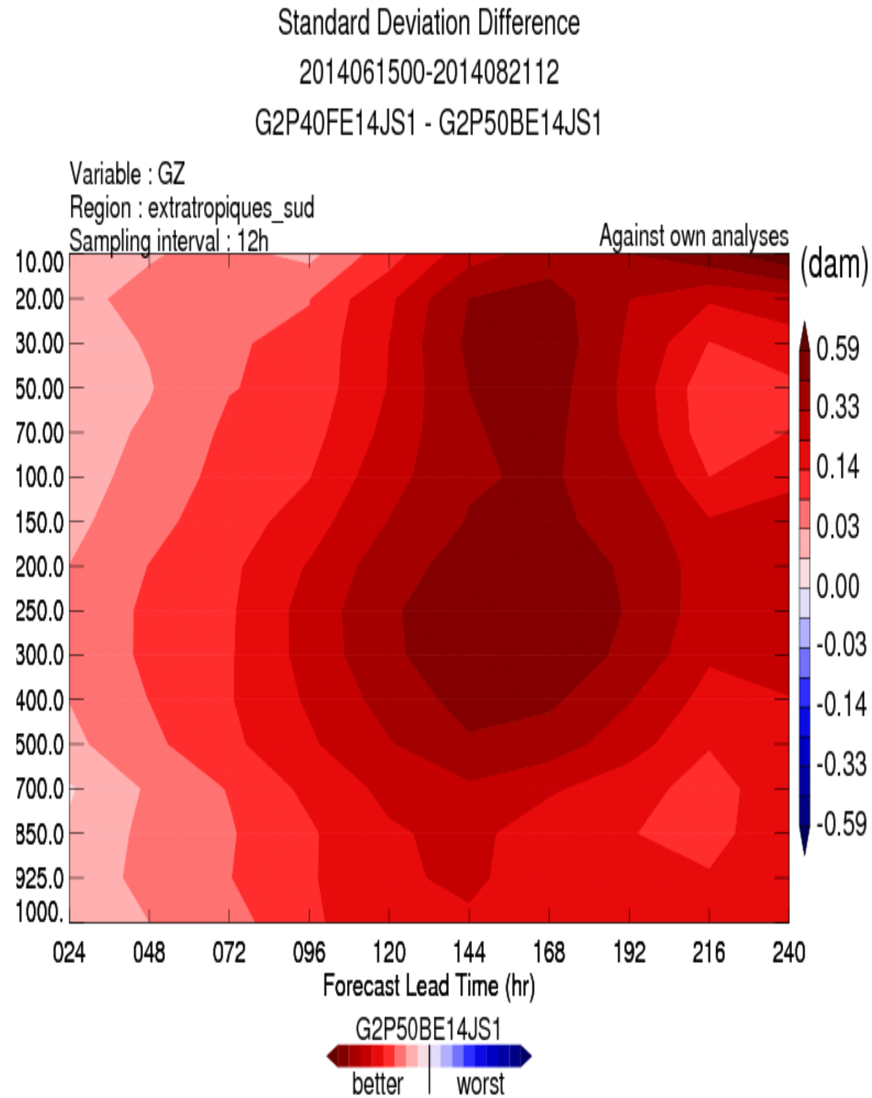
Écart type et moyenne de l'erreur de GZ 250hPa Extra-trop sud vs analyses respectives: Hiver





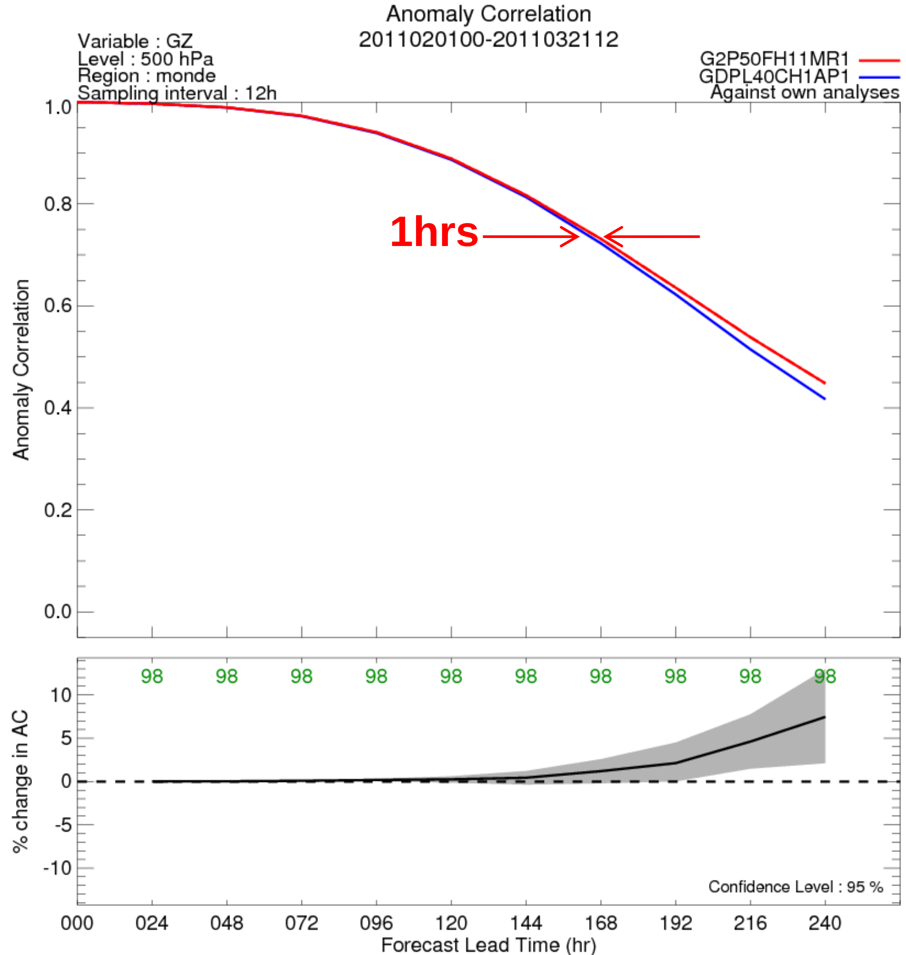
Différence de l'écart type de l'erreur de GZ vs analyses respectives: Été



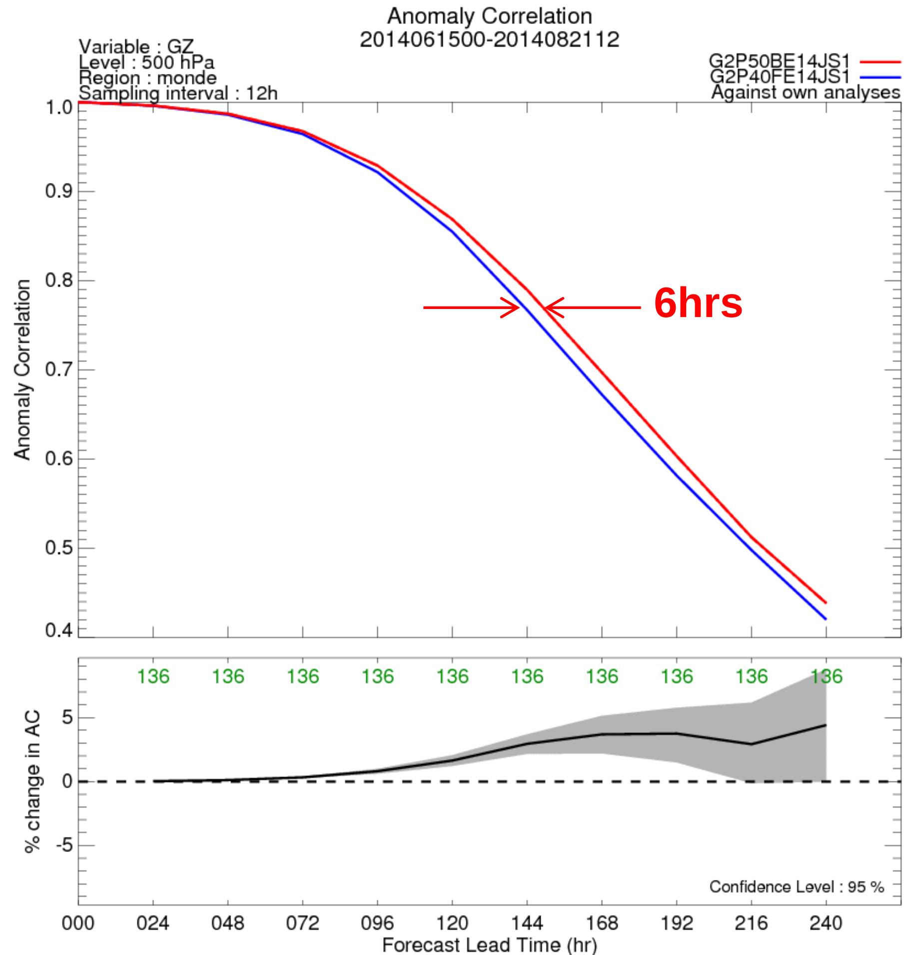


Corrélation d'anomalie GZ 500 hPa
Analyses respectives - Monde

Hiver



Été

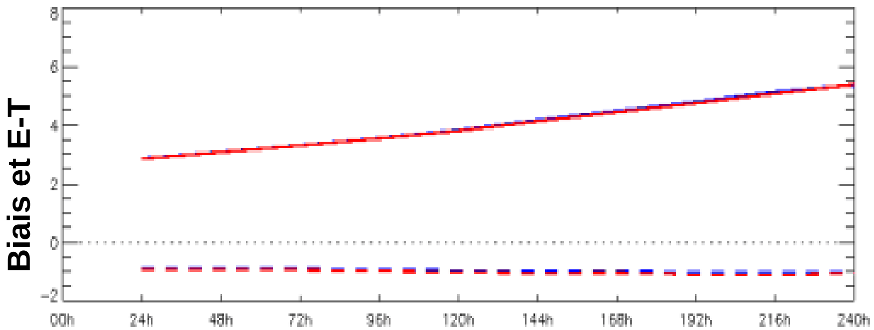


Scores contre Données de surface

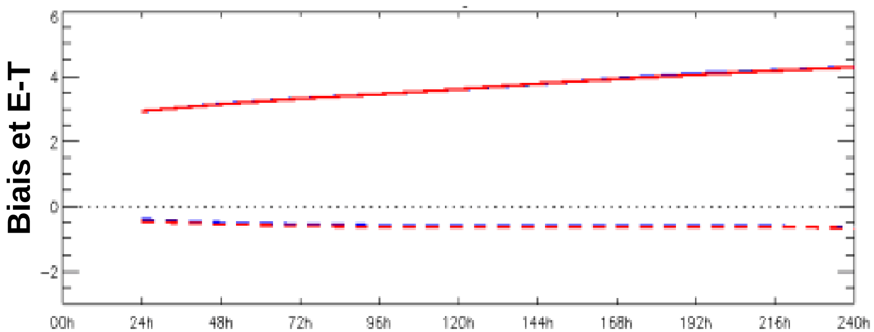
Écart type et biais de température et dépressions du point de rosée contre observations synoptiques: ARCAD Monde

Hiver 2011

Température

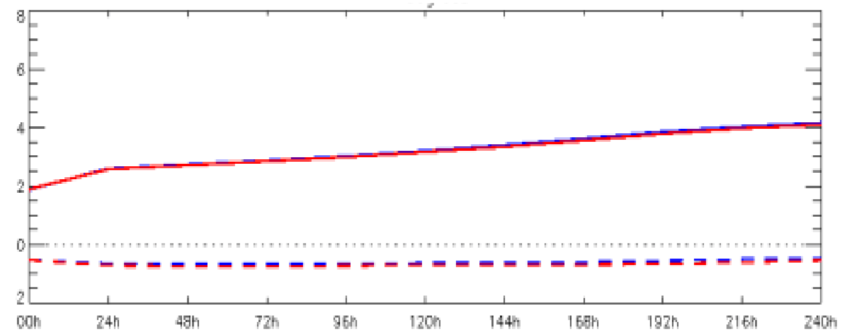


T - Td



Été 2014

Température



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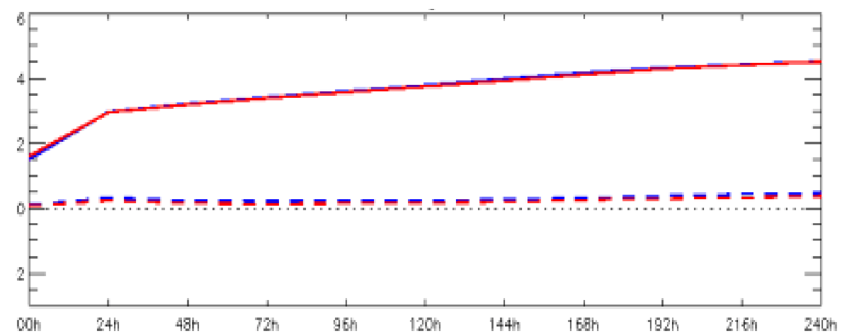
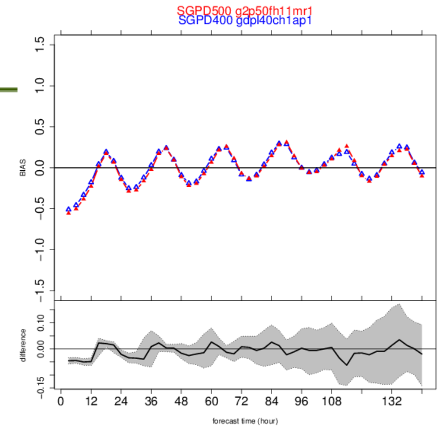
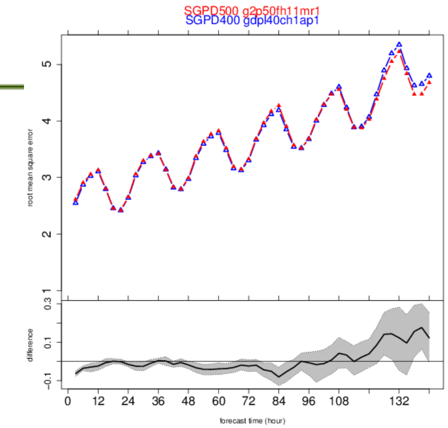
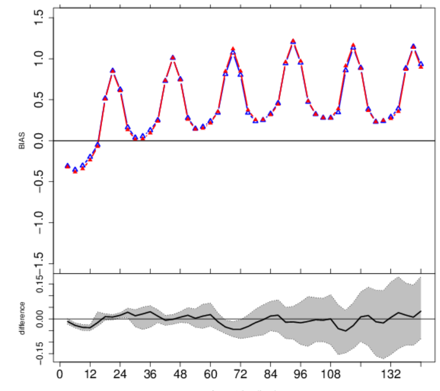
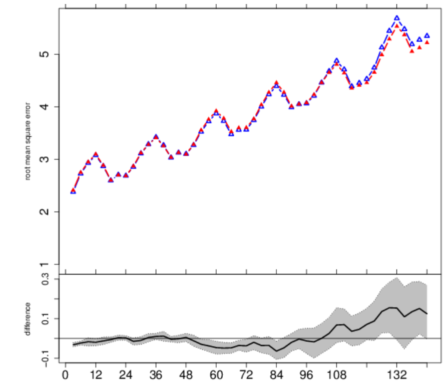
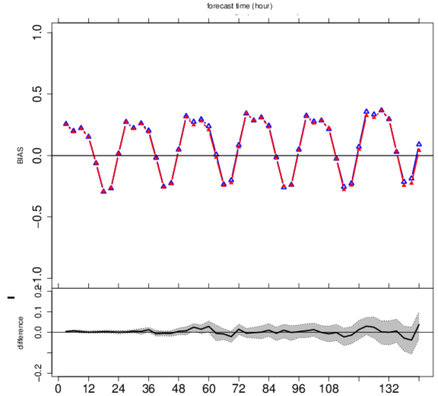
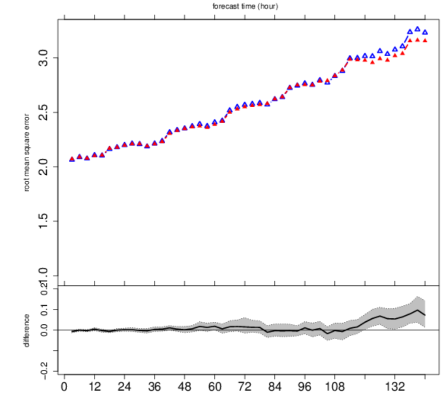


USTAT - Hiver 2011 - Amérique du Nord – 00Z

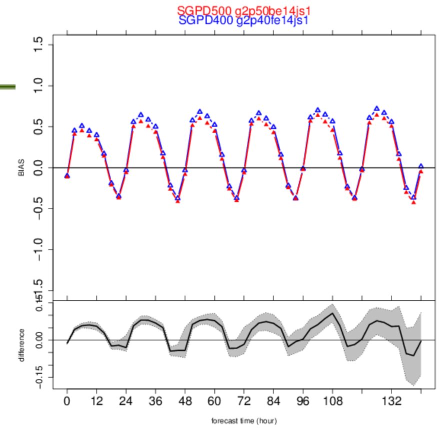
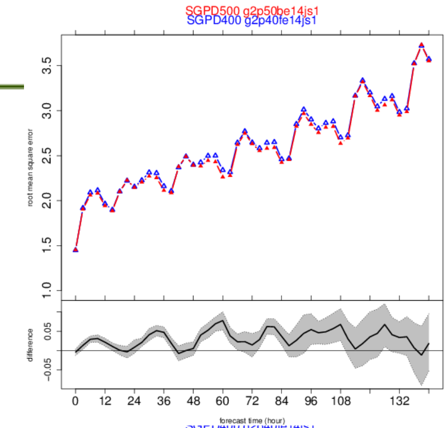
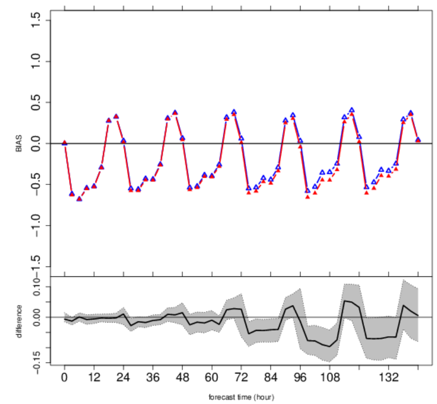
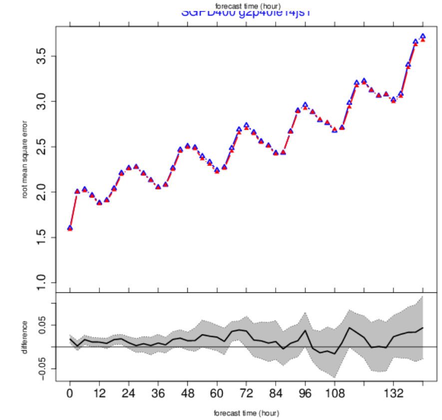
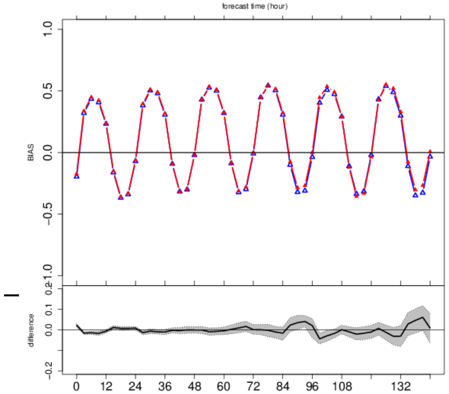
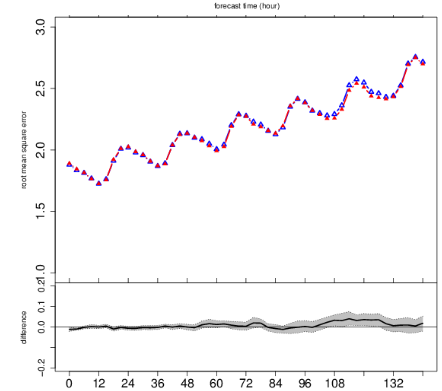
Marcel Vallée

	Biais	**Écart Type**
Température (C) (2m)		
Point de rosée (C) (2m)		
Vitesse du vent (m/s) (10m)		

DRAFT -

USTAT- Été 2014 - Amérique du Nord – 00Z

Marcel Vallée

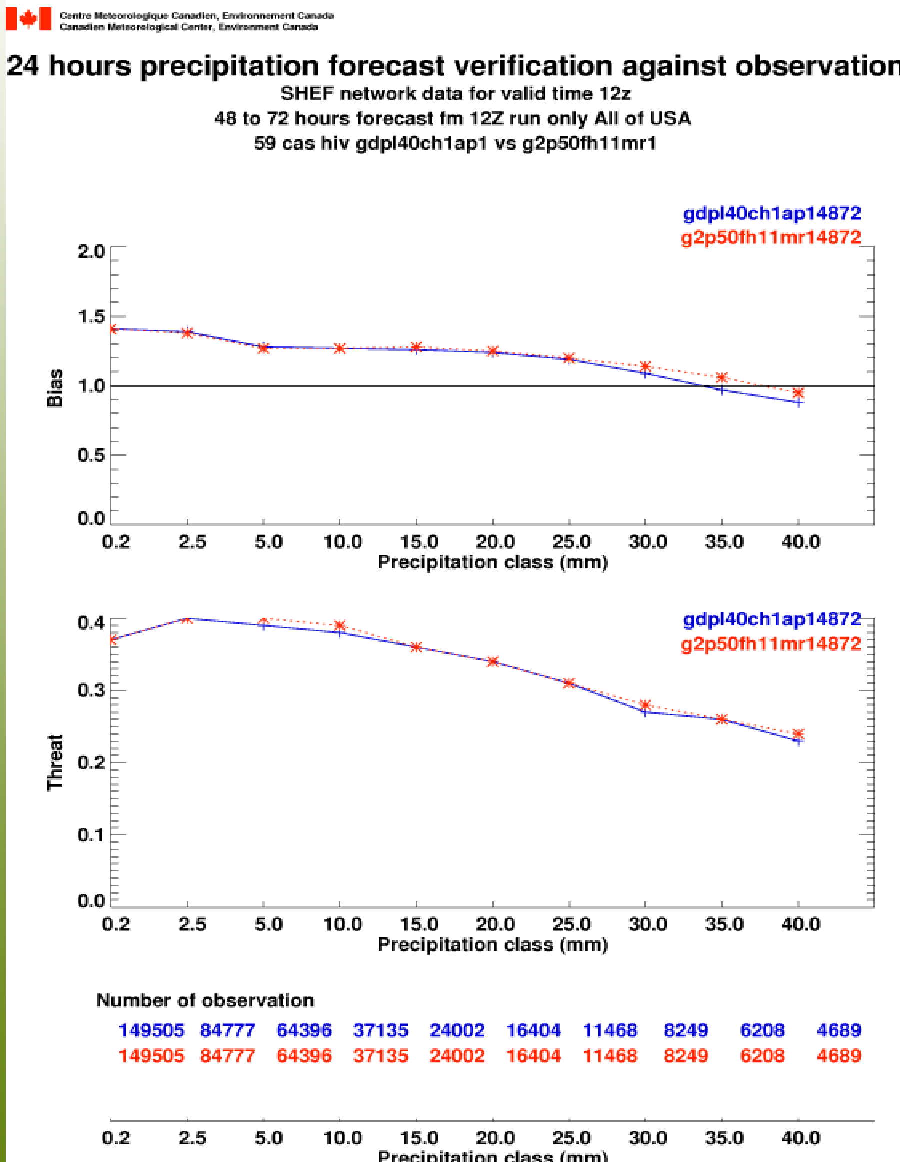
	Biais	**Écart Type**
Température (C) (2m)		
Point de rosée (C) (2m)		
Vitesse du vent (m/s) (10m)		

DRAFT –

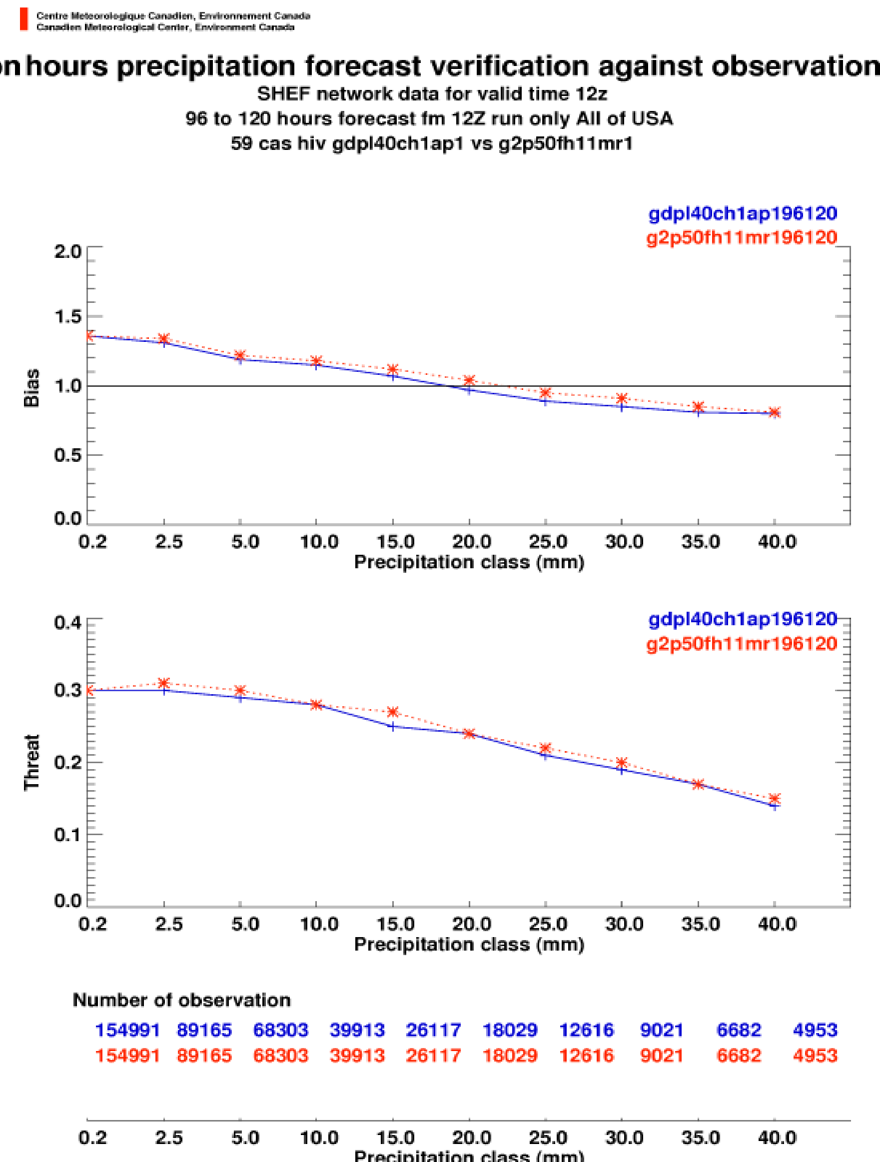
Scores de Précipitation

Scores de précipitation – SHEF - Hiver

Accumulation 48–72 heures



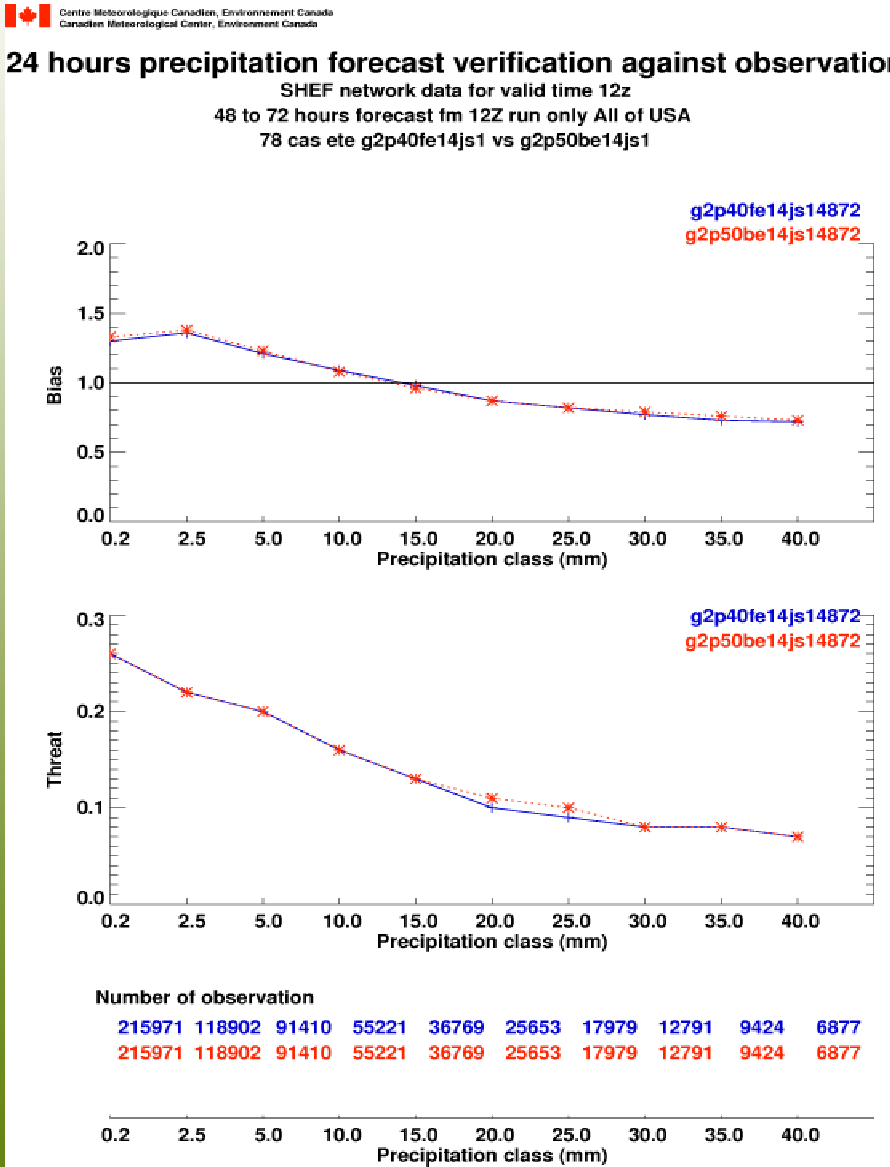
Accumulation 96–120 heures

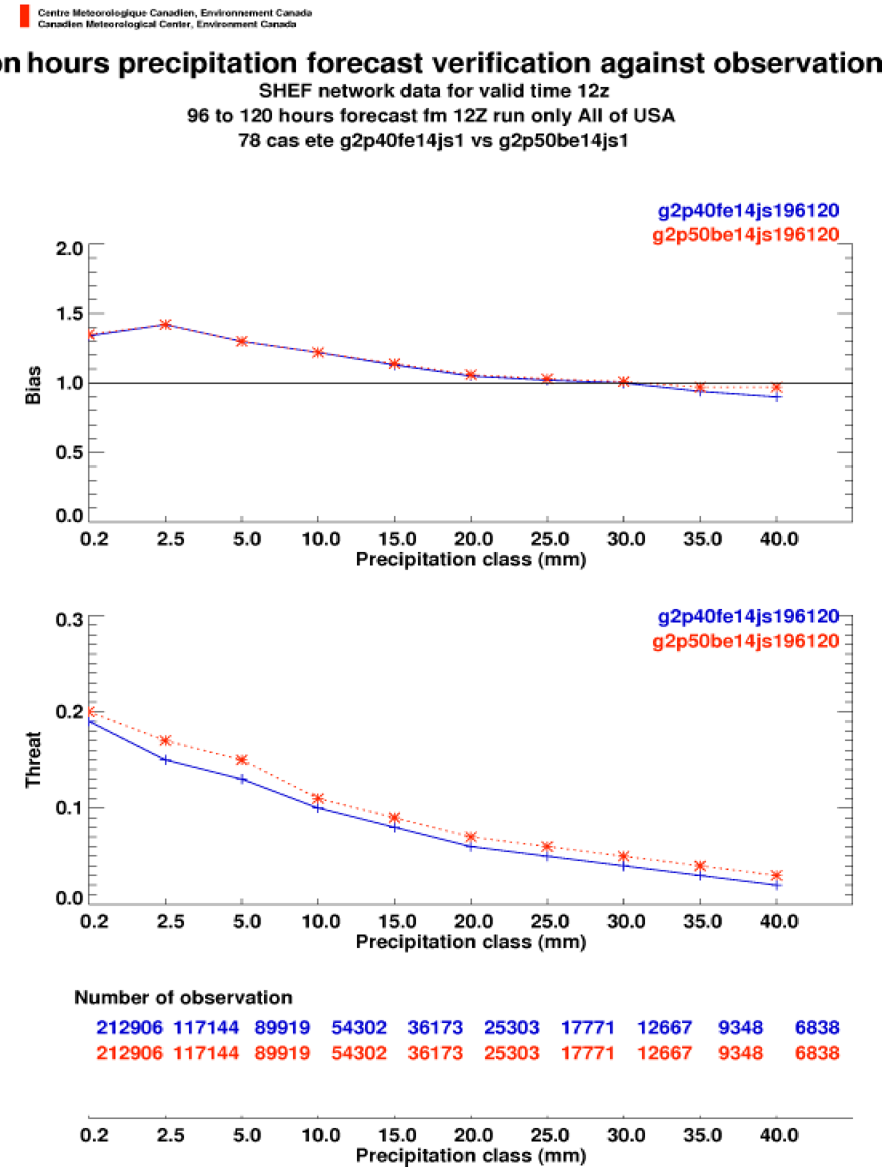


Scores de précipitation – SHEF - Été

Accumulation 48–72 heures

Accumulation 96–120 heures



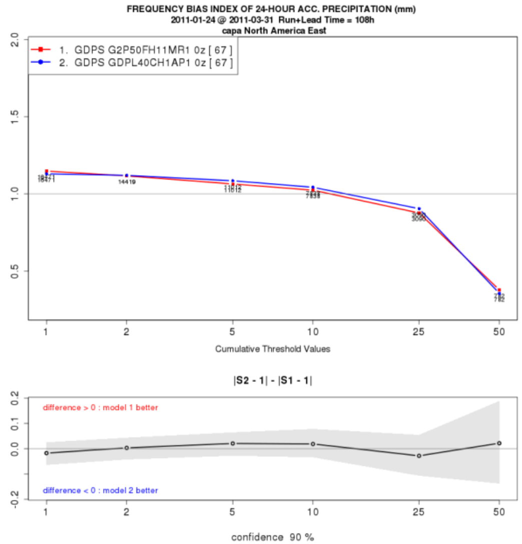


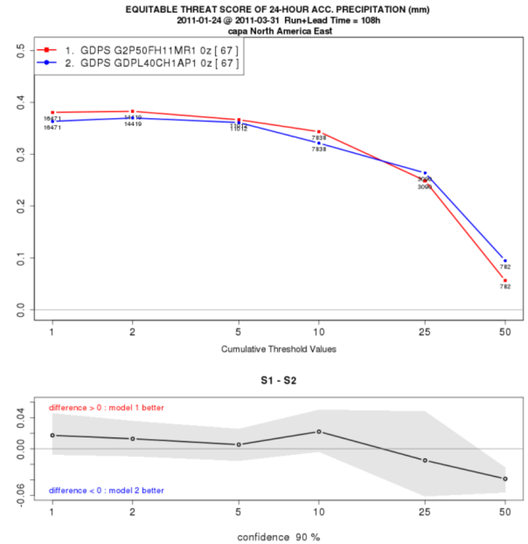
EMET – Acc. PCPN 24 heures @ 108 hrs – Hiver 2011 – 00Z

François Lemay

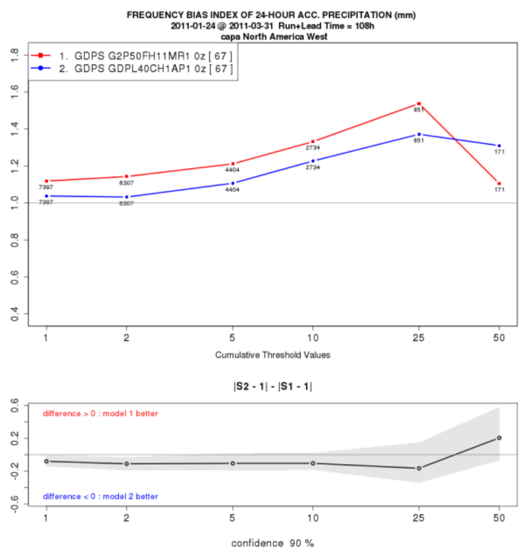
Frequency Bias | **Equitable Threat**

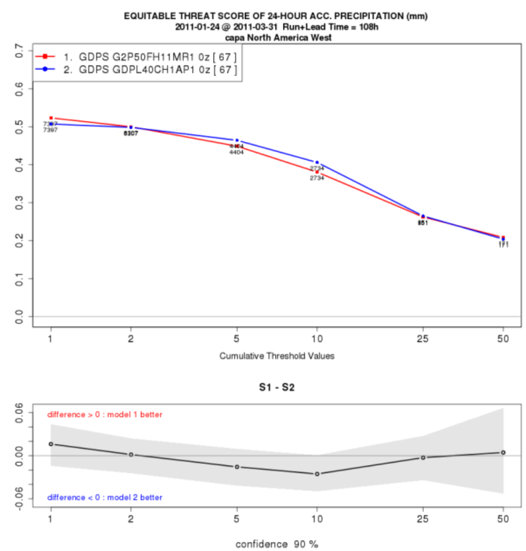
Amérique du Nord Est





Amérique du Nord Ouest



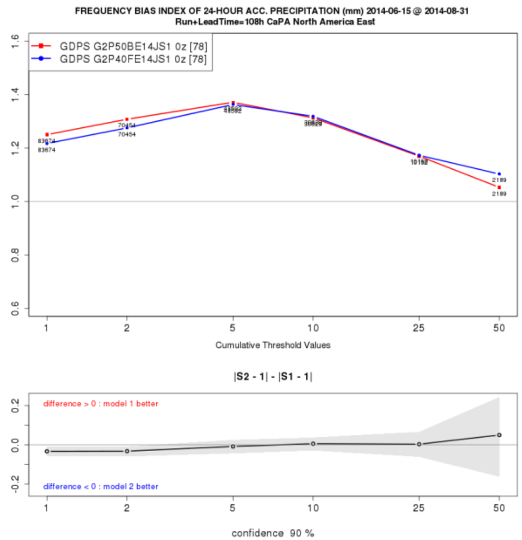


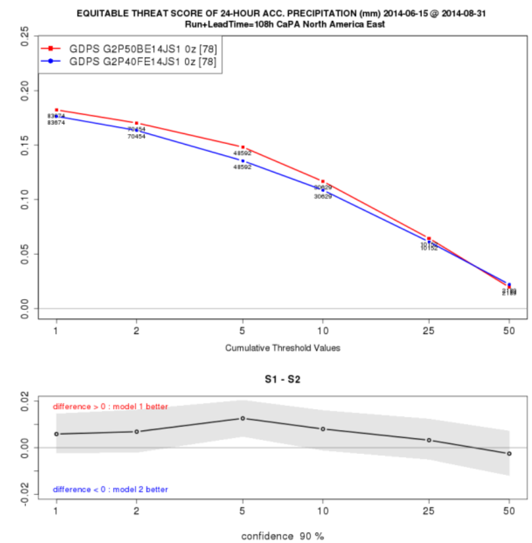
EMET – Acc. PCPN 24 heures @ 108 hrs – Été 2014 – 00Z

François Lemay

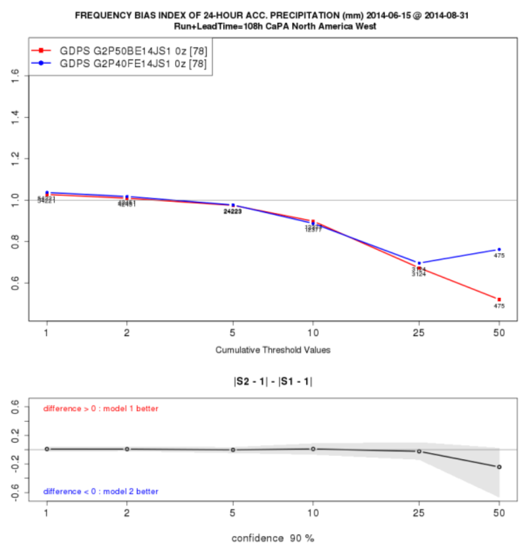
Frequency Bias | **Equitable Threat**

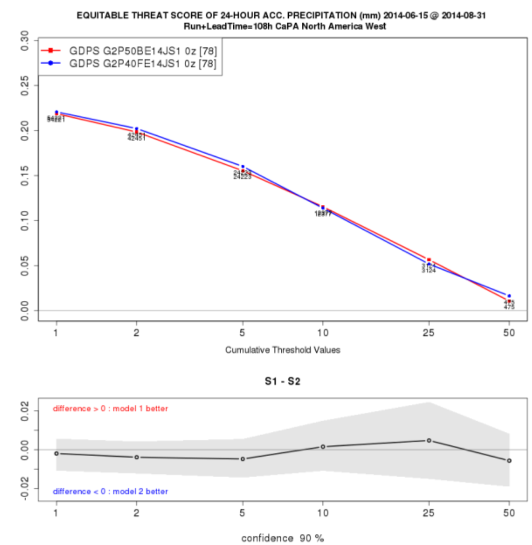
Amérique du Nord Est





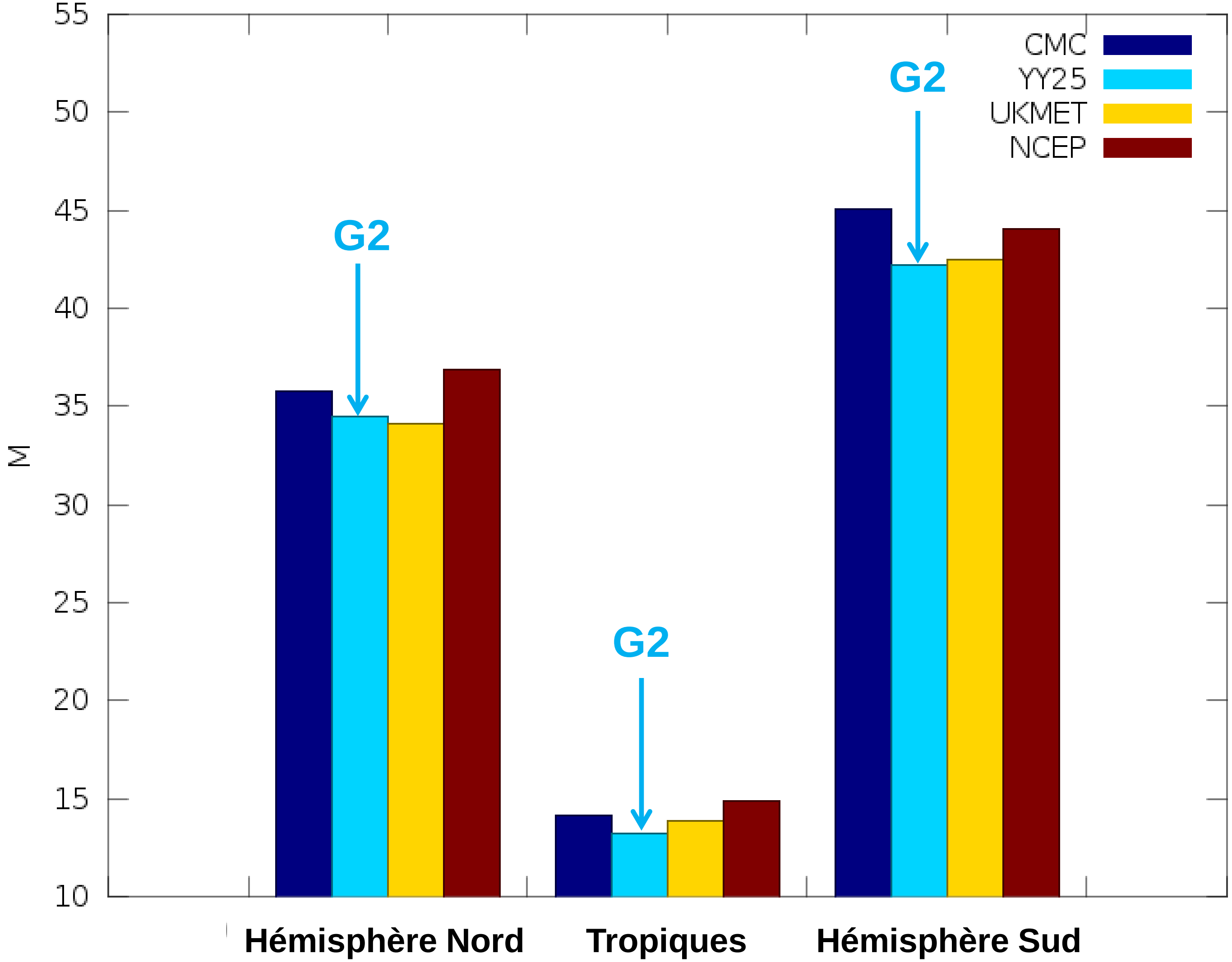
Amérique du Nord Ouest





Le grand Jeu: échange de scores au sein de l'OMM

Erreur RMS GZ 500 hPa @ 120 hrs Juillet/Août 2014



En résumé: comportement du GDPS500

- On observe une amélioration significative de la plupart des scores dans l'ensemble des régions
- Le nouveau système a peu d'impact sur le comportement des variables de surface
- La précipitation est peu sensible aux changements introduits par le nouveau système
- Tous les progs ont été refaits en appliquant le correctifs à ISBA (pluie sur neige) et il n'y a pas de différence significative en terme de scores avec les contrôles
- Avec ces changements nous demeurons compétitifs avec les autres centres

Documentation

- Séminaire de Abdessamad Qaddouri
- Séminaire de Claude Girard
- Page WIKI de l’implantation (YinYang 25km)
- Page WIKI ARMA du SGPD5.0.0
- Page où sont regroupés tous les scores présentés ici et beaucoup plus