

Update on the preparation of a global 4D-Var parallel system

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20 August 2007

20/08/2007



Environment
Canada

Environnement
Canada

Canada

Rapport d'avancement de la passe ajout d'observations

- L'équipe: D. Anselmo, J. Aparicio, A. Beaulne, J.-M. Bélanger, M. Buehner, G. Deblonde, L. Garand, J. Hallé, S. Laroche, P. Koclas, J. Morneau, R. Sarrazin, N. Wagneur
- Composantes examinées:
 - *– RTTOV7 >> RTTOV8 (plusieurs améliorations, nécessaire pour IASI)
 - *– estimation/correction de biais dynamique (données de radiance)
 - *– nouvelle interpolation pour RTTOV (importantes avec analyse à 58 niveaux)
 - *– données AMSU supplémentaires (extreme scan angles)
 - nouvelles statistiques (background et observations)
 - *– SSM/I (incluant l'élimination de amsu-a ch3 et filtre de nuage pour amsu-b)
 - *– QuikScat
 - *– AIRS
 - GPS-RO
 - *– augmentation volume de données conventionnelles:
 - UA (43 niveaux au lieu de 28)
 - AI (plus haute résolution dans le verticale)
 - *• SW (3.9 micron, seulement pendant la nuit et à bas niveaux)
 - P_{sfc} (toutes les 3 heures)
 - *– diffusion des vents réels dans la couche-éponge (M. Roch)

Volume de Données

(for a typical 6h period)

| Systeme operationnel | | Nouvelles donnees | |
|-----------------------------|----------------|--------------------------|----------------|
| RAOBS | 50000 | SSMI | 14000 |
| Aircraft | 55000 | QuikScat | 10000 |
| Profilers | 8000 | AIRS | 75000 |
| Surface | 13000 | | |
| GOES | 5000 | | |
| SatWind | 40000 | SatWind | 1500 |
| AMSU-A | 50000 | AMSU-A | 14000 |
| AMSU-B | 20000 | AMSU-B | 5000 |
| Total | ~240000 | Total | ~120000 |

Impacts Indépendants

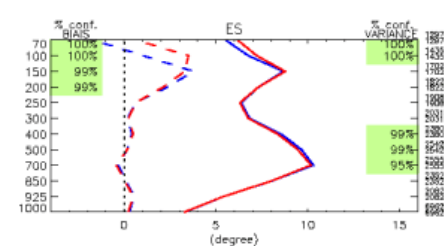
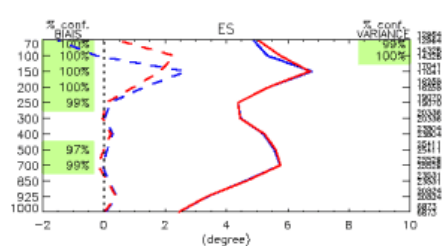
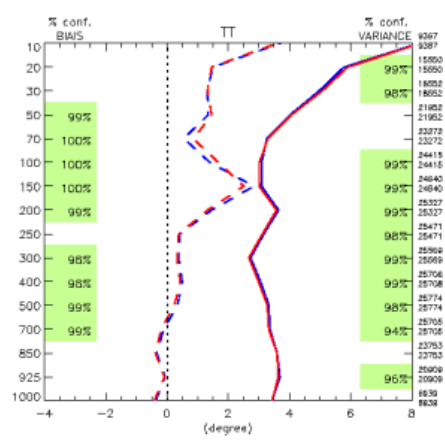
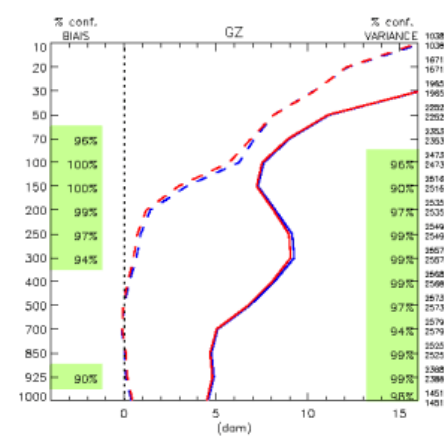
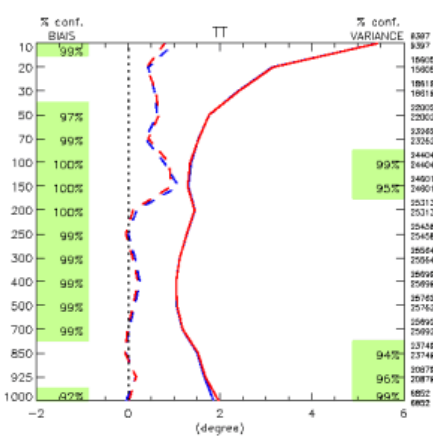
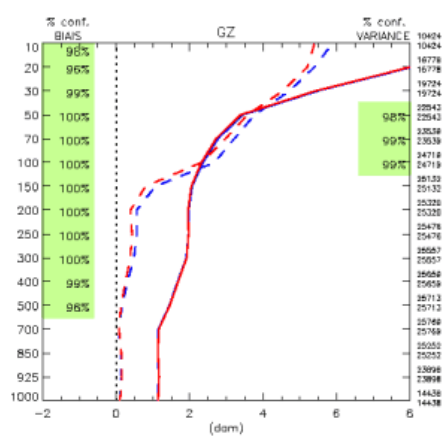
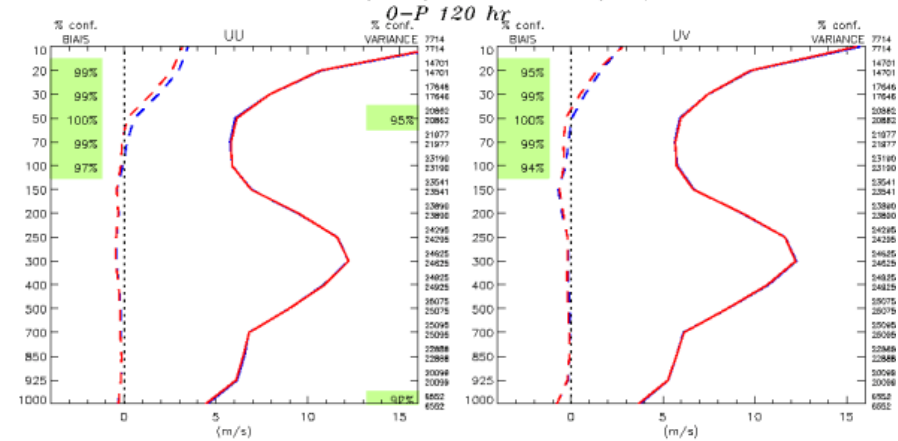
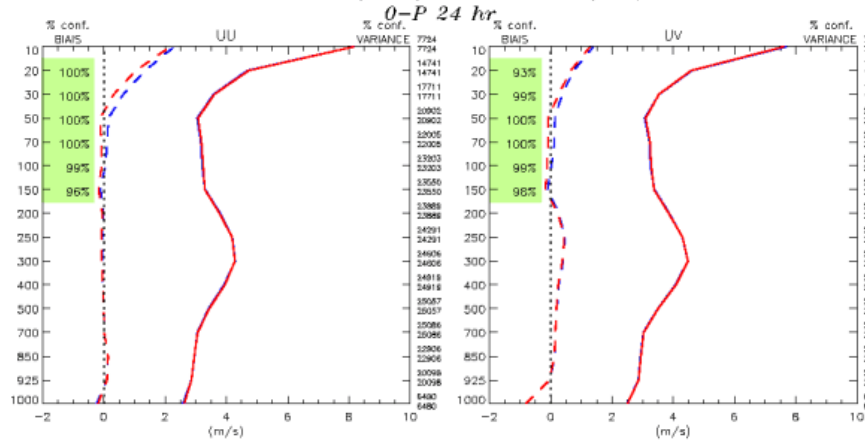
Sur la période de l'**hiver** 2004/5 seulement:

1. RTTOV8/correction de biais dynamique/nouveau interpolation/données AMSU supplémentaires – 4D-Var, 2 mois
 - **positif** (vs. contrôle), surtout dans hémisphère sud et biais GZ
2. SSM/I – 4D-Var, 1 mois
 - **légèrement positif** (vs. cycle 1) entre 200-500hPa, toutes les variables
3. QuikScat – 4D-Var, 1 mois
 - **légèrement positif** (vs. cycle 1) dans hémisphère sud
4. SatWind – 4D-Var, 1 mois
 - **légèrement positif** (vs. cycle 1) dans hémisphère sud
5. Diffusion des vents réels, l'éponge – 4D-Var (2 mois, l'hiver 2006/7)
 - **légèrement positif** (vs. operational) dans le stratosphère, hémisphère nord
6. AIRS
 - problèmes avec des incréments très grand près du toit
 - réglé avec une réduction du nombre de canaux (100 à 87, 83 at high lats)
 - évalué en 4D-Var sur les périodes des cycles finaux
 - **impact positif** (vs. cycle avec tout les autres modifications)

RTTOV8, correction de biais, etc.

M4DH05F1 (CNTL) vs K4H5F1R4 (EXP)

M4DH05F1 (CNTL) vs K4H5F1R4 (EXP)



Hémisphère Nord, 24h

Hémisphère Nord, 120h

Type : 0-P 24 hr
 Region : Hémisphere Nord
 Lat-Ion : (20N, 180W) (90N, 180E)
 Stat.

- ◇ — E-T m_u04121500_05021000_120_m4dh05f1 { 115 }
- - - BIAIS m_u04121500_05021000_120_m4dh05f1
- ◇ — E-T m_u04121500_05021000_120_k4h5f1r4 { 115 }
- - - BIAIS m_u04121500_05021000_120_k4h5f1r4

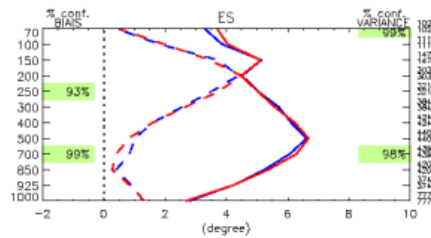
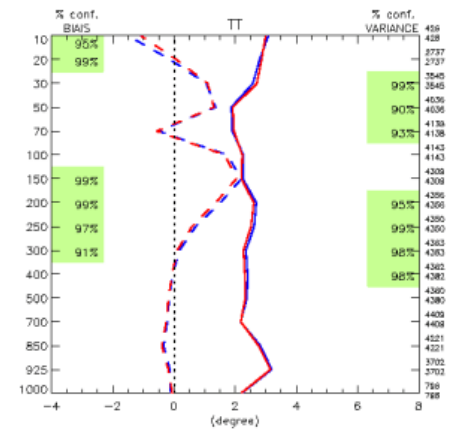
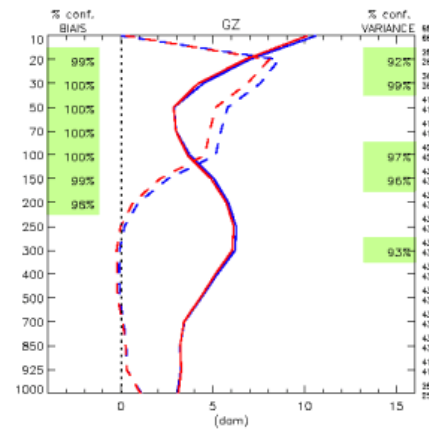
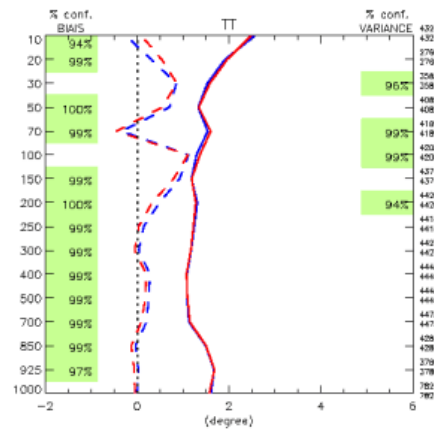
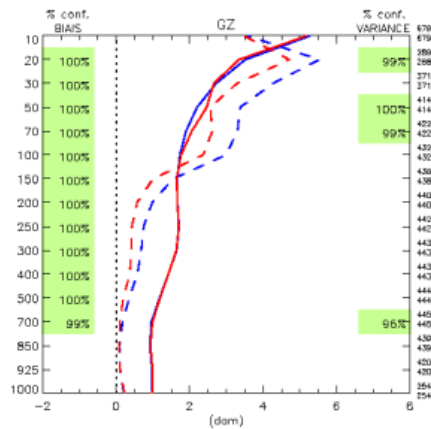
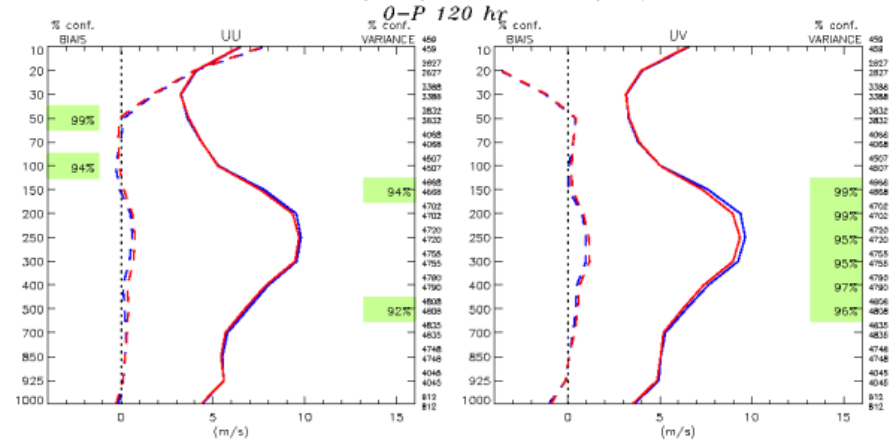
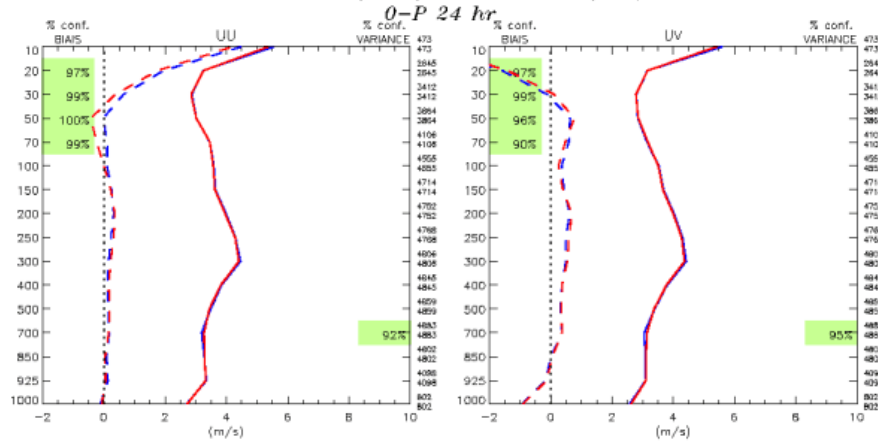
Type : 0-P 120 hr
 Region : Hémisphere Nord
 Lat-Ion : (20N, 180W) (90N, 180E)
 Stat.

- ◇ — E-T m_u04121500_05021000_120_m4dh05f1 { 115 }
- - - BIAIS m_u04121500_05021000_120_m4dh05f1
- ◇ — E-T m_u04121500_05021000_120_k4h5f1r4 { 115 }
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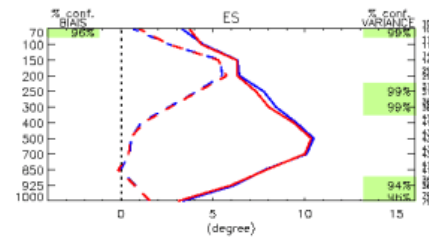
RTTOV8, correction de biais, etc.

M4DH05F1 (CNTL) vs K4H5F1R4 (EXP)

M4DH05F1 (CNTL) vs K4H5F1R4 (EXP)



Hémisphère Sud, 24h



Hémisphère Sud, 120h

Type : 0-P 24 hr
 Region : Hemisphere Sud
 Lat-lon : (90S, 180W) (20S, 180E)
 Stat.

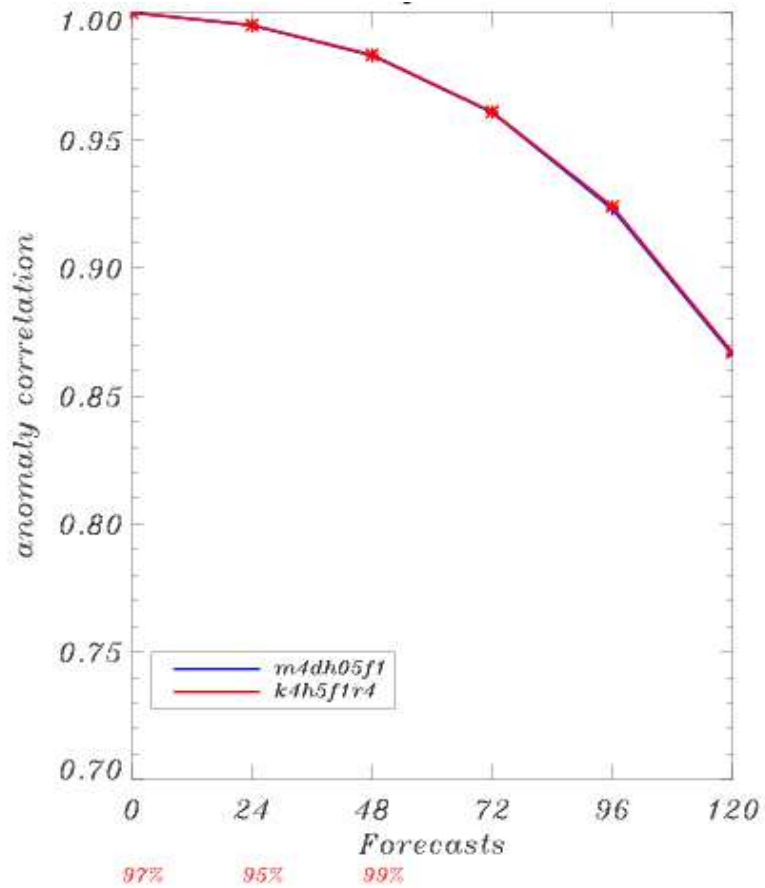
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Type : 0-P 120 hr
 Region : Hemisphere Sud
 Lat-lon : (90S, 180W) (20S, 180E)
 Stat.

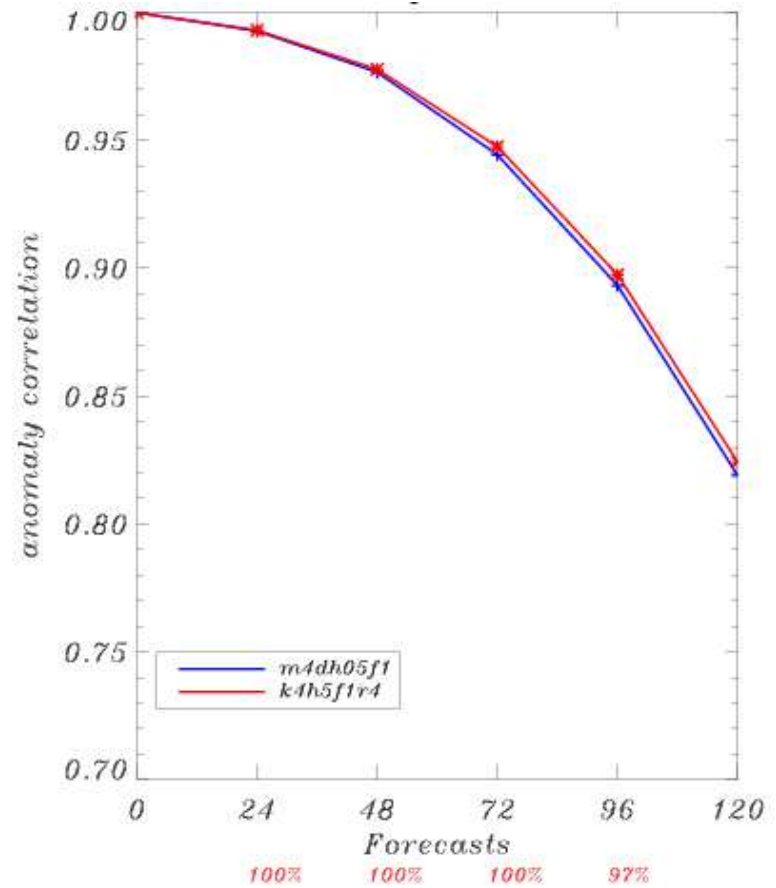
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- ◇ ——— E-T m_u04121500_05021000_120_k4h5f1r4 (115)
- - - - BIAS m_u04121500_05021000_120_k4h5f1r4

RTTOV8, correction de biais, etc.

GZ 500hPa CORA Hémisphère Nord



GZ 500hPa CORA Hémisphère Sud

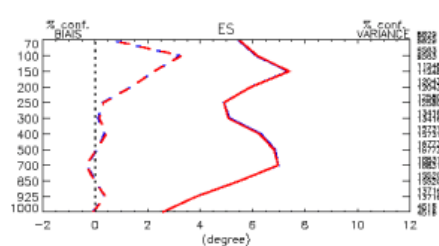
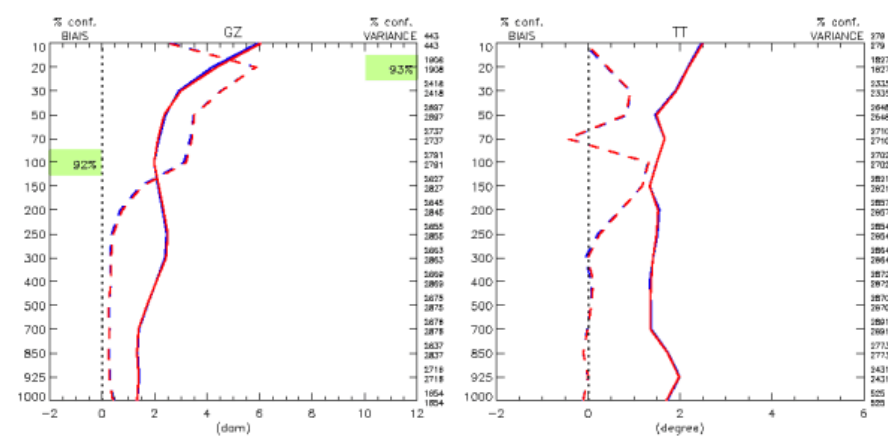
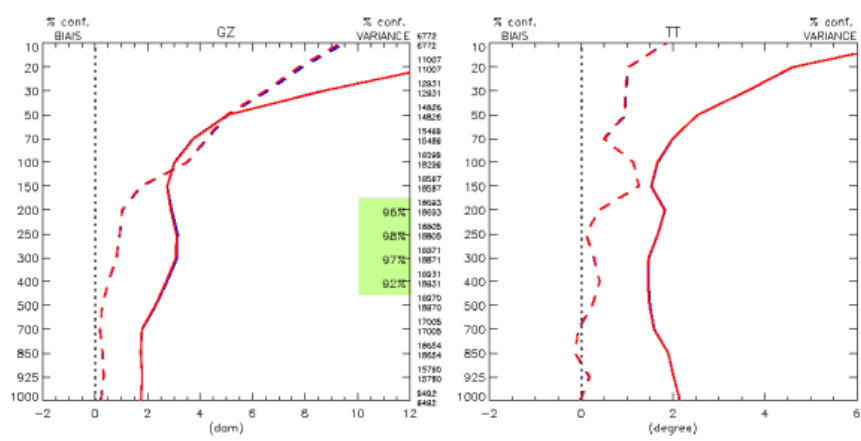
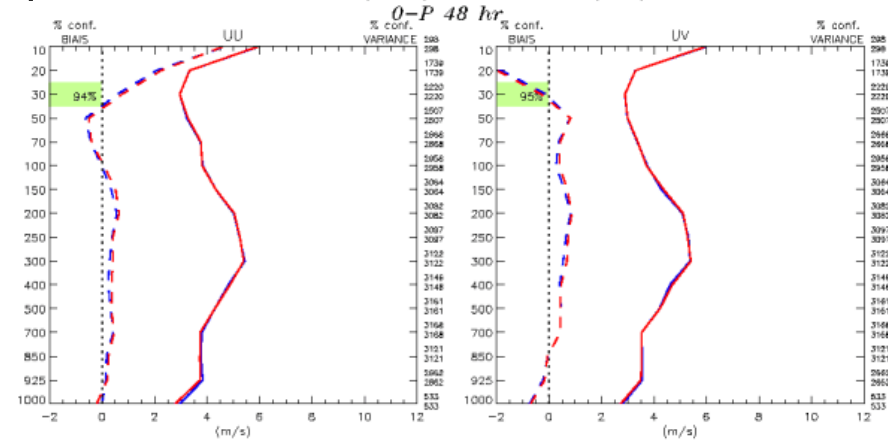
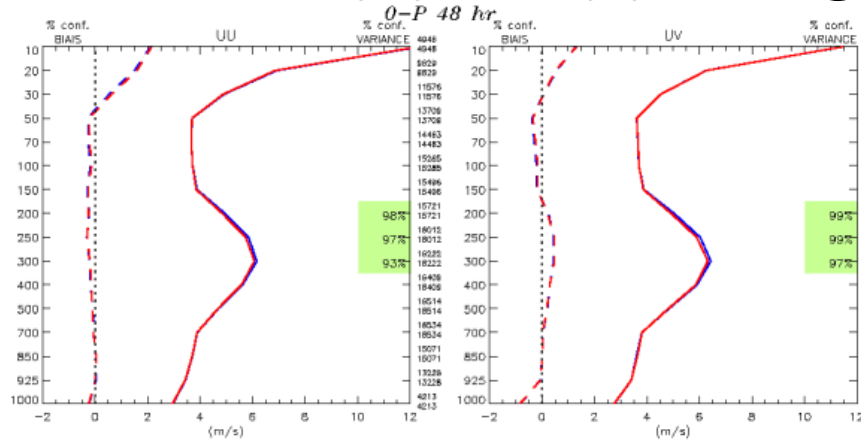


Impact of individual components in addition to updates to radiance assimilation (RTTOV8, new interpolation, dynamic bias correlation, extra amsu data)

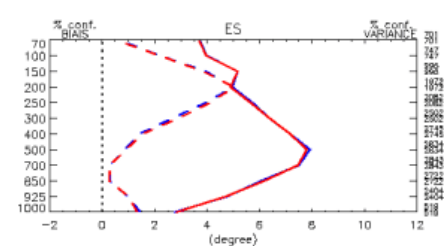
SSM/I

K4H5F1R4 (CNTL) vs K4H5MIR3 (EXP)

K4H5F1R4 (CNTL) vs K4H5MIR3 (EXP)



Hémisphère Nord, 48h



Hémisphère Sud, 48h

◇ — E-T m_u04122500_05013112_120_k4h5f1r4 (76)
□ - - - BIAS m_u04122500_05013112_120_k4h5f1r4
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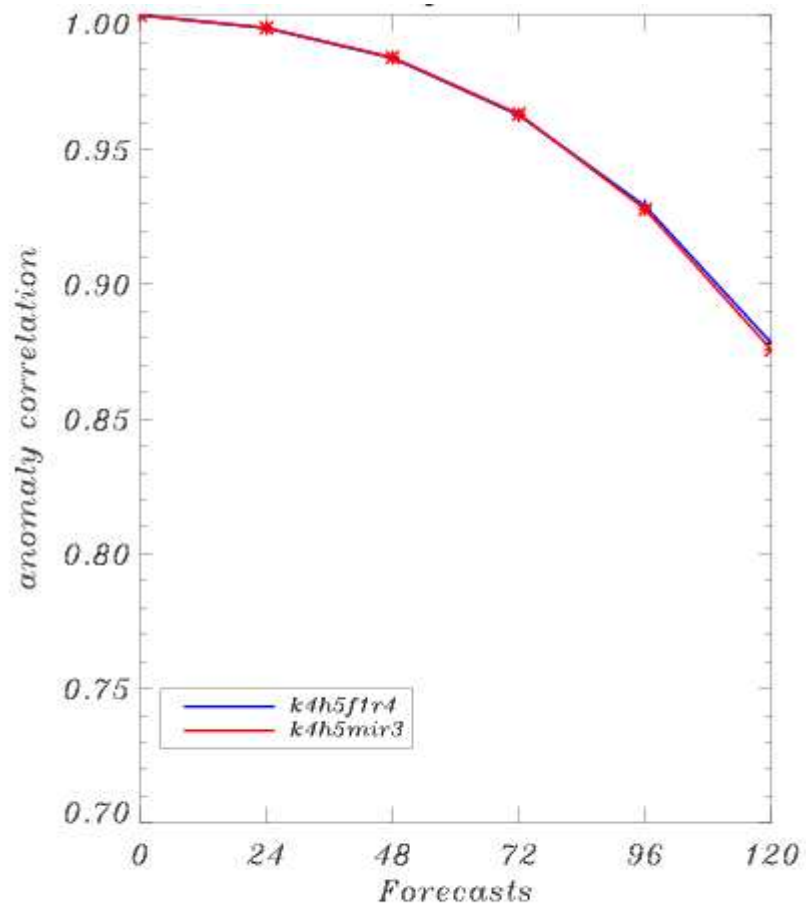
Type : 0-P 48 hr
Region : Hemisphere Nord
Lat-lon : (20N, 180W) (90N, 180E)
Stat.

◇ — E-T m_u04122500_05013112_120_k4h5f1r4 (76)
□ - - - BIAS m_u04122500_05013112_120_k4h5f1r4
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□ - - - BIAS m_u04122500_05013112_120_k4h5mir3

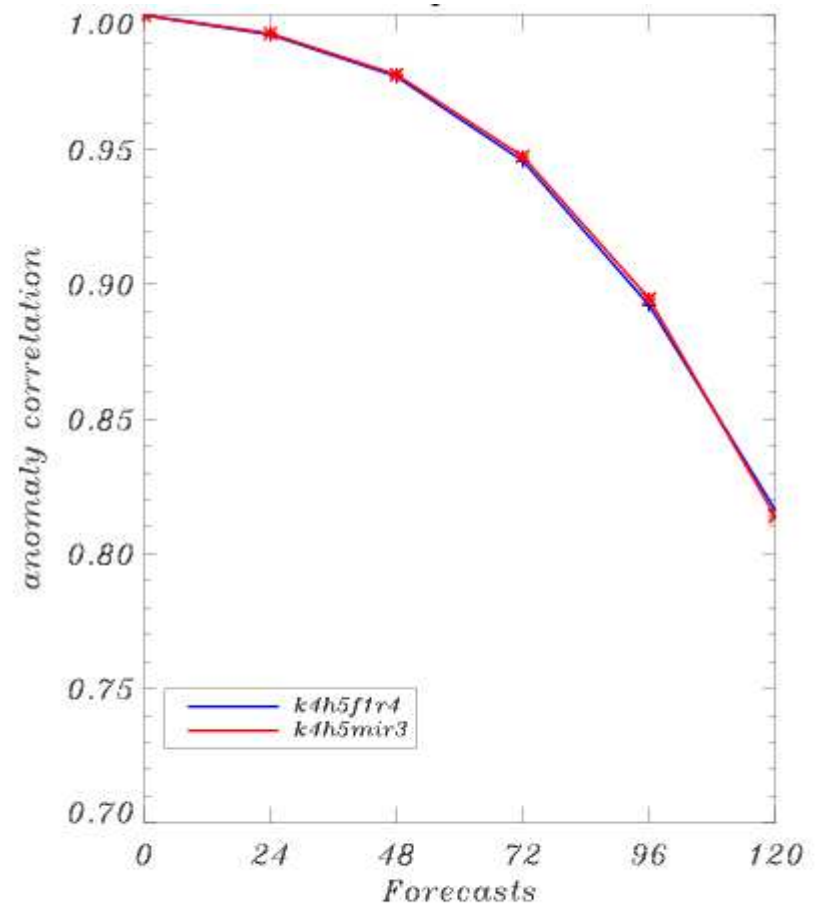
Type : 0-P 48 hr
Region : Hemisphere Sud
Lat-lon : (90S, 180W) (20S, 180E)
Stat.

SSM/I

GZ 500hPa CORA Hémisphère Nord



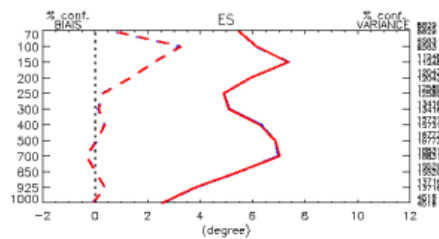
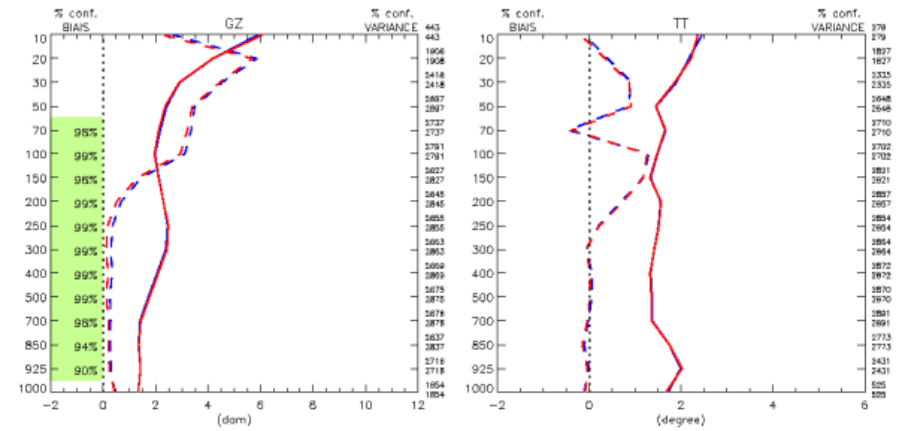
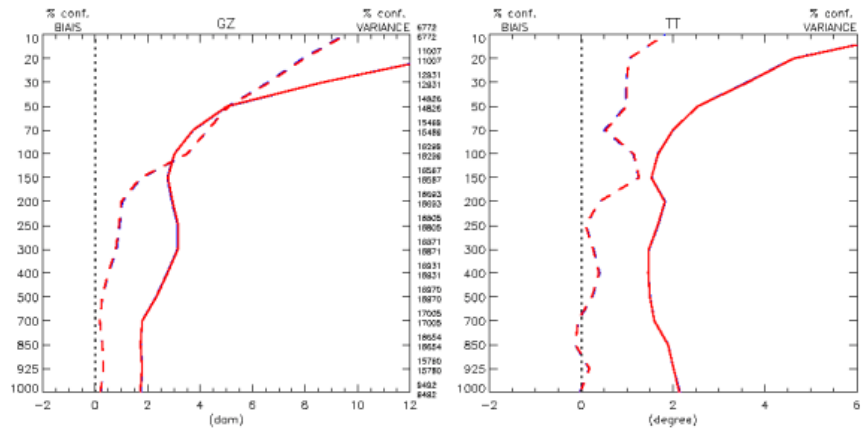
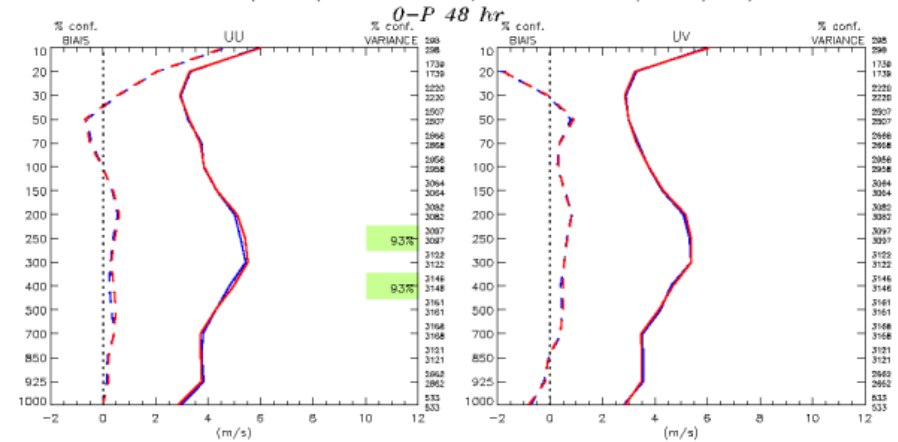
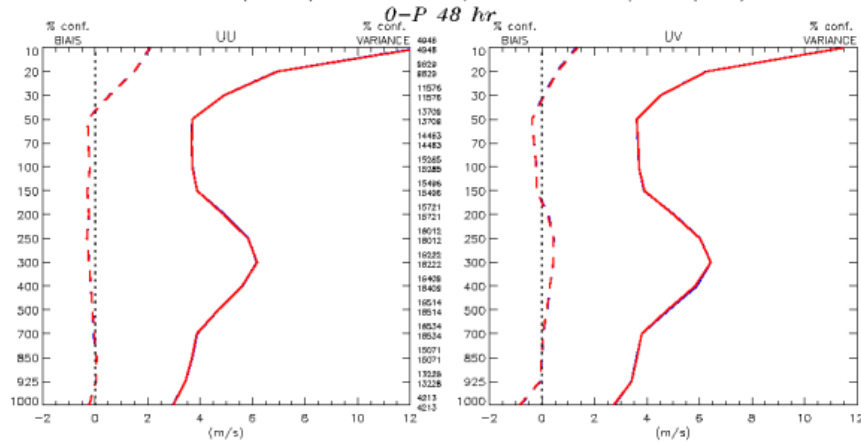
GZ 500hPa CORA Hémisphère Sud



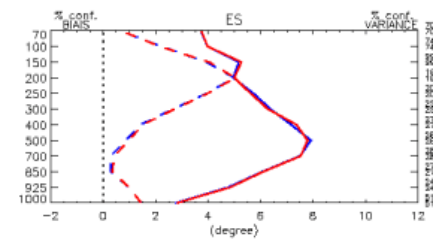
QuikScat

K4H5SC02(4Dvar/MG+Quikscat) vs K4H5F1R4(4Dvar/MG)

K4H5SC02(4Dvar/MG+Quikscat) vs K4H5F1R4(4Dvar/MG)



Hémisphère Nord, 48h



Hémisphère Sud, 48h

Type : 0-P 48 hr
 Region : Hemisphere Nord
 Lat-lon : (20N, 180W) (90N, 180E)
 Stat.

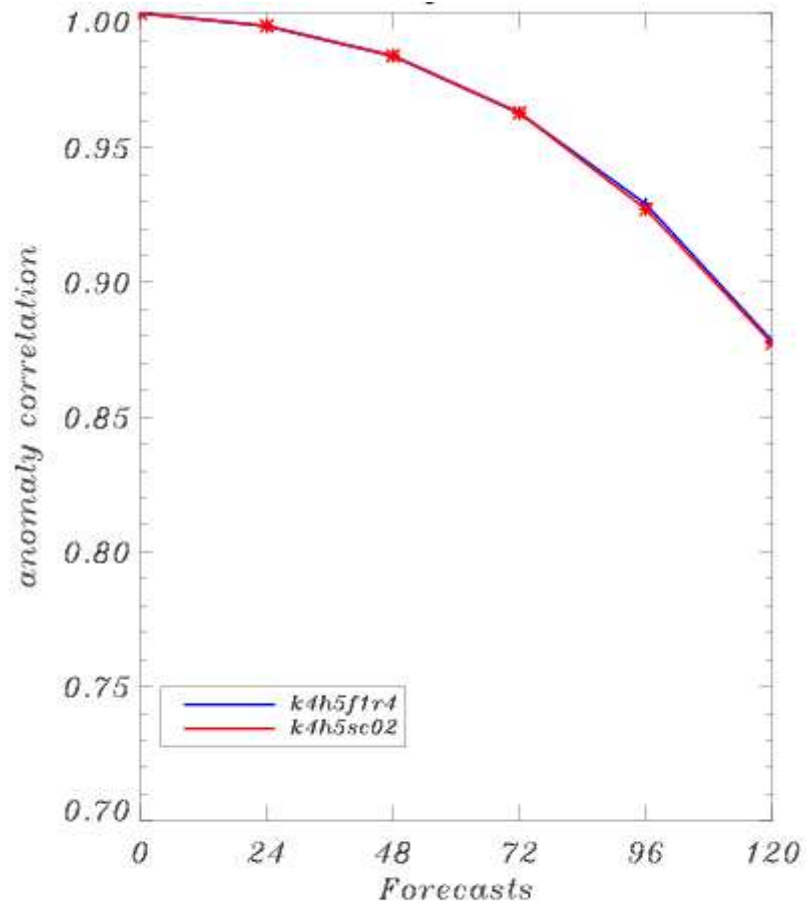
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- ◇ — E-T m_ua041225_050131_120_coloc_ua_k4h5f1r4_ua_k4h5f1r4 (76)
- ◇ - - BIAIS m_ua041225_050131_120_coloc_ua_k4h5f1r4_ua_k4h5f1r4

Type : 0-P 48 hr
 Region : Hemisphere Sud
 Lat-lon : (90S, 180W) (20S, 180E)
 Stat.

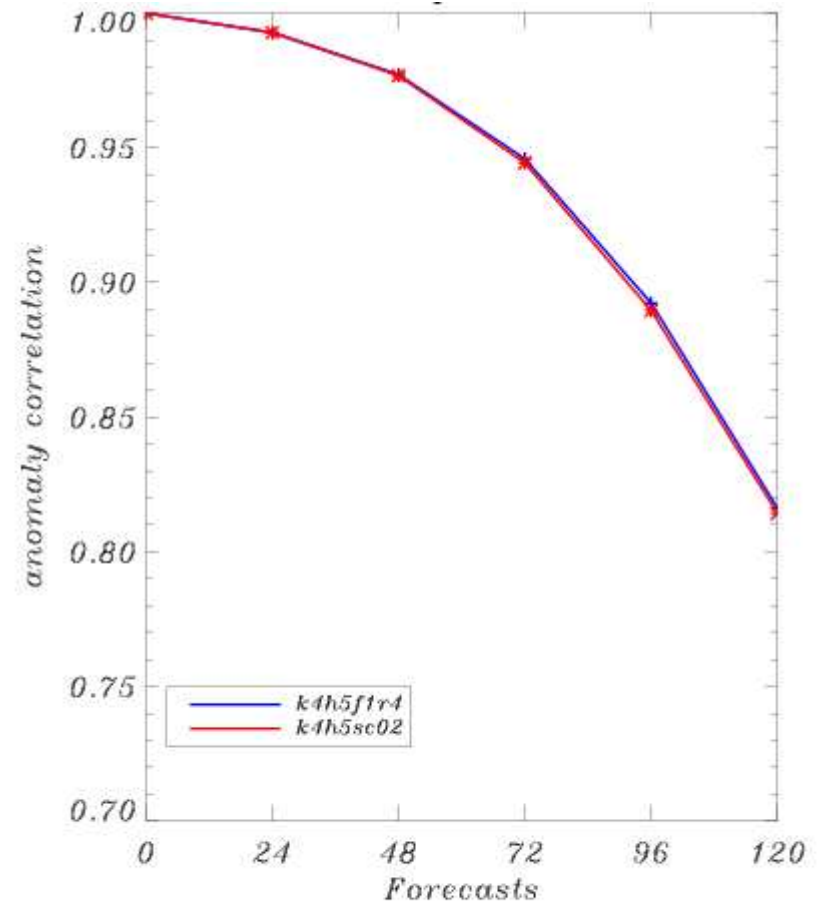
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- ◇ — E-T m_ua041225_050131_120_coloc_ua_k4h5f1r4_ua_k4h5f1r4 (76)
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QuikScat

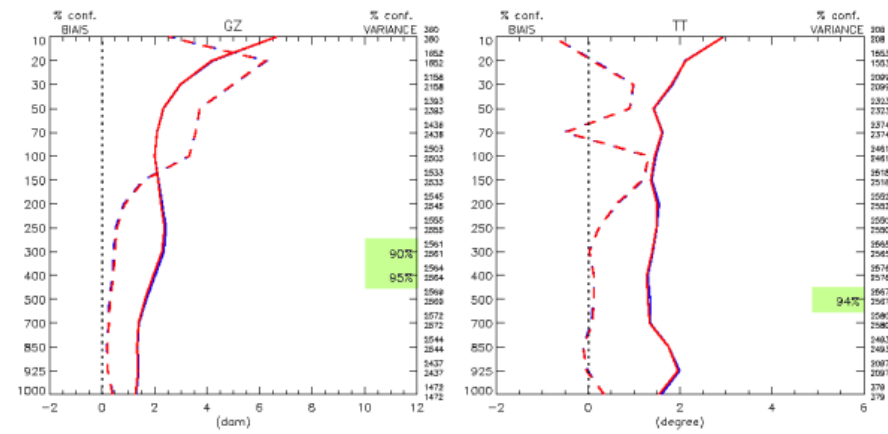
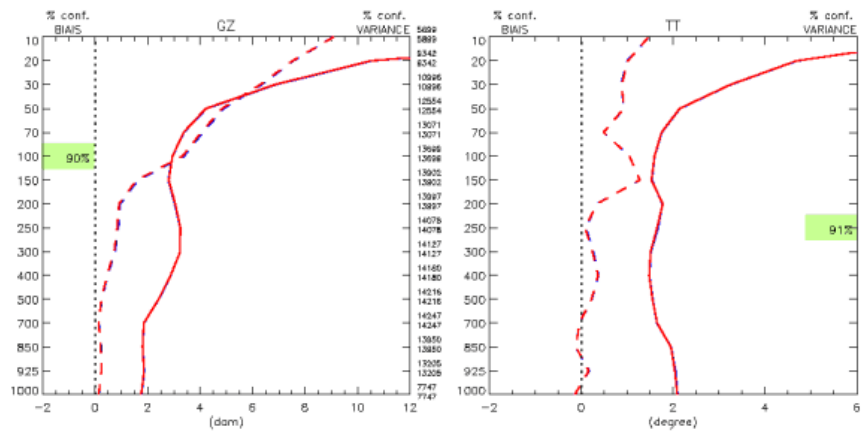
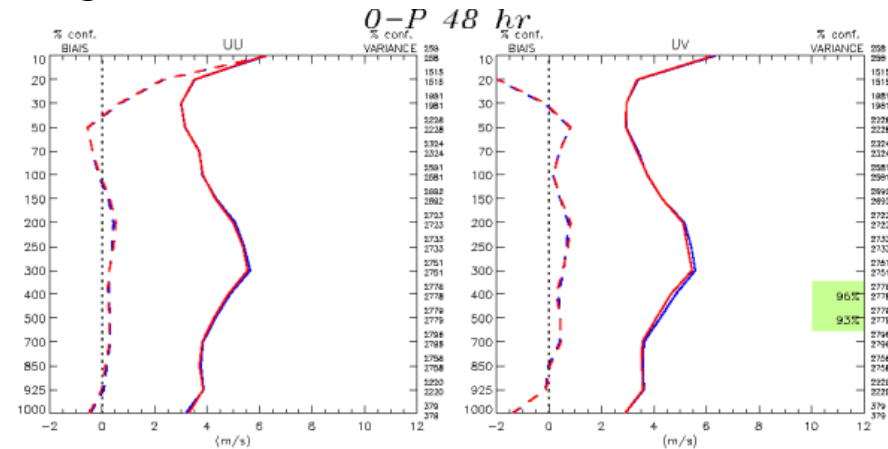
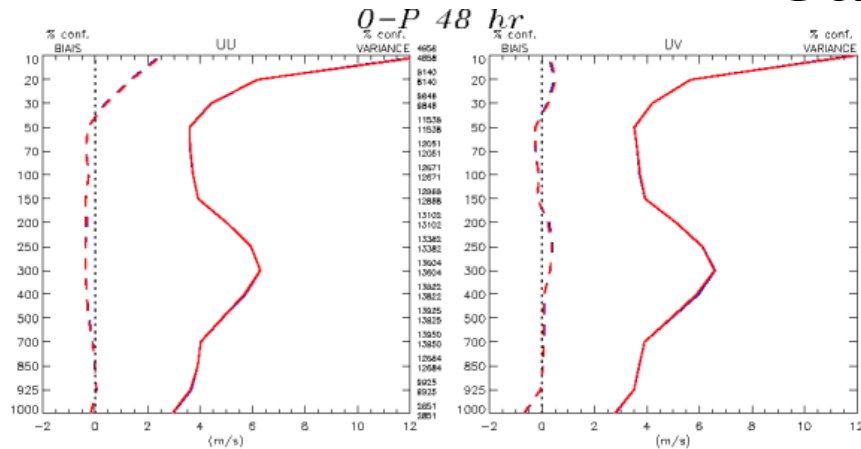
GZ 500hPa CORA Hémisphère Nord



GZ 500hPa CORA Hémisphère Sud



SatWind



Hémisphère Nord, 48h

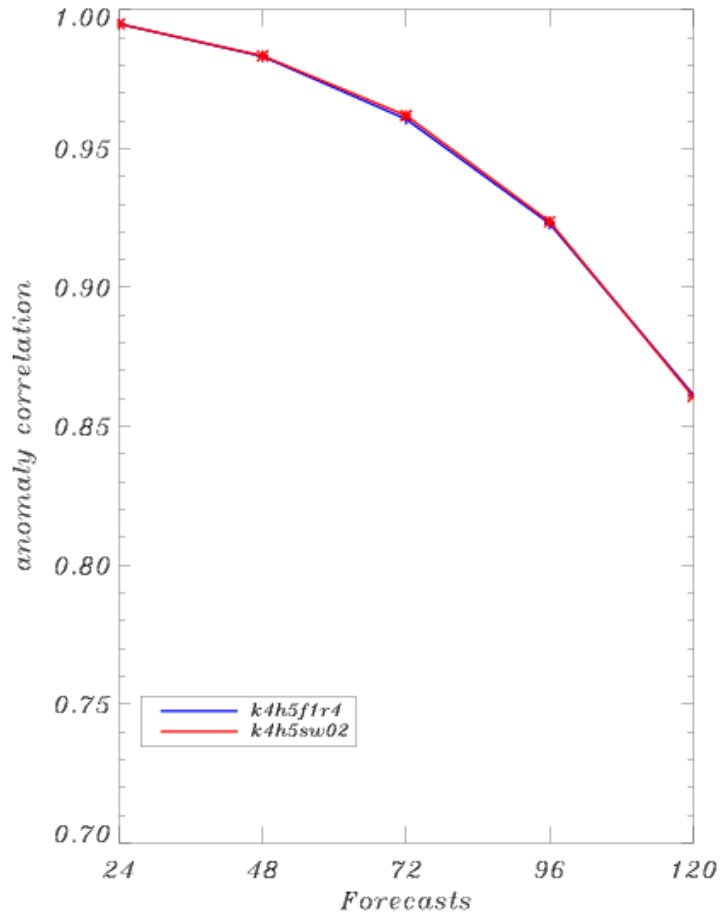
Hémisphère Sud, 48h

| | | | |
|---|-------|---|---------------------------------------|
| ◇ | — | E-T m_ua04121500_05011512_120_k4h5f1r4 (64) | Type : 0-P 48 hr |
| ◇ | - - - | BIAS m_ua04121500_05011512_120_k4h5f1r4 | Region : Hemisphere Nord |
| ◇ | — | E-T m_ua04121500_05011512_120_k4h5sw02 (64) | Lat-lon : (20N, 180W) (90N, 180E) |
| ◇ | - - - | BIAS m_ua04121500_05011512_120_k4h5sw02 | Stat. |

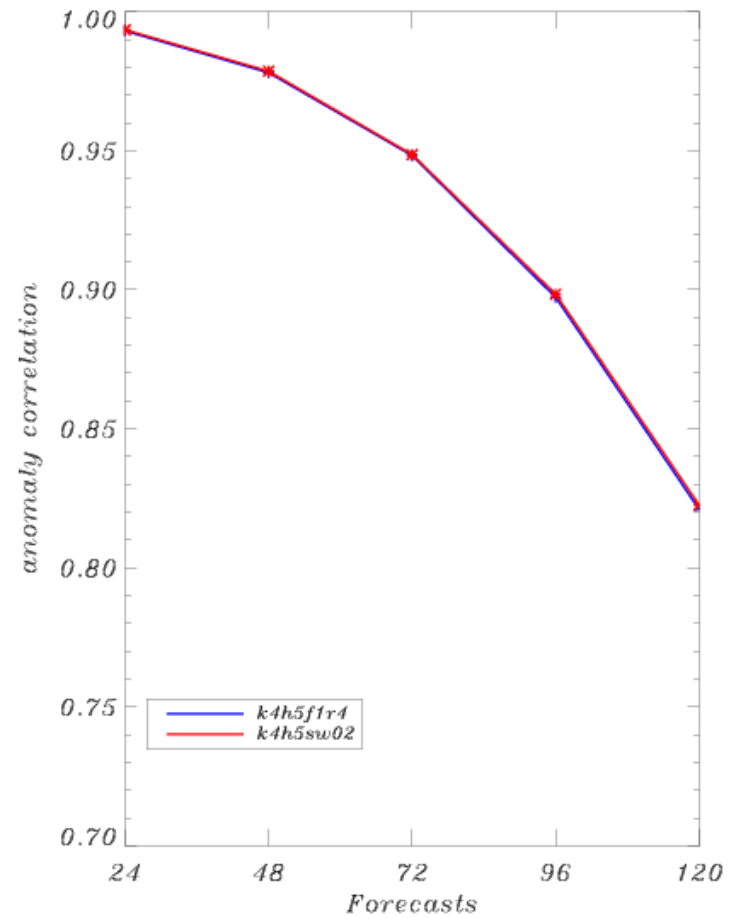
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|---|-------|---|---------------------------------------|
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| ◇ | - - - | BIAS m_ua04121500_05011512_120_k4h5f1r4 | Region : Hemisphere Sud |
| ◇ | — | E-T m_ua04121500_05011512_120_k4h5sw02 (64) | Lat-lon : (90S, 180W) (20S, 180E) |
| ◇ | - - - | BIAS m_ua04121500_05011512_120_k4h5sw02 | Stat. |

SatWind

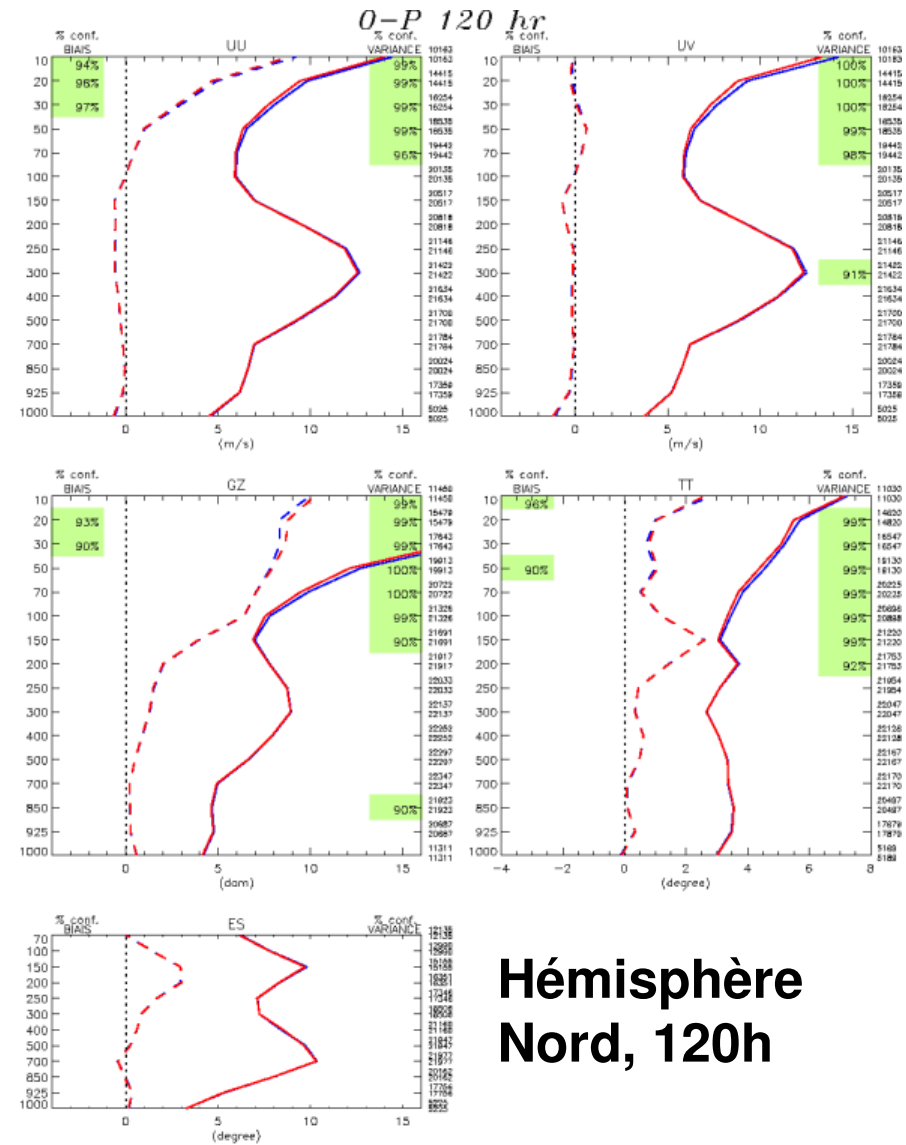
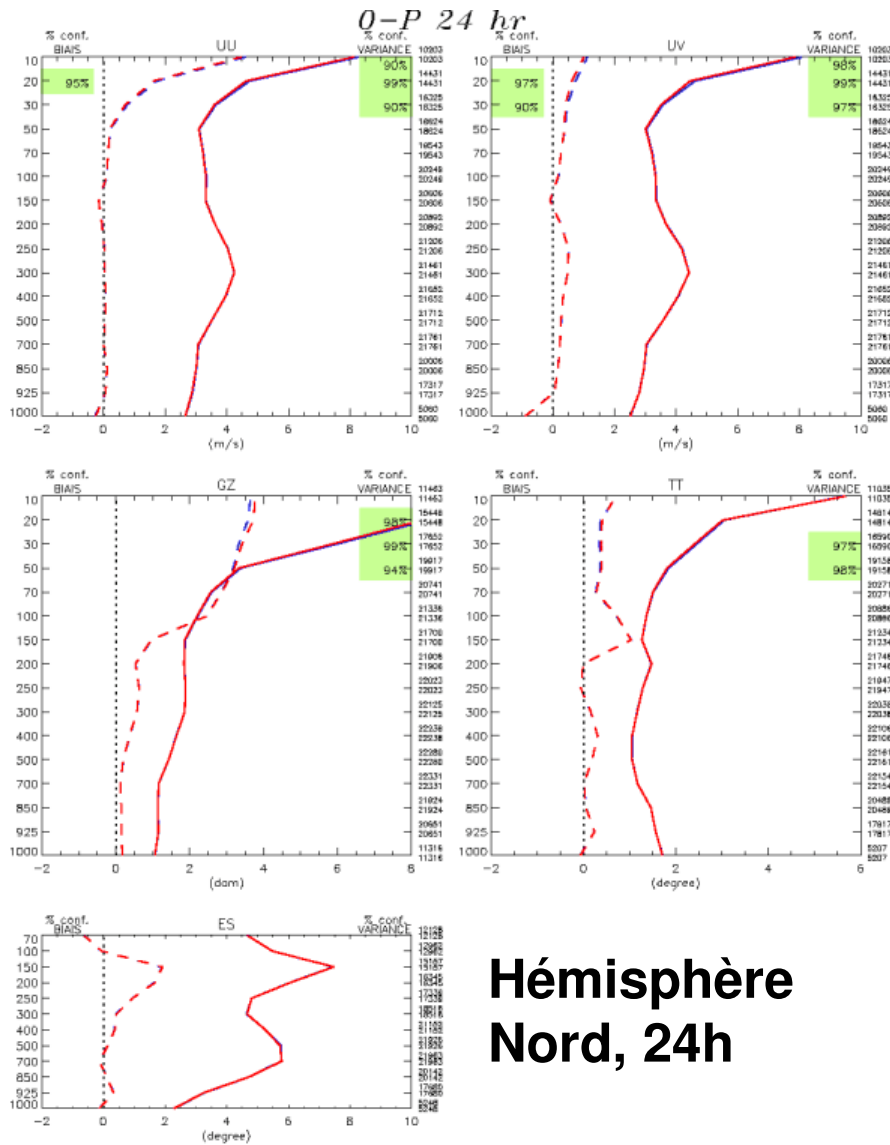
GZ 500hPa CORA Hémisphère Nord



GZ 500hPa CORA Hémisphère Sud



Diffusion des Vents Réels



Type : 0-P 24 hr
 Region : Hemisphere Nord
 Lat-lon : (20N, 150W) (90N, 180E)
 Stat.

- E-T m_u061210_070128_144_coloc_uu_g2op1206.uu_k4rd6erw (99)
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- E-T m_u061210_070128_144_coloc_uv_g2op1206 (99)
- - - BIAS m_u061210_070128_144_coloc_uv_g2op1206

Type : 0-P 120 hr
 Region : Hemisphere Nord
 Lat-lon : (20N, 150W) (90N, 180E)
 Stat.

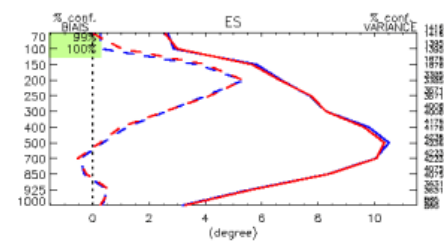
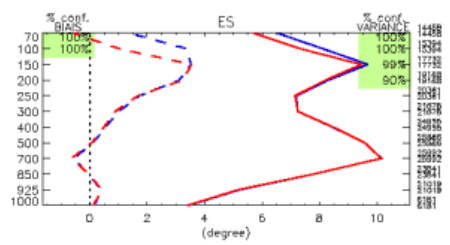
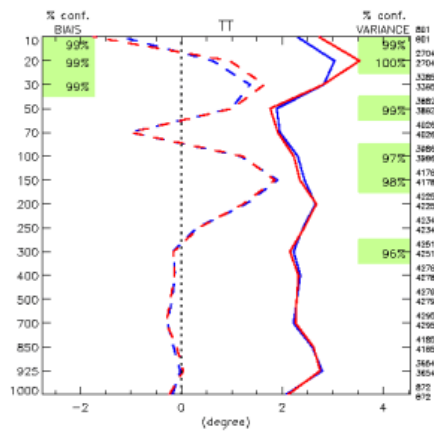
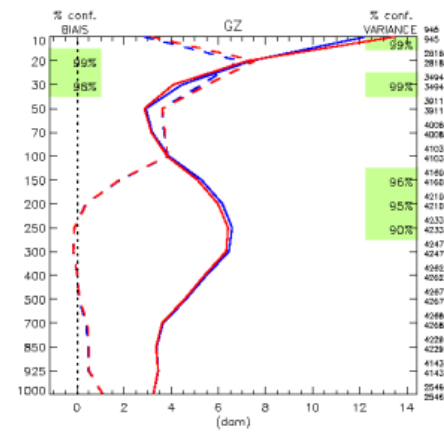
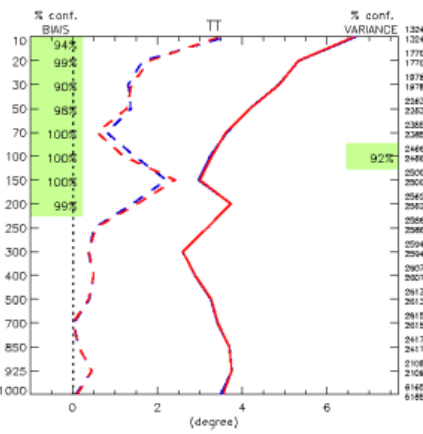
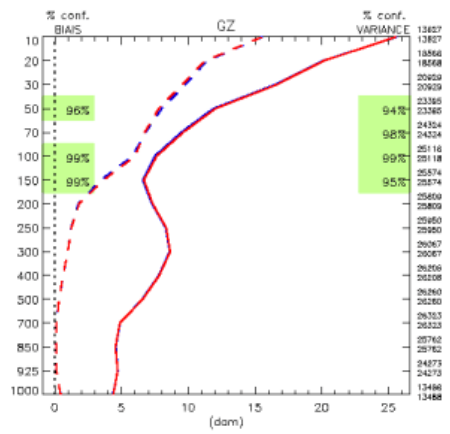
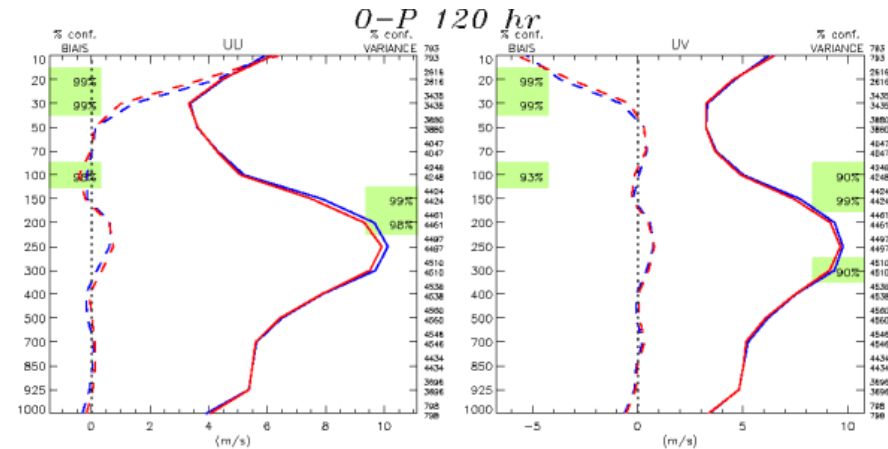
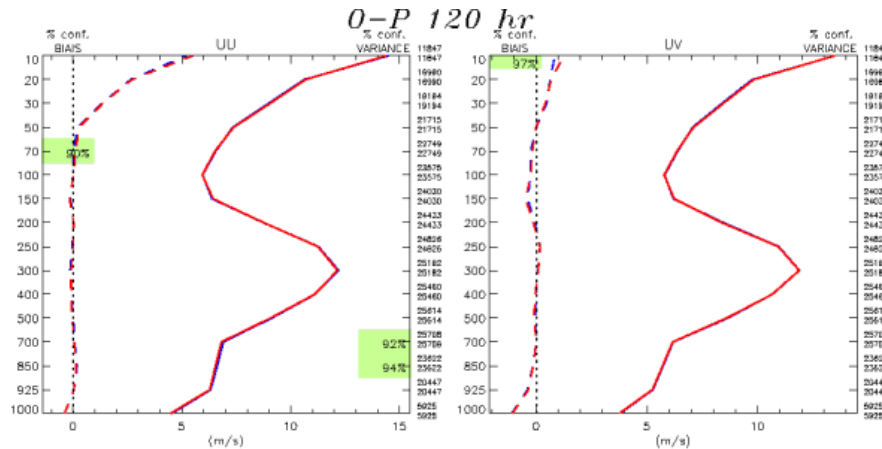
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Les Cycles Finaux

- Stratégie:
 - 2 mois l'hiver, 2 mois l'été
 - utilise une période plus récente pour l'hiver (2006/2007), avec l'opérationnel (analyse G2) comme contrôle
 - 2 cycles finaux pour l'hiver (complété):
 - 1) RTTOV8/correction de biais/etc. + SSM/I + QuikScat + SatWind + diffusion des vents réel
 - 2) La même choses, plus AIRS
 - refaire le cycle de contrôle, l'été 2006 (à cause des problèmes avec le passe parallèle)
 - 2 cycles finaux pour l'été: avec et sans AIRS (encore ~1 semaine à faire)

Impact of adding AIRS data to
experiment with all other additions
(SSM/I, QuikScat, SatWind, etc.)

Impact of AIRS in Winter Final Cycle



Hémisphère Nord, 120h

Hémisphère Sud, 120h

Type : 0-P 120 hr

Region: Hémisphère Nord

Lat:lon : (20N, 180E)

Stat: (116)

- ◇ E-T m_ua07010100_07022712_240_coloc_ua_k4h7cb01_ua_k4h7cb18_newprog.ua_k4h7cb01
- ◇ BIAS m_ua07010100_07022712_240_coloc_ua_k4h7cb01_ua_k4h7cb18_newprog.ua_k4h7cb01
- ◇ E-T m_ua07010100_07022712_240_coloc_ua_k4h7cb18_newprog.ua_k4h7cb01
- ◇ BIAS m_ua07010100_07022712_240_coloc_ua_k4h7cb18_newprog.ua_k4h7cb01

Type : 0-P 120 hr

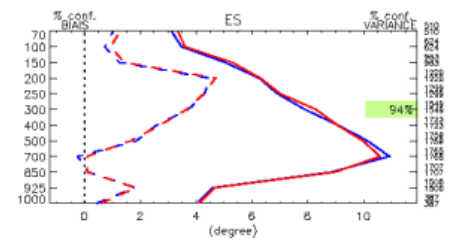
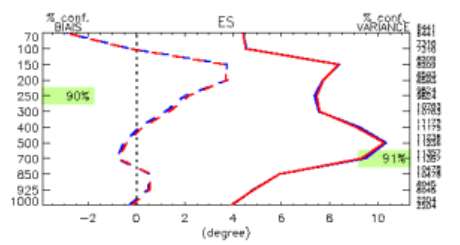
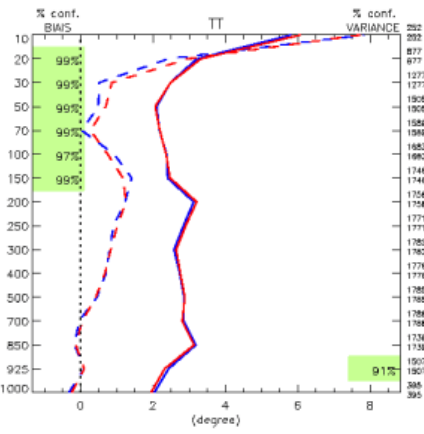
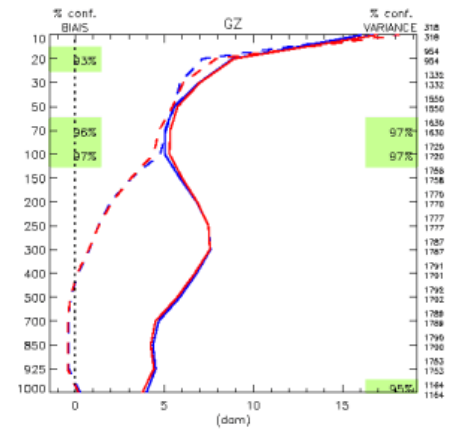
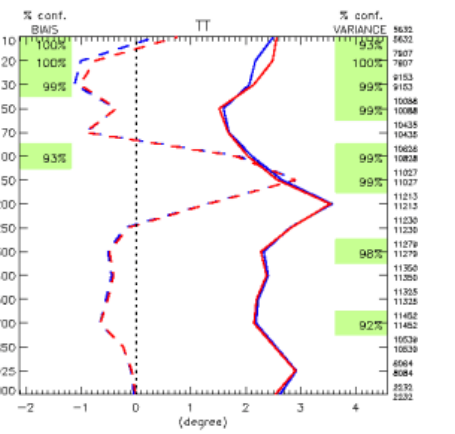
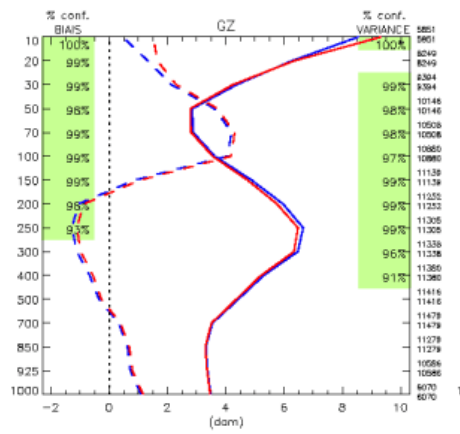
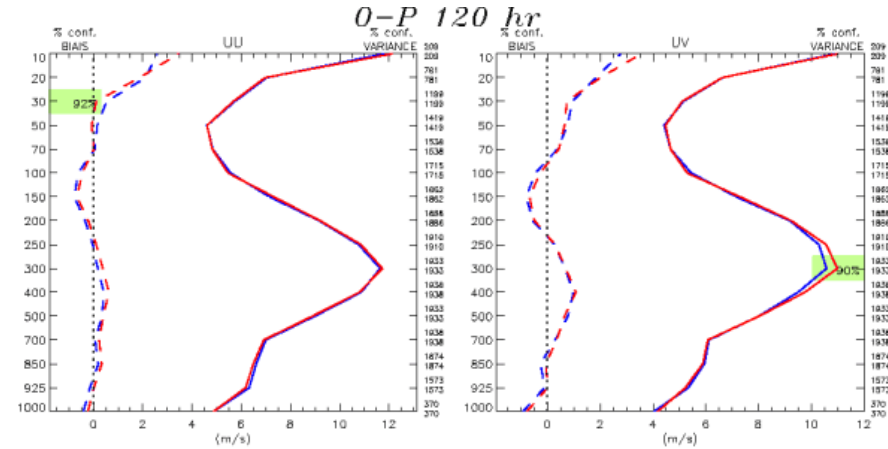
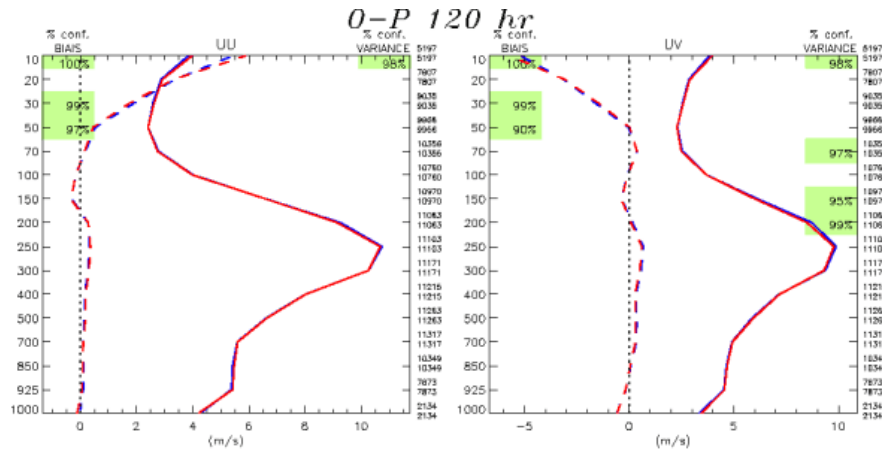
Region: Hémisphère Sud

Lat:lon : (20S, 180E)

Stat: (116)

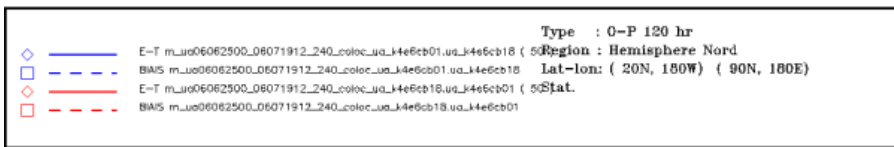
- ◇ E-T m_ua07010100_07022712_240_coloc_ua_k4h7cb01_ua_k4h7cb18_newprog.ua_k4h7cb01
- ◇ BIAS m_ua07010100_07022712_240_coloc_ua_k4h7cb01_ua_k4h7cb18_newprog.ua_k4h7cb01
- ◇ E-T m_ua07010100_07022712_240_coloc_ua_k4h7cb18_newprog.ua_k4h7cb01
- ◇ BIAS m_ua07010100_07022712_240_coloc_ua_k4h7cb18_newprog.ua_k4h7cb01

Impact of AIRS in Summer Final Cycle (incomplete)

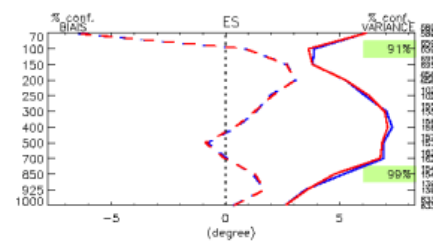
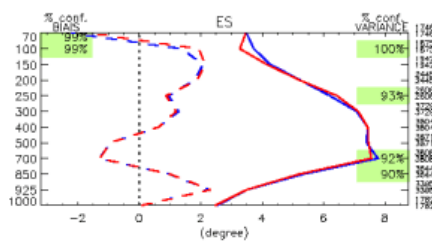
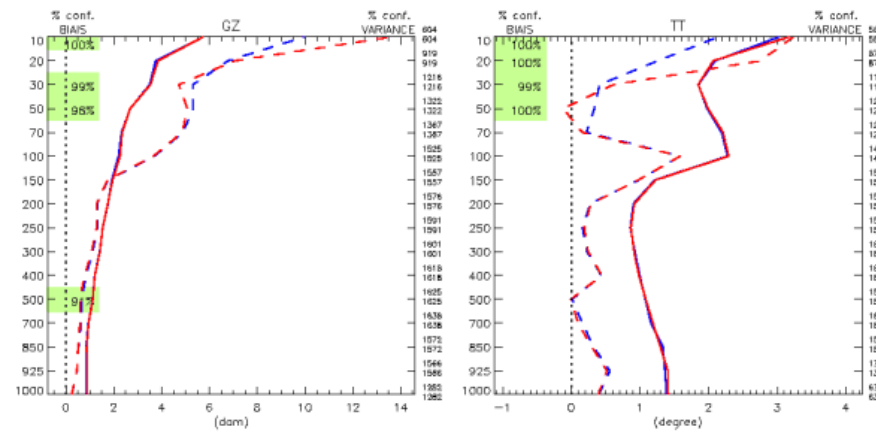
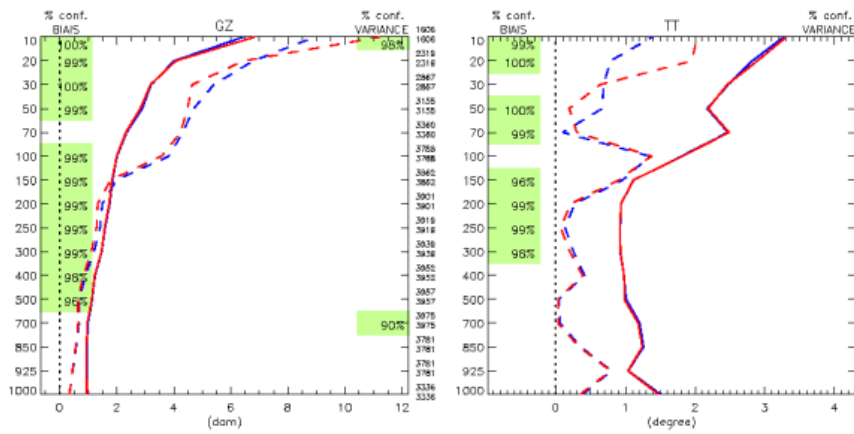
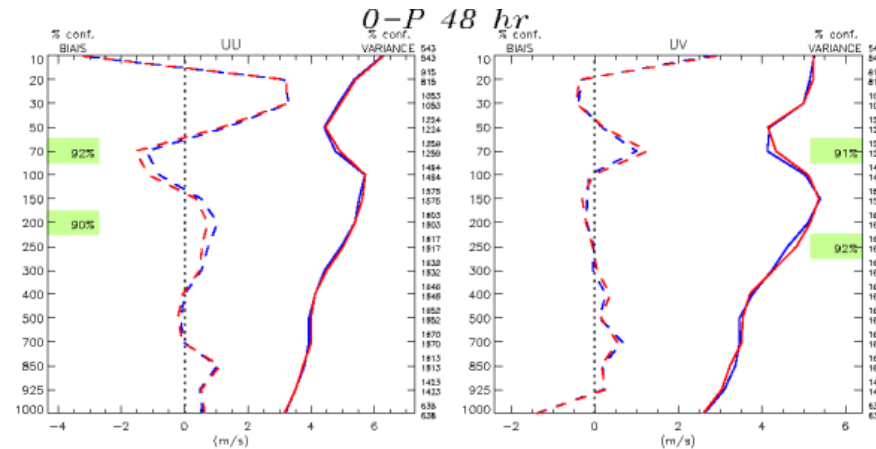
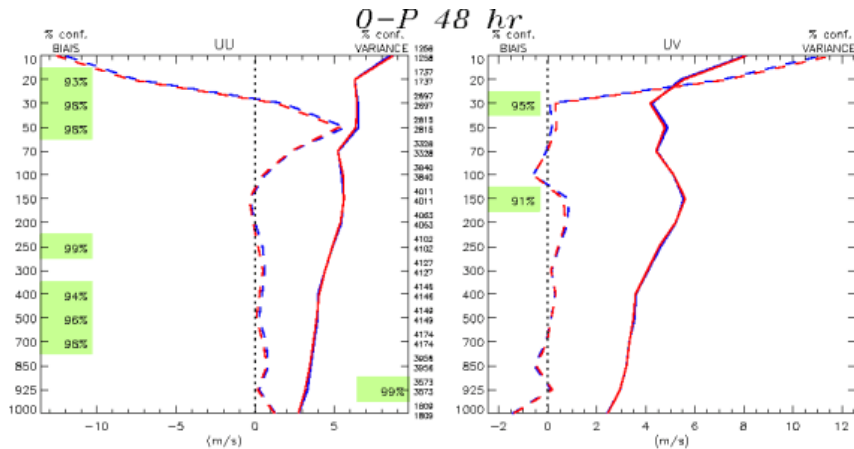


Hémisphère Nord, 120h

Hémisphère Sud, 120h



Impact of AIRS in Final Cycles



**Tropics, Winter
48h**

**Tropics, Summer
48h**

Type : 0-P 48 hr
 Region : Tropiques
 Lat-lon : (20S, 180W)
 Stat : 116

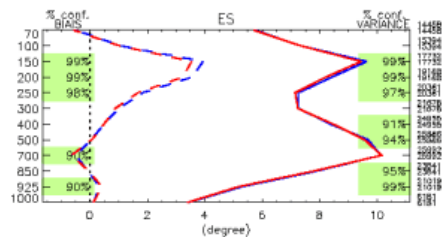
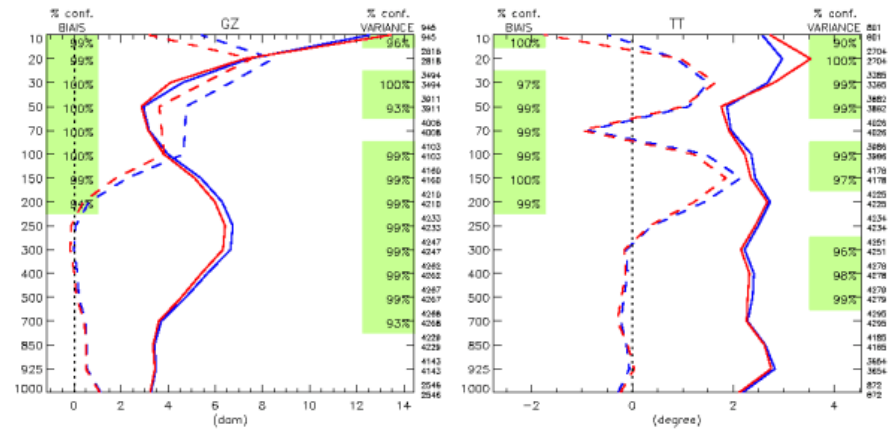
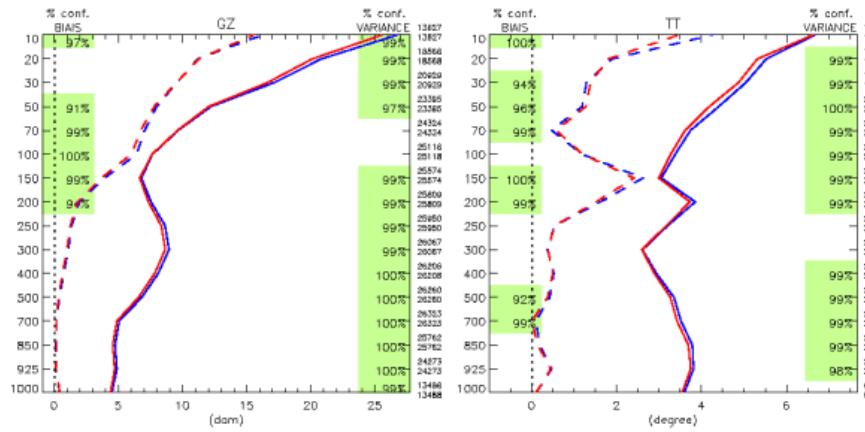
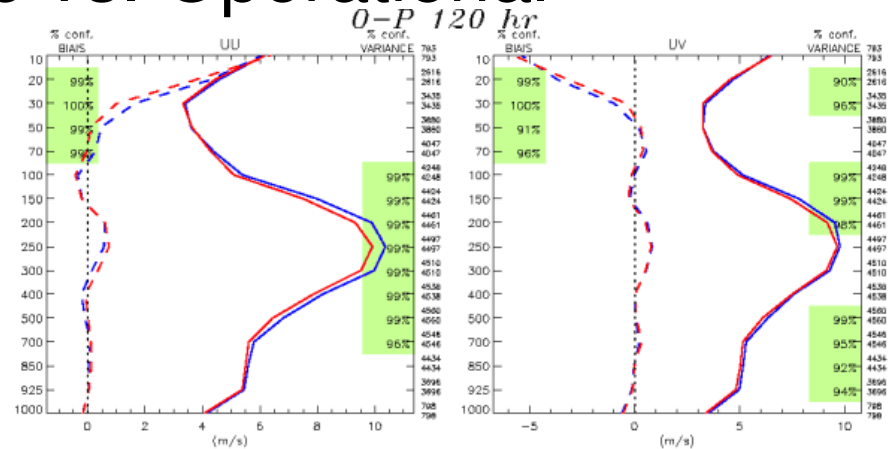
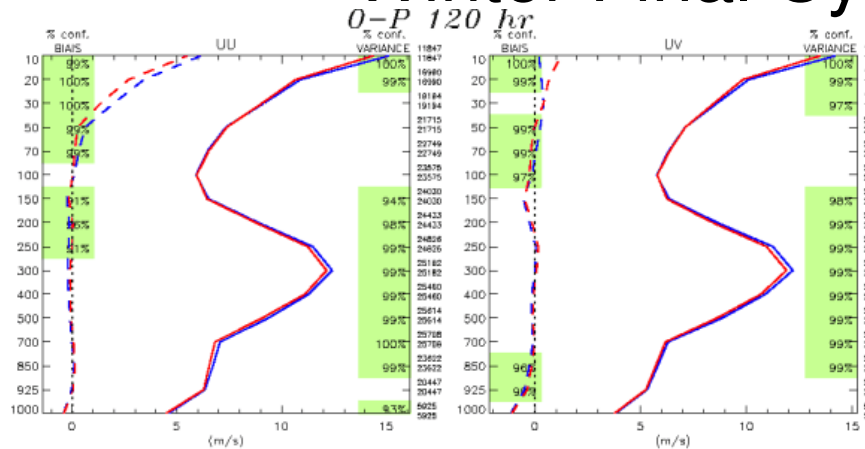
- ◇ E-T m_us07010100_07022712_240_coloc_us_k4h7cb01.us_k4h7cb18_newprog.us_k4h7cb01
- ◇ BIAS m_us07010100_07022712_240_coloc_us_k4h7cb01.us_k4h7cb18_newprog.us_k4h7cb01
- ◇ E-T m_us07010100_07022712_240_coloc_us_k4h7cb18.us_k4h7cb18
- ◇ BIAS m_us07010100_07022712_240_coloc_us_k4h7cb18.us_k4h7cb18

Type : 0-P 48 hr
 Region : Tropiques
 Lat-lon : (20S, 180W)
 Stat : 5

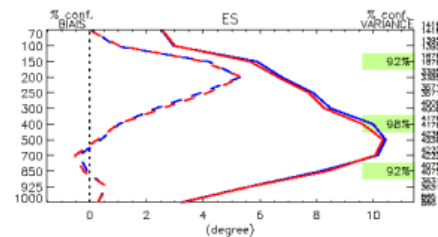
- ◇ E-T m_us06062500_06071912_240_coloc_us_k4e6cb01.us_k4e6cb18
- ◇ BIAS m_us06062500_06071912_240_coloc_us_k4e6cb01.us_k4e6cb18
- ◇ E-T m_us06062500_06071912_240_coloc_us_k4e6cb18.us_k4e6cb01
- ◇ BIAS m_us06062500_06071912_240_coloc_us_k4e6cb18.us_k4e6cb01

Impact of ALL changes (AIRS, SSM/I,
QuikScat, SatWind, etc.) relative to
Operational configuration

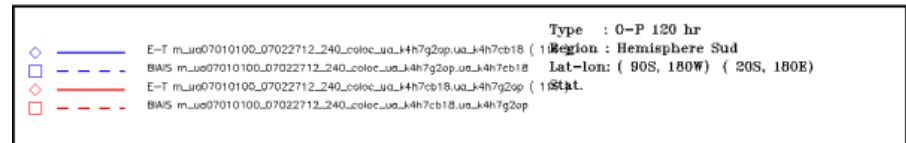
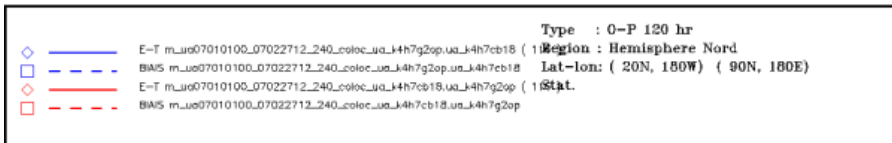
Winter Final Cycle vs. Operational



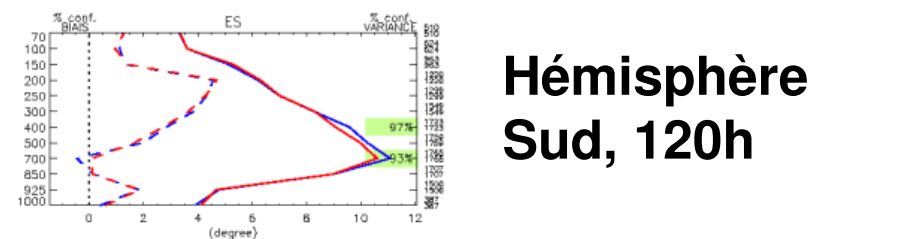
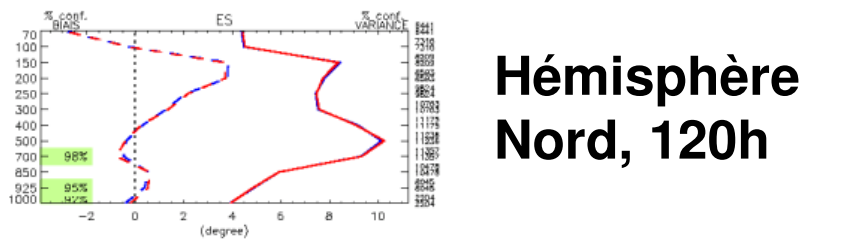
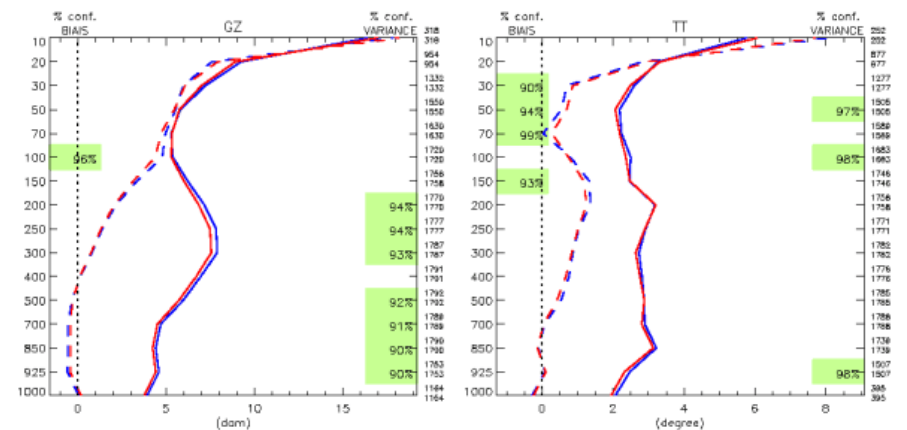
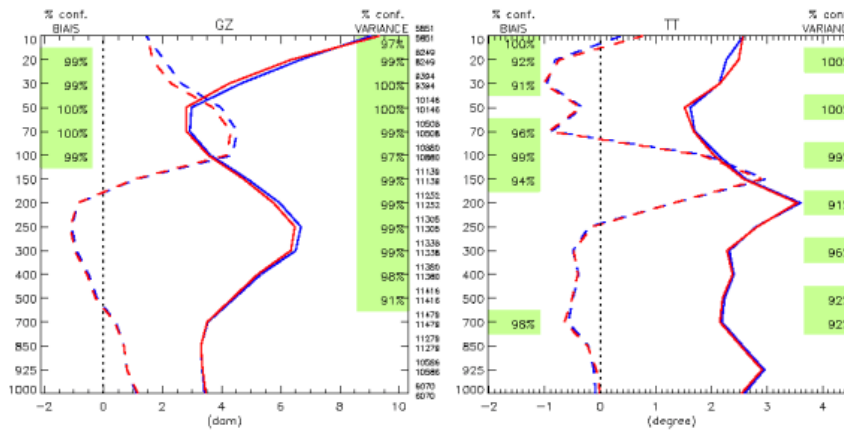
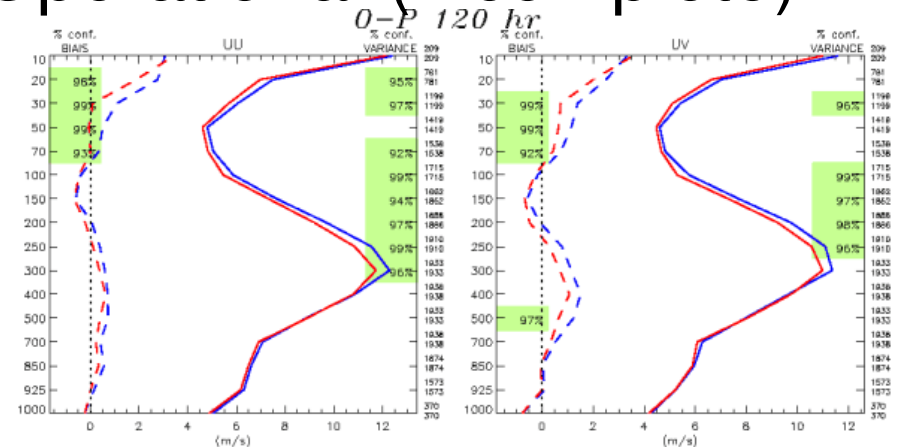
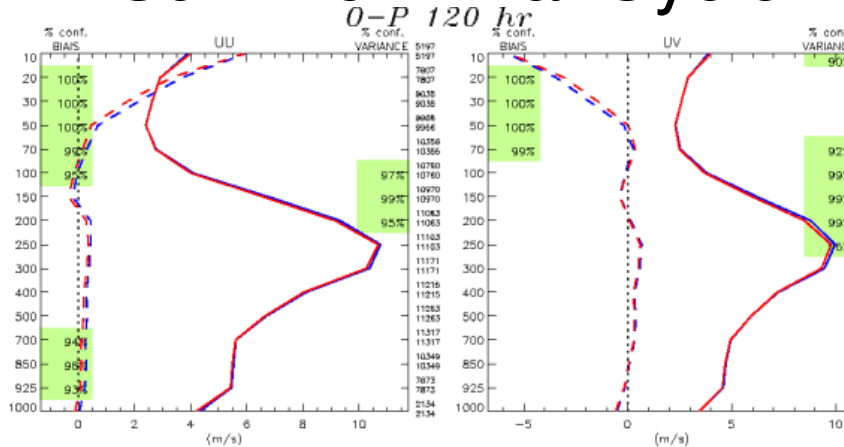
Hémisphère Nord, 120h



Hémisphère Sud, 120h

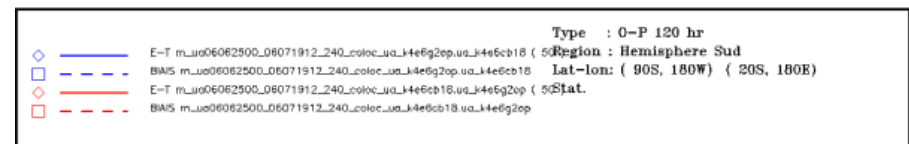


Summer Final Cycle vs. Operational (incomplete)

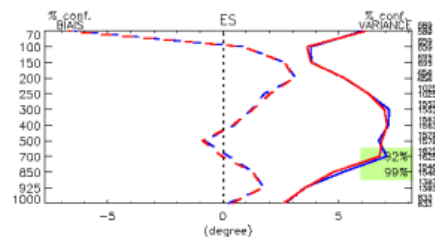
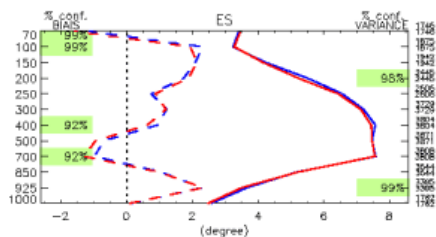
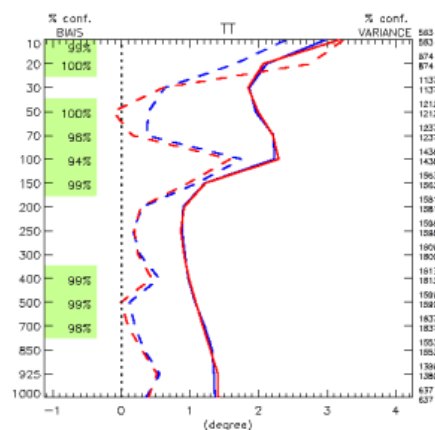
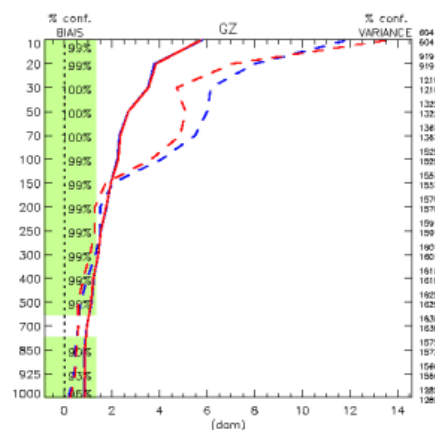
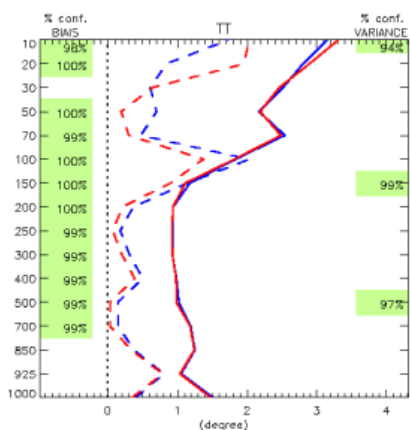
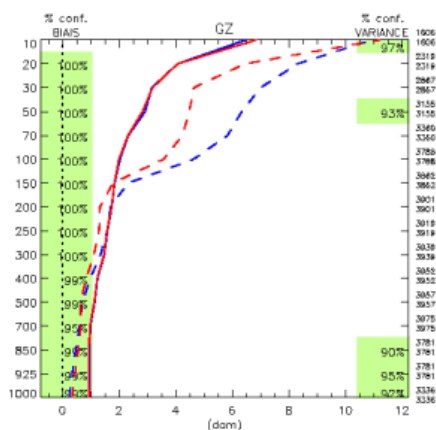
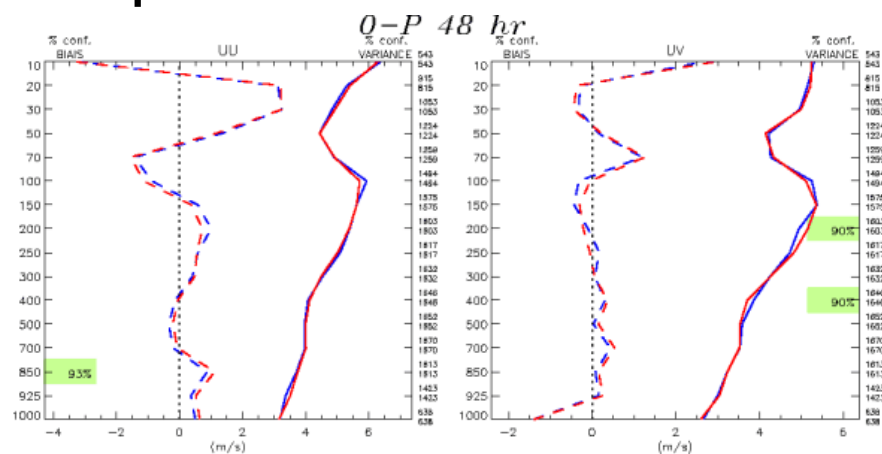
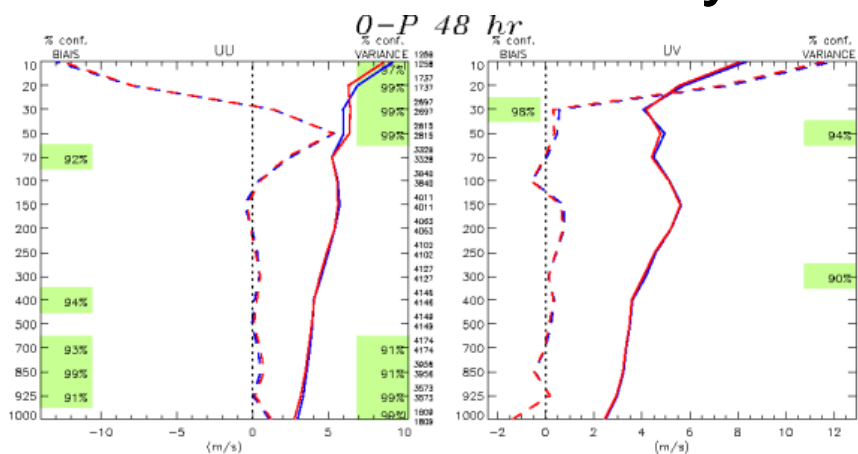


Hémisphère Nord, 120h

Hémisphère Sud, 120h



Final Cycles vs. Operational



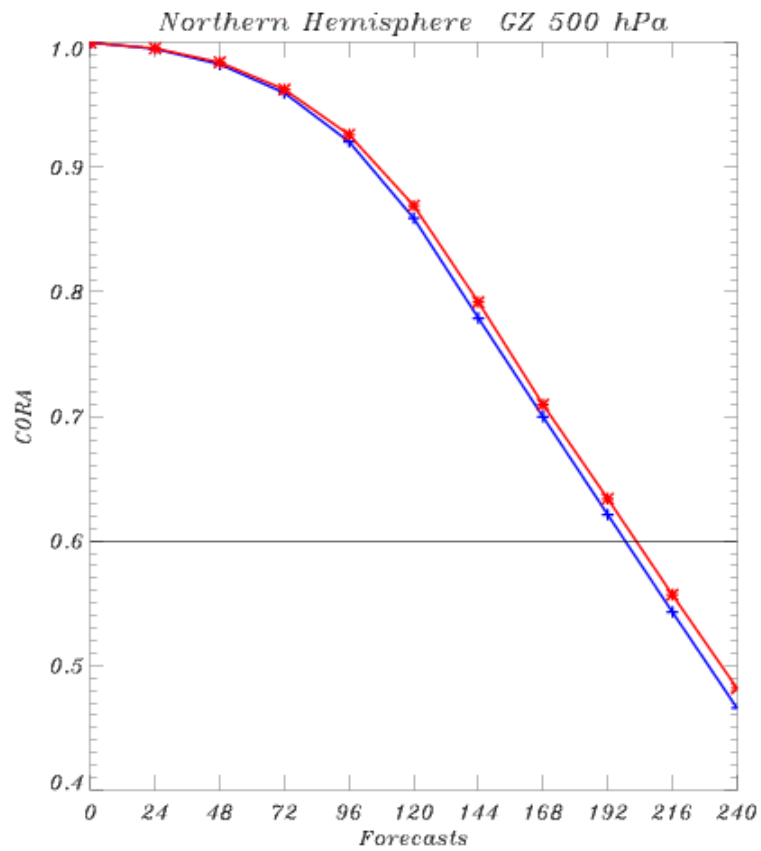
**Tropics, Winter
48h**

**Tropics, Summer
48h**

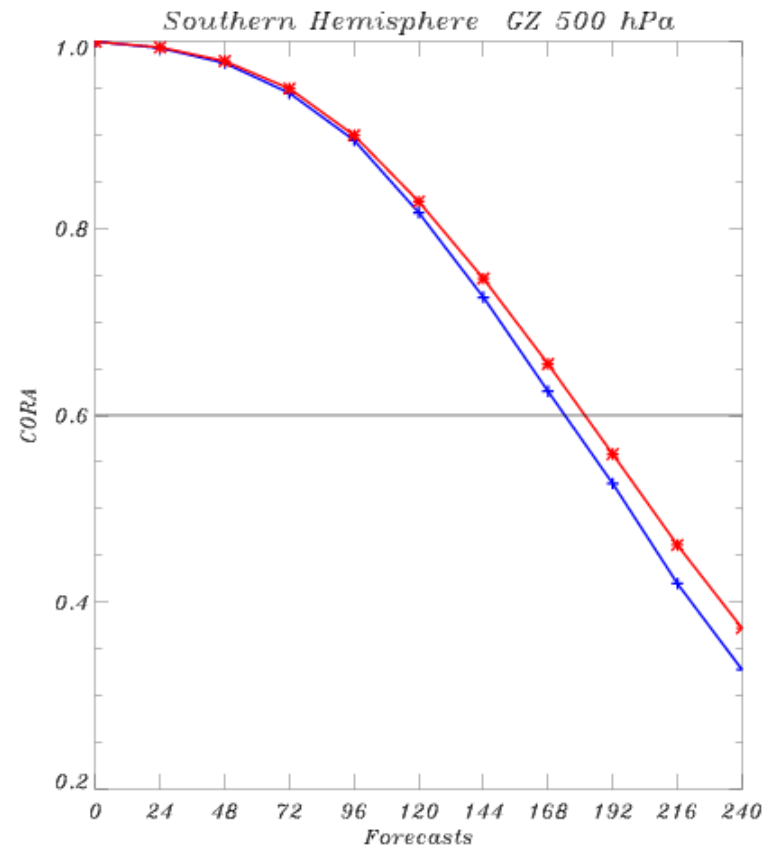


Winter Final Cycle vs. Operational

GZ 500hPa CORA Hémisphère Nord

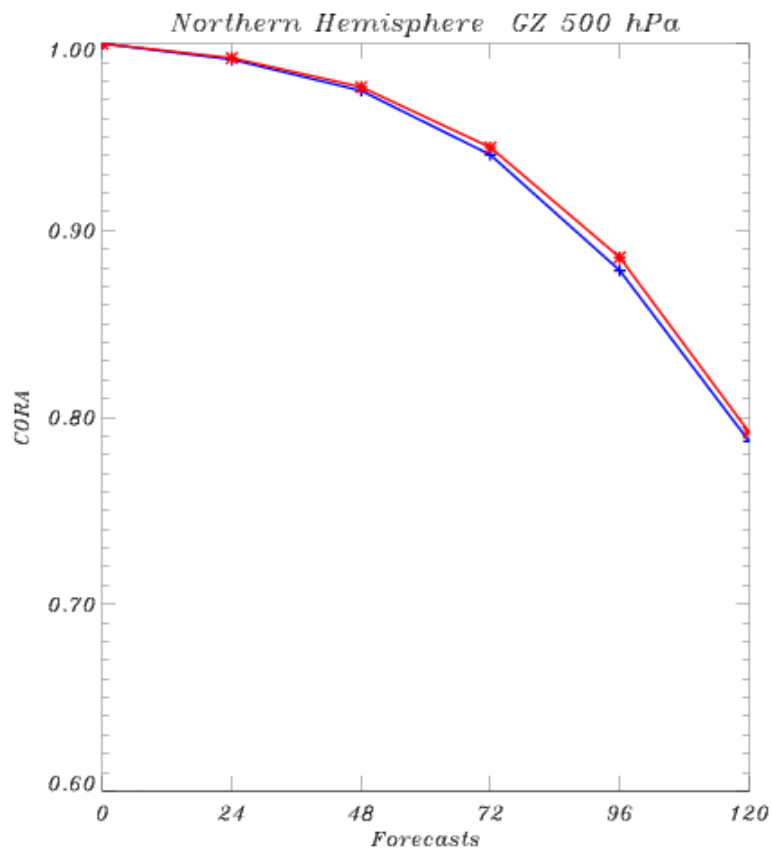


GZ 500hPa CORA Hémisphère Sud

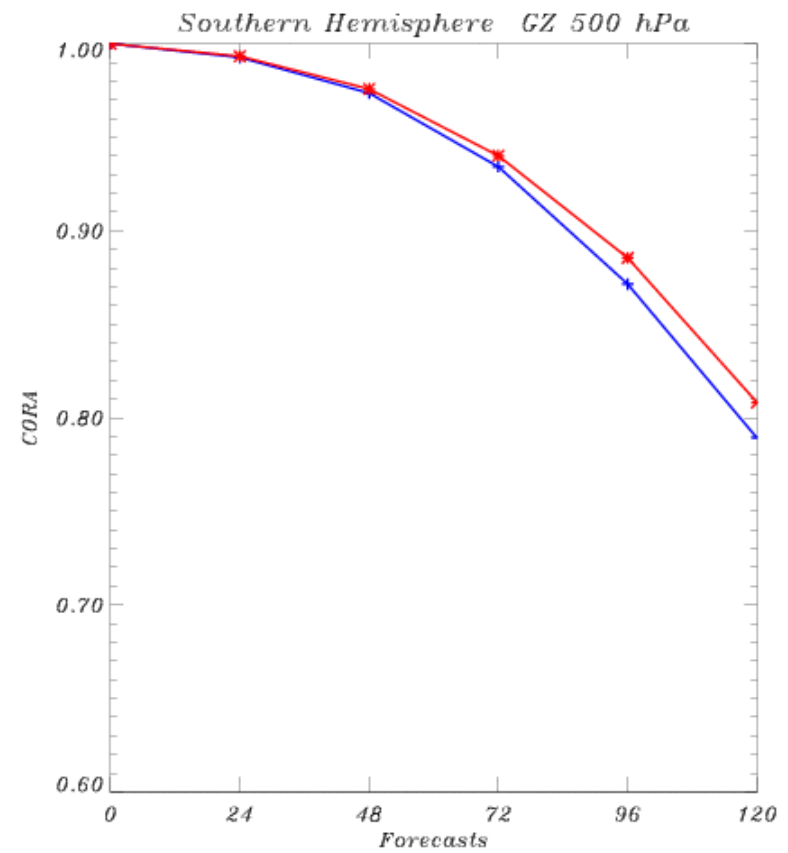


Summer **Final Cycle** vs. **Operational** (incomplete)

GZ 500hPa CORA Hémisphère Nord

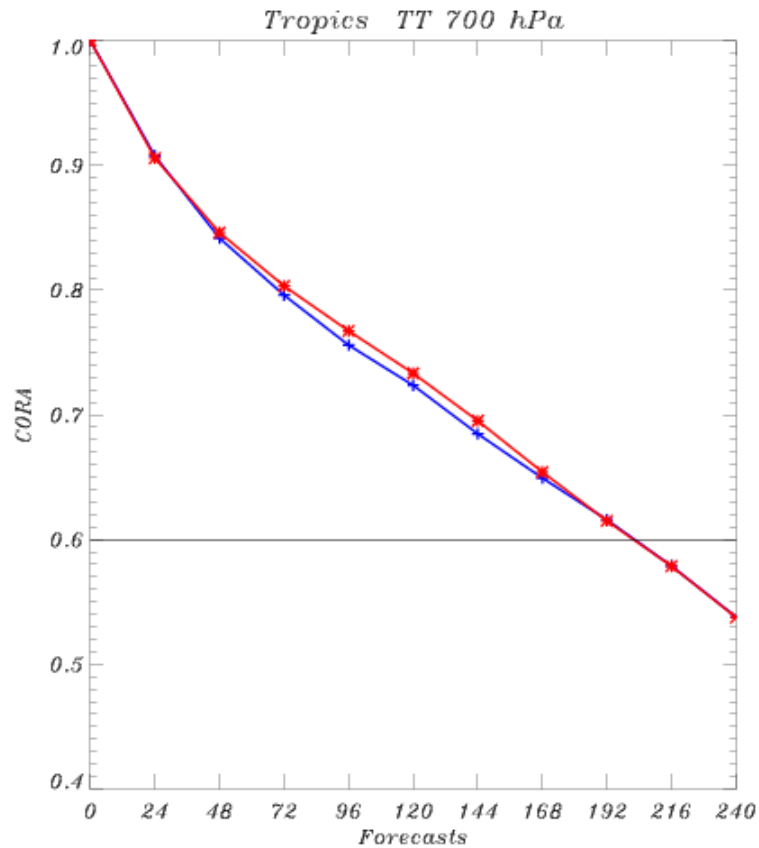


GZ 500hPa CORA Hémisphère Sud

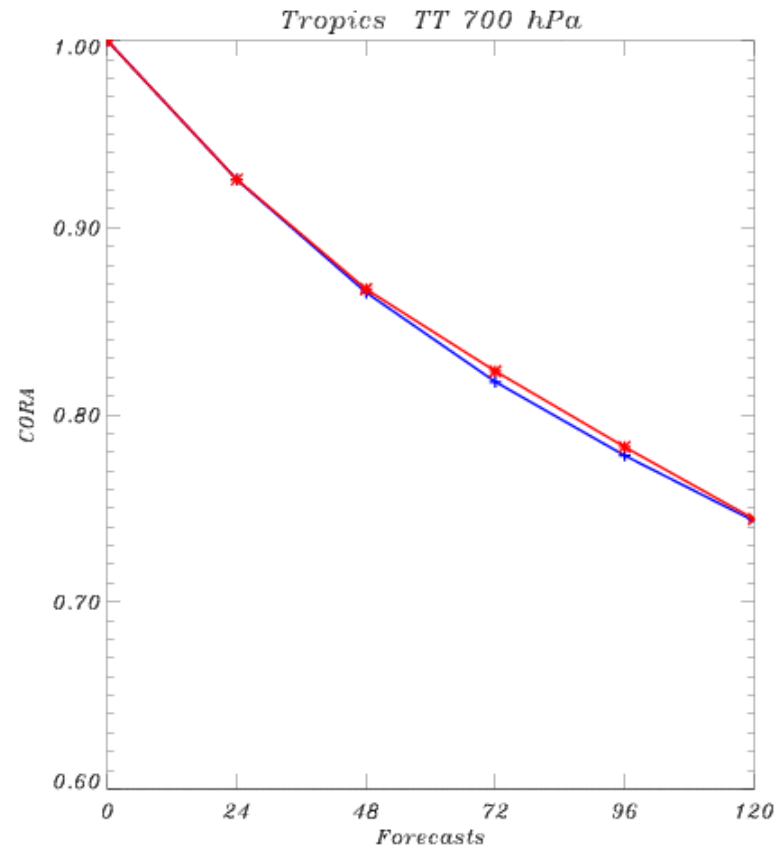


Final Cycle vs. Operational

TT 700hPa CORA Winter, Tropics



TT 700hPa CORA Summer, Tropics



Selected Winter Impacts of:

All changes (AIRS, SSM/I, QuikScat, etc.)

and

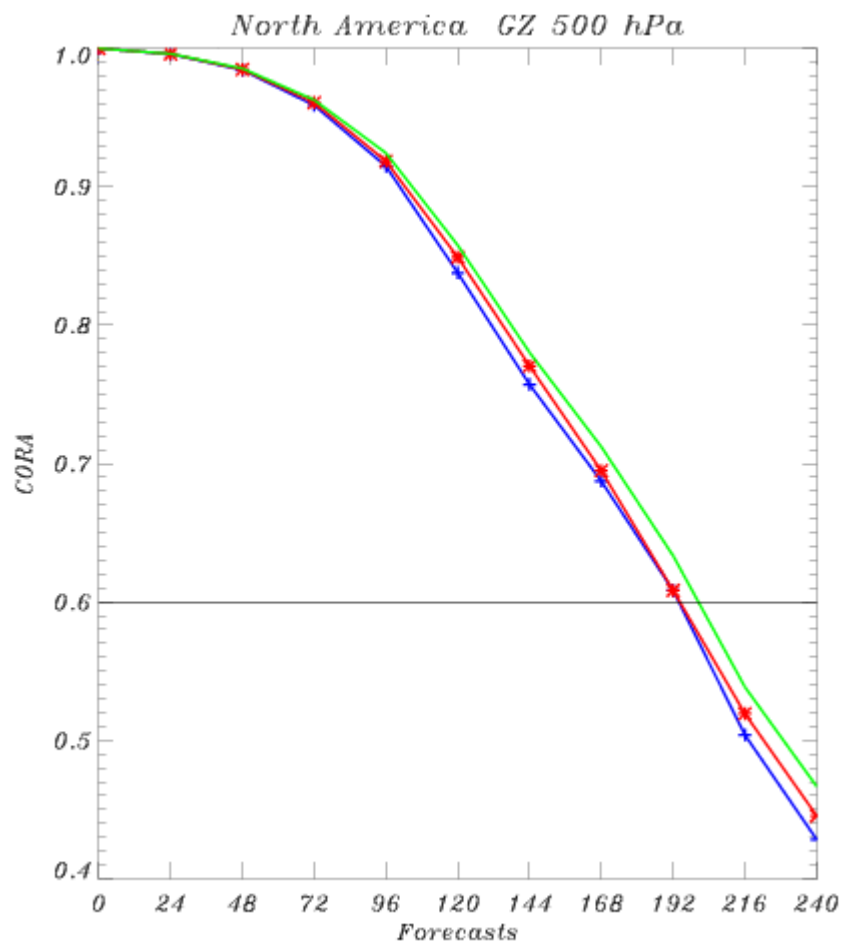
All changes MINUS AIRS

relative to Operational configuration

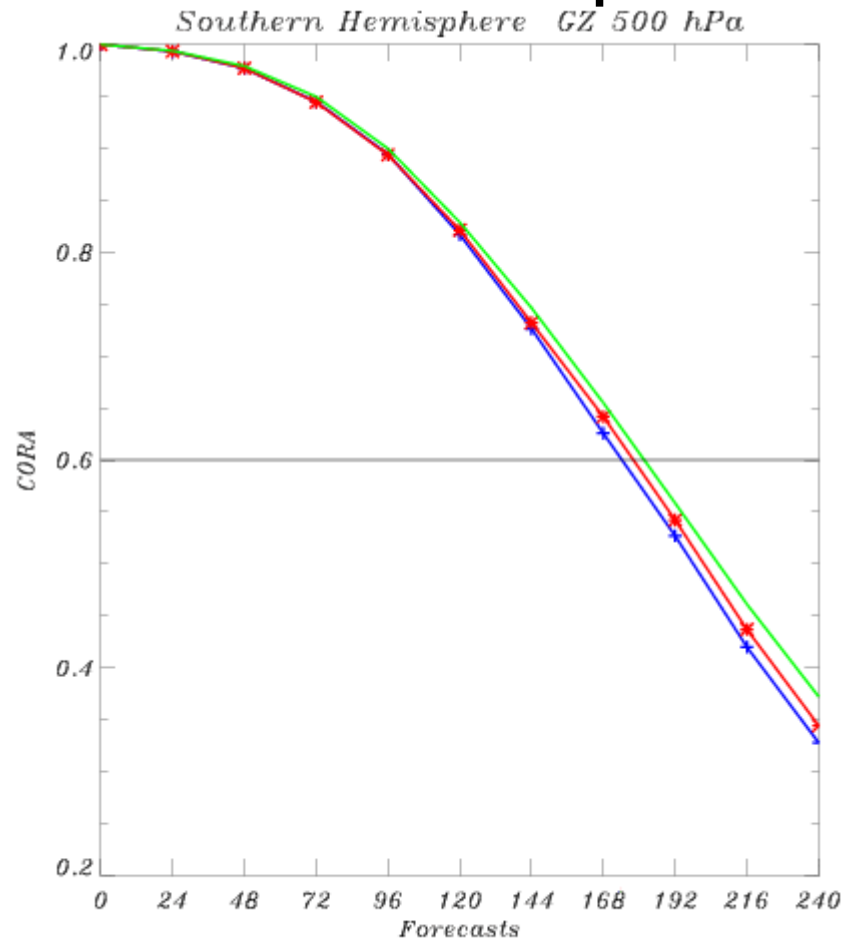
Winter period only

Anomalies GZ à 500hPa

North America

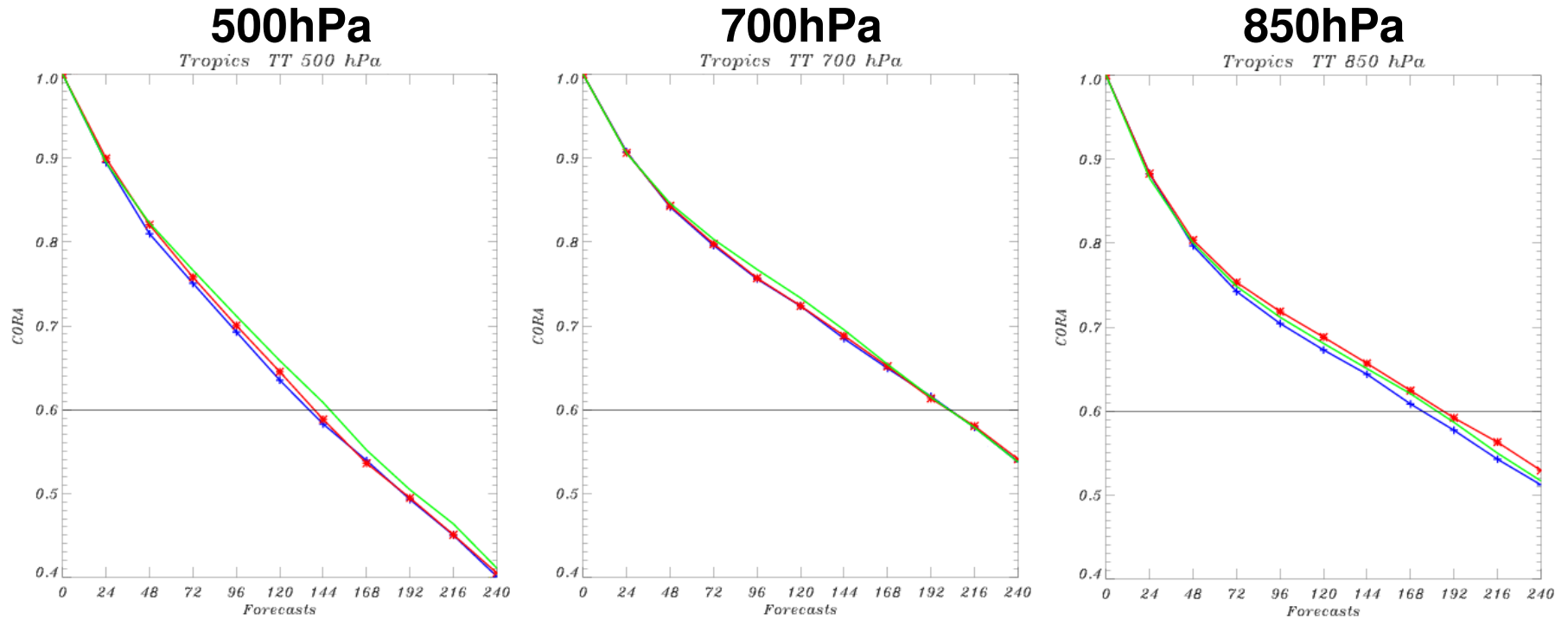


Southern Hemisphere



WINTER: control, no AIRS, with AIRS

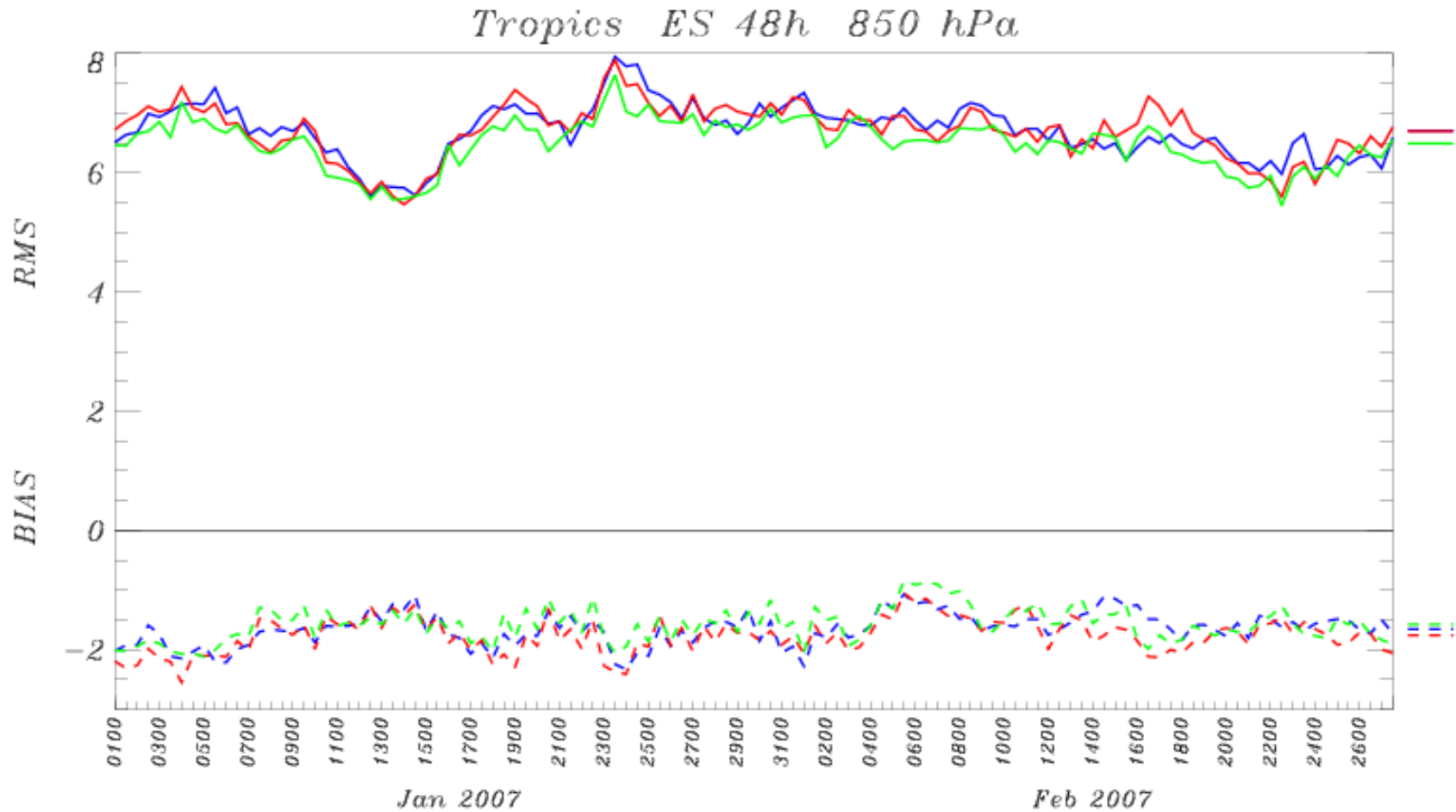
Anomalies TT, Tropiques



WINTER: control, no AIRS, with AIRS

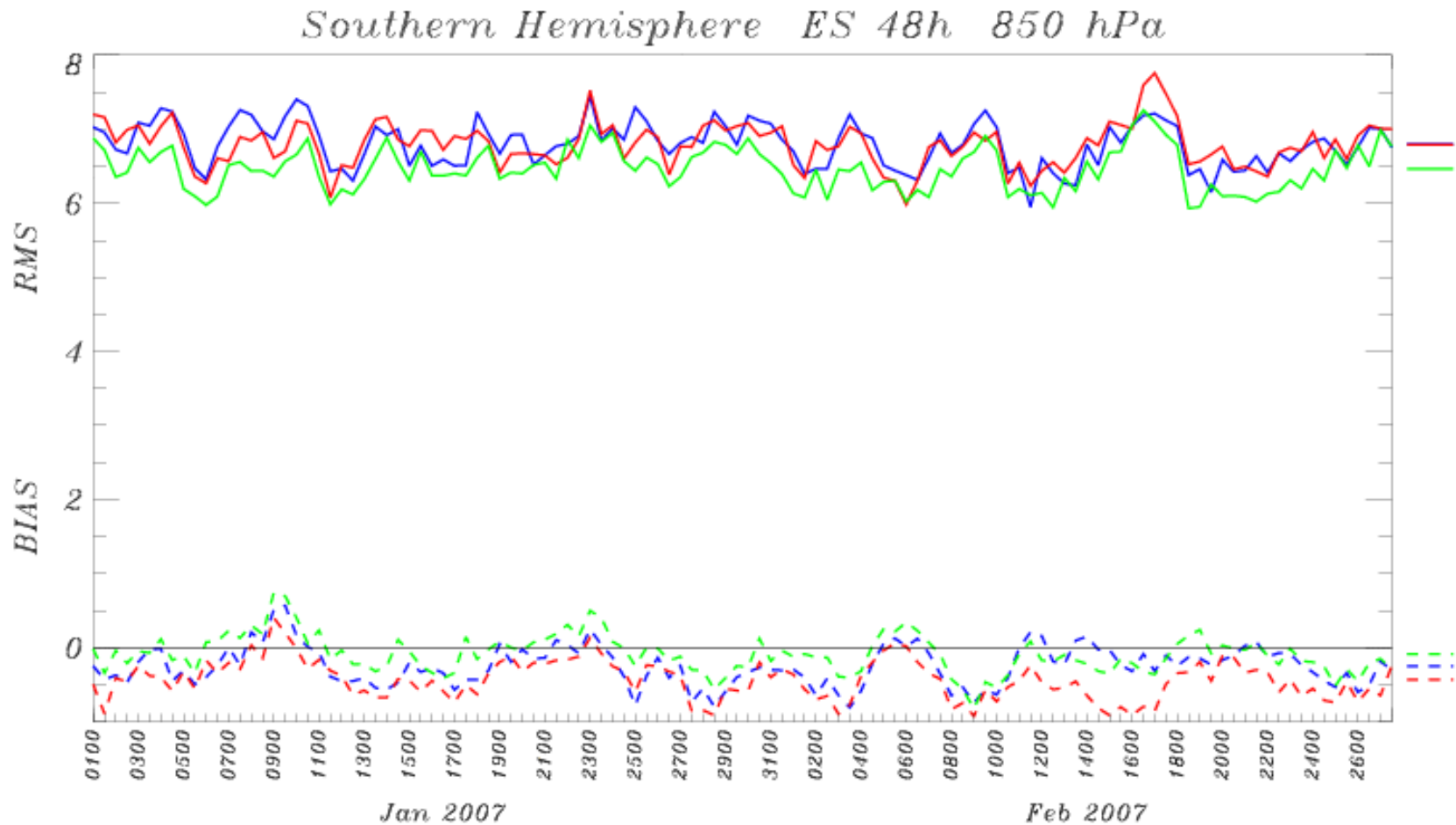
Time series, ES à 850hPa, 48h, Tropics

WINTER: control, no AIRS, with AIRS



Time series, ES à 850hPa, 48h, Southern Hemisphere

WINTER: control, no AIRS, with AIRS



Conclusion

- Apport des nouvelles observations est clairement positif avec un gain de prévisibilité de l'ordre de:
 - ~3 heures à 5 jours dans l'hémisphère nord
 - ~6 heures à 5 jours dans l'hémisphère sud
- Impact du a AIRS compte pour environ 50% du total
- Plus d'information concernant AIRS: séminaire interne de Louis Garand, le 14 septembre

Échéancier probable pour passe parallèle

- 31 aout: Résultats complets pour l'été
- 15-31 aout: Produire résultats d'impact dans le régional
- ~ 13 Septembre: Proposition formelle a CPOP
- 15-30 sept :branchement de PP, monitoring, spin-up
- 1 octobre: début officiel pour validation au CMC

Extra slides

Impact of amsu-a Observations

