Országos Meteorológiai Szolgálat

Radiance data assimilation issues

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1- CHMI; 2-OMSZ

Acknowledgement: Alena Trojáková, Magnus Lindskog, Vincent Guidard

this presentation comprises

- Short introduction
- Some issues related to the model configuration
  → with respect to radiances assimilation
- Setting radiance data assimilation with variational bias correction

Implementation of satellite radiances (in our case the IASI data)

→ **important remark:** After "successful" implementation, we could not see the advantage of assimilating the IASI radiances with the ALADIN/Hungary (!)

→ **issue 1**: ***model top vs the RTTOV top***

→ **issue 2:** ***model domain and its geographical location***

The Hungarian model domain is ***mainly located over land*** and at ***mid-latitude*** (different cloud effects), ***model top (5hPa) below the RTTOV top (0.005hPa)***
The Norwegian model domain is ***half over sea and half over land*** and high-latitude (cloud influence is different), ***model top (0.2hPa)*** is higher enough to do better job.

- Combination of all the above listed constraints creates questions, which we would like to study

The bias estimated using "coldstart" dropped too fast (!) While in Harmonie similar study showed "better convergence" to the nominal bias value within few days.

→ With Patrik, we wanted to understand the reason(s)

What is coldstart?

Is it sufficient to just start the experiment without VARBC coefficients at the beginning of the passive experiment?

Remember (from CY36):

lbc_$sensor=.T./.F. # Switch on/off bias correction for sensor

YCONFIG(sensor,channel)%NCSTART=0 # Coldstart option to set bias parameters to zero (similar to NCS_CONFIG=0, in the previous cycles)

YCONFIG(sensor,channel)%NCSTART=1 # Bias parameters set to prescribed values for group

YCONFIG(sensor,channel)%NCSTART=2 # Coldstart option to use mode of fg departures

YCONFIG(sensor,channel)%NPARAM=0 # Switch off correction for selected sensors and channels

```
! ------------------------------------------------------------
  IF (.NOT. (ANY(yvarbc(ix)%aparams==RMDI)) ) CYCLE

! Several options:
! ---------------
  IF (yvarbc(ix)%ncstart==0) THEN

!   Initialise to zero
!   ------------------
    yvarbc(ix)%aparams = 0.0_JPRB
    WRITE(nulout,'(a,i0,a)') myname//': Bias parameters set to zero for group ', ix, &
               & ' (class '//TRIM(yvarbc(ix)%obsclass)//', key '//TRIM(yvarbc(ix)%groupkey)//')'

  ELSEIF (yvarbc(ix)%ncstart==1) THEN

    yvarbc(ix)%aparams = yvarbc(ix)%zparams
    WRITE(nulout,'(a,i0,a)') myname//': Bias parameters set to prescribed values for group ', ix, &
               & ' (class '//TRIM(yvarbc(ix)%obsclass)//', key '//TRIM(yvarbc(ix)%groupkey)//')'

  ELSEIF (yvarbc(ix)%ncstart==2) THEN

!   Use the mode of the first-guess departures if possible
!   ------------------------------------------------------
    IF (SUM(yvarbc(ix)%nhstfgdep(:))>0) THEN ! Histogram of uncorrected departures is defined

      yvarbc(ix)%aparams(:) = 0.0_JPRB
                                                                                   710 33
```

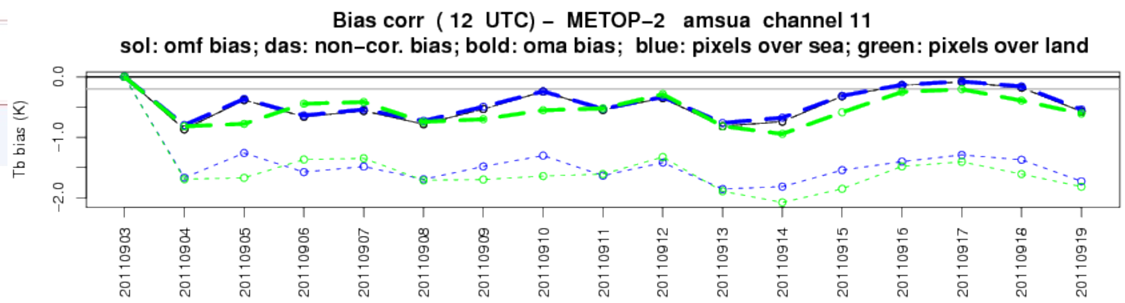
Experiments with passive data assimilation:

COLDSTART (without predictors 5 and 6):

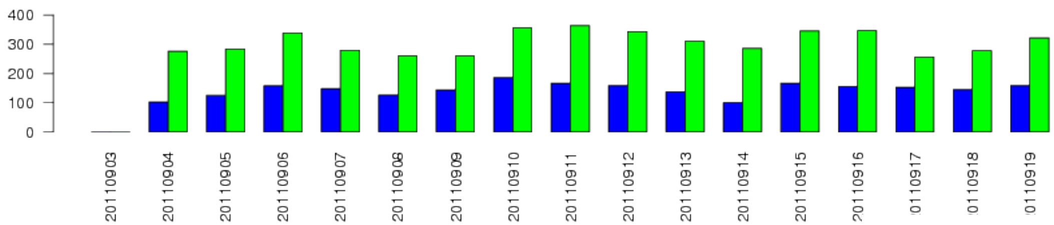
1– with NCSTART=2 (nothing in the namelist with respect to coldstart decision)
2– with NCSTART=0 (setting in the namelist YCONFIG(sensor,channel)%NCSTART=0)

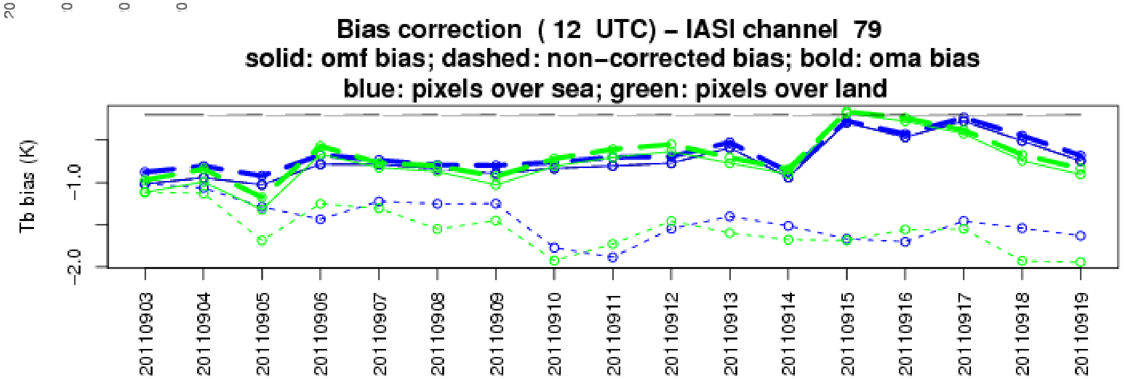
WARMSTART:

1– with the predictors 5 and 6
2– without the predictors 5 and 6



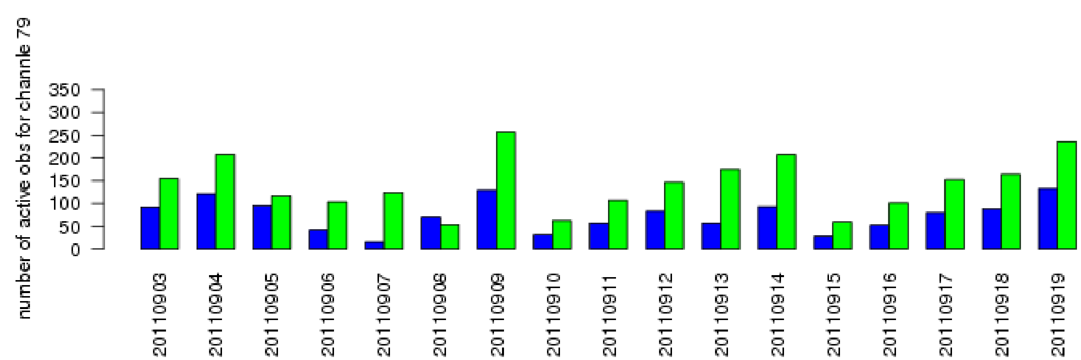
NCSTART=2

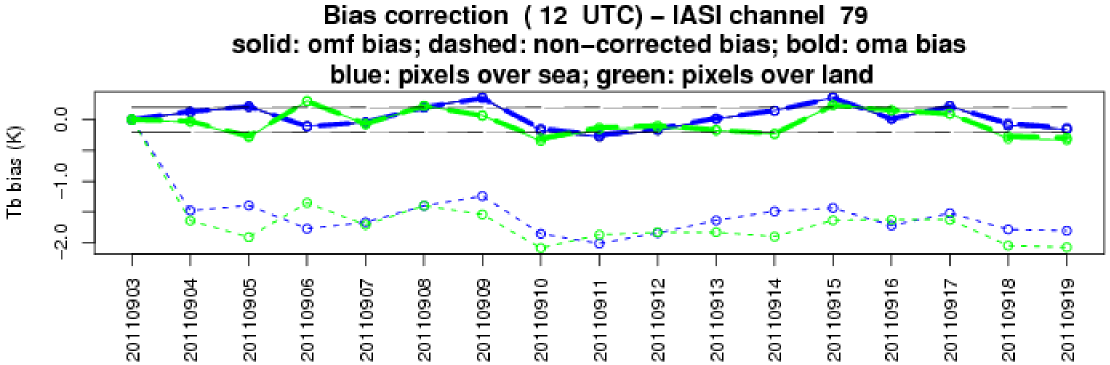




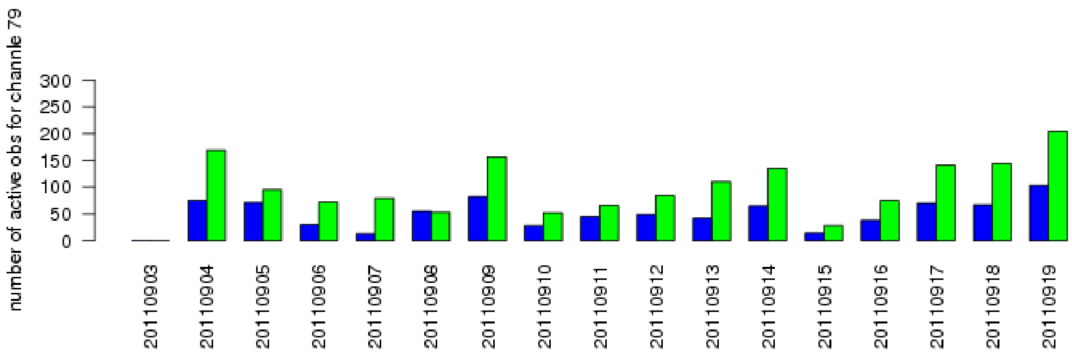
COLD-START TESTS

NCSTART=0



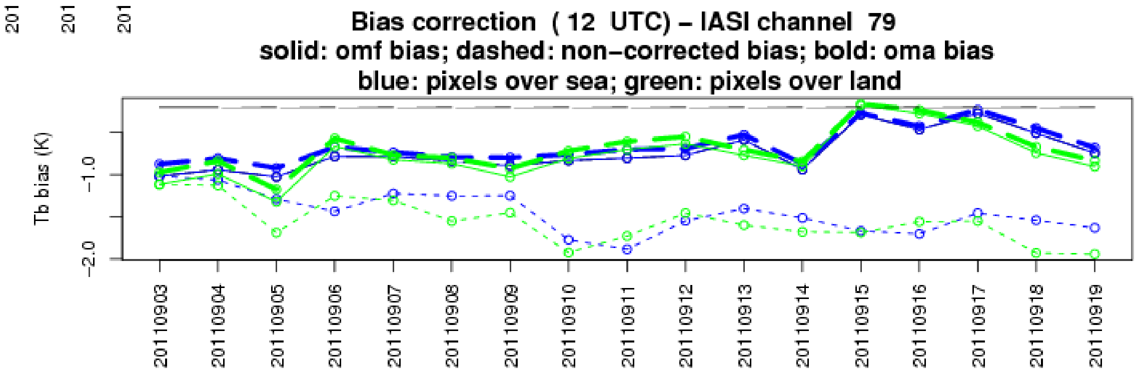


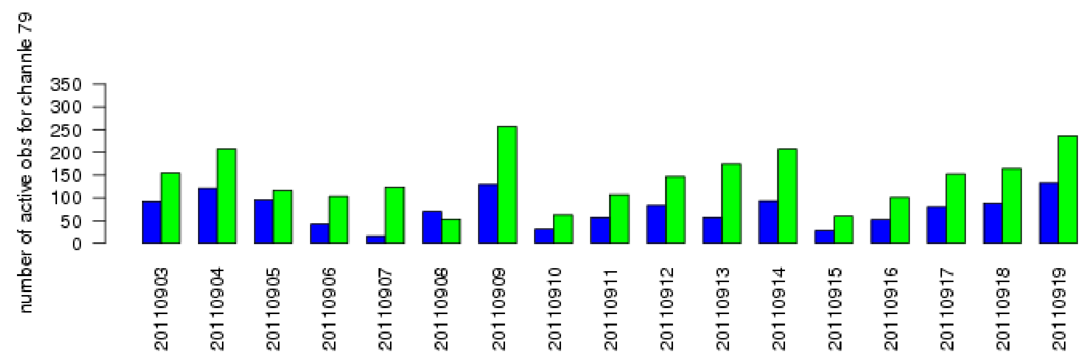
NCSTART=2

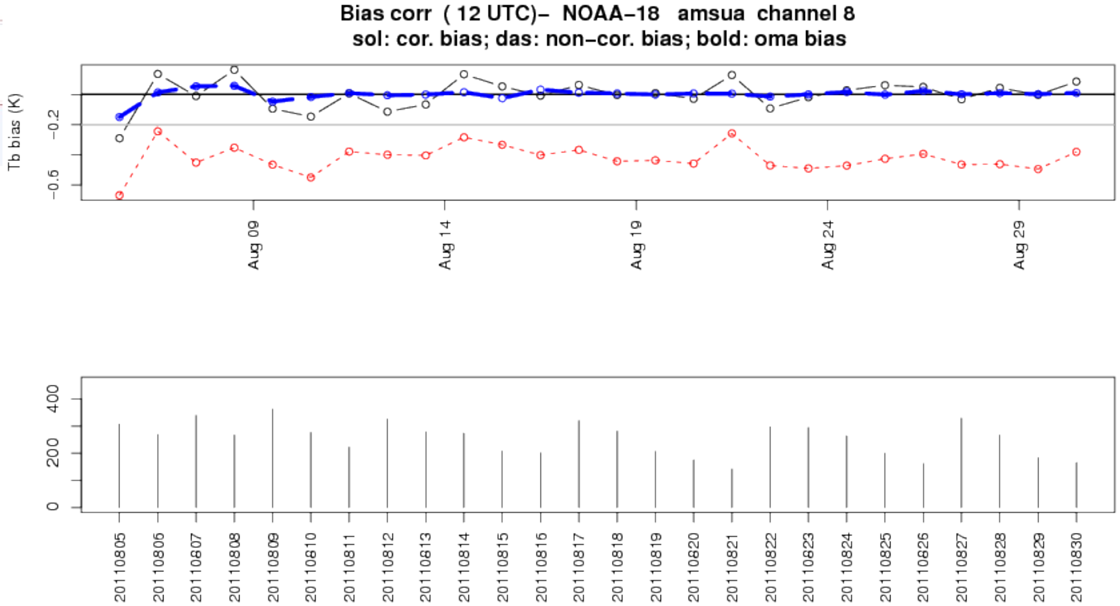


COLD-START TESTS

NCSTART=0

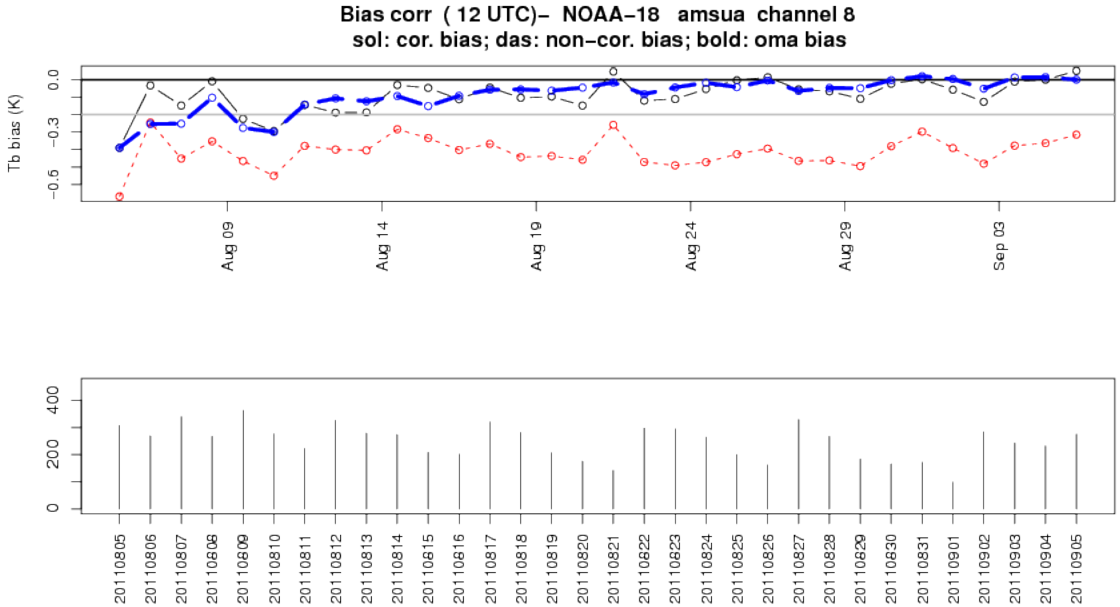






With predictors 5 and 6

WARM-START TESTS



Without predictors 5 and 6

Check the functionality of the predictors
Node of the observations screening

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VarBC_pred (print_stats): Gather and print predictor statistics

Predictor definitions:

p0 : 1 (constant)
p1 : 1000-300hPa thickness minus     9207.0 divided by      446.0
p2 : 200-50hPa thickness   minus     8491.0 divided by      387.0
p3 : T_skin                minus      285.0 divided by       20.5
p4 : total column water    minus       25.0 divided by       17.8
p5 : 10-2hPa thickness     minus    11338.0 divided by      467.0
p6 : 50-5hPa thickness     minus    14975.0 divided by      570.0
p7 : surface wind speed    minus        6.0 divided by        3.6
p8 : nadir viewing angle   minus        5.5 divided by       28.7
p9 : nadir view angle **2  minus      853.0 divided by      744.0
p10: nadir view angle **3  minus     9300.0 divided by    46700.0
p11: nadir view angle **4  minus  1540000.0 divided by  2799000.0
p12: cos solar zen angle   minus        0.0 divided by        0.3
p13: solar elevation       minus      -12.0 divided by       40.0
p14: TMI diurnal bias      minus        0.0 divided by        1.0
p15: land or sea ice mask  minus        0.0 divided by        1.0
p16: view angle (land)     minus        5.5 divided by       28.7
p17: view angle **2 (land) minus      853.0 divided by      744.0
p18: view angle **3 (land) minus     9300.0 divided by    46700.0

Cross-correlations:
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	nsample	mean	stdv	p0	p1	p2	p3	p4	p5	p6	p7	p8	p9	p10	p11	p12	p13	p14	p15	p16	p17	p18
p0	38592	1.000	0.000																			
p1	38592	0.182	0.251		1.000	-0.905	0.730	0.429	0.624	0.632	0.033	0.106	-0.245	0.018	-0.230	0.444		0.144	-0.187	0.173	-0.165	0.080
p2	38592	0.460	0.284			1.000	-0.603	-0.230	-0.731	-0.738	-0.025	-0.170	0.089	-0.065	0.092	-0.475		-0.137	0.255	-0.205	0.003	-0.111
p3	38592	0.513	0.358				1.000	0.151	0.576	0.577	0.242	0.090	-0.059	0.032	-0.058	0.423		0.125	-0.186	0.164	-0.056	0.090
p4	38592	-0.067	0.394					1.000	0.114	0.119	0.030	-0.117	-0.247	-0.113	-0.221	0.208		-0.027	0.005	0.006	-0.220	-0.037
p5	38592	-11.938	0.080						1.000	0.993	0.255	0.022	0.046	-0.017	0.039	0.732		0.101	-0.357	0.056	0.053	0.024
p6	38592	3.719	0.123							1.000	0.250	0.019	0.039	-0.015	0.033	0.725		0.105	-0.368	0.057	0.048	0.028
p7	38592	-0.125	0.899								1.000	0.004	0.181	0.023	0.162	0.205		-0.017	-0.535	0.033	0.037	0.031
p8	38592	0.002	1.036									1.000	0.112	0.923	0.100	-0.411		0.348	-0.007	0.801	0.085	0.735
p9	38592	0.084	0.992										1.000	0.158	0.961	-0.188		0.045	-0.071	0.086	0.808	0.120
p10	38592	-0.038	1.046											1.000	0.157	-0.455		0.333	-0.015	0.728	0.115	0.793
p11	38592	-0.056	0.593												1.000	-0.187		0.047	-0.065	0.070	0.770	0.112
p12	38592	2.184	0.261													1.000		-0.021	-0.302	-0.296	-0.165	-0.330
p13	0																					
p14	38592	0.535	0.240															1.000	-0.008	0.313	0.014	0.299
p15	38592	0.668	0.463																1.000	-0.001	0.025	-0.027
p16	38592	-0.003	0.823																	1.000	0.106	0.918
p17	38592	0.016	0.798																		1.000	0.144
p18	38592	-0.033	0.823																			1.000

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VarBC_setup (dump_table): Writing VarBC information to file VARBC.cycle

VarBC_setup (dump_table): expid = MIN1 date = 20110919 time = 120000
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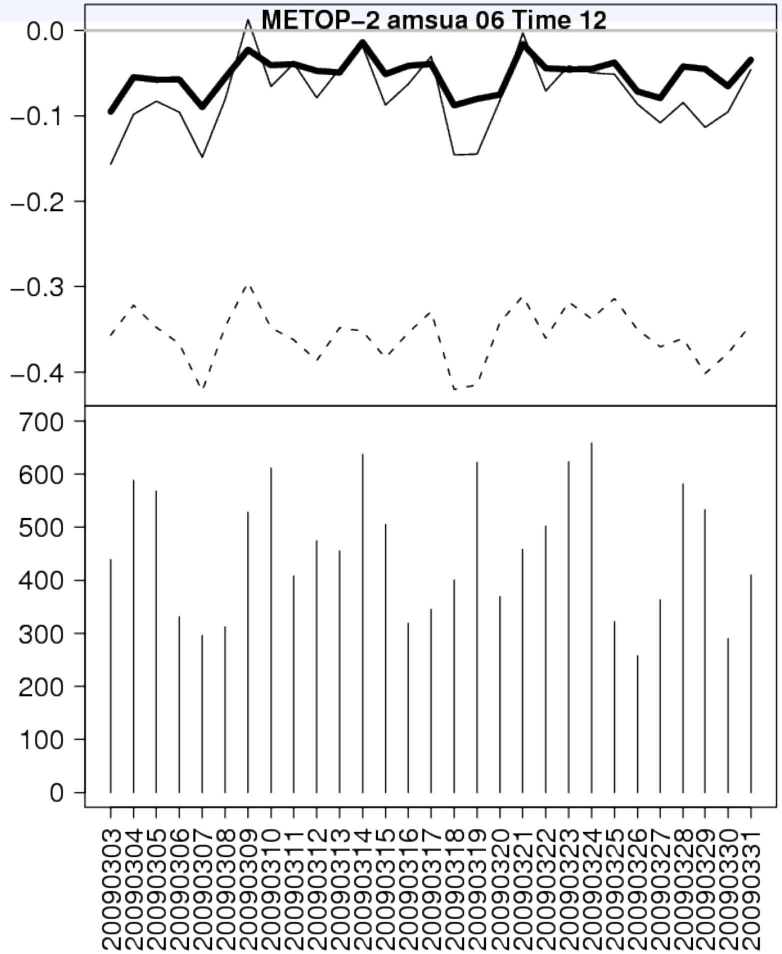
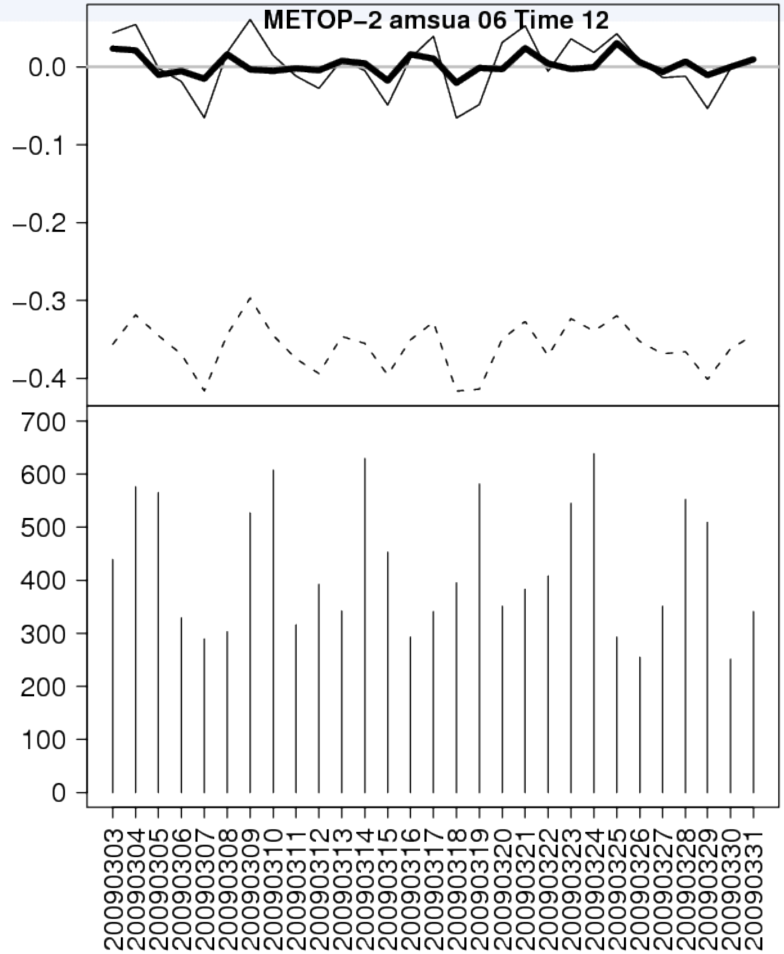
How to compute the bias coefficients?

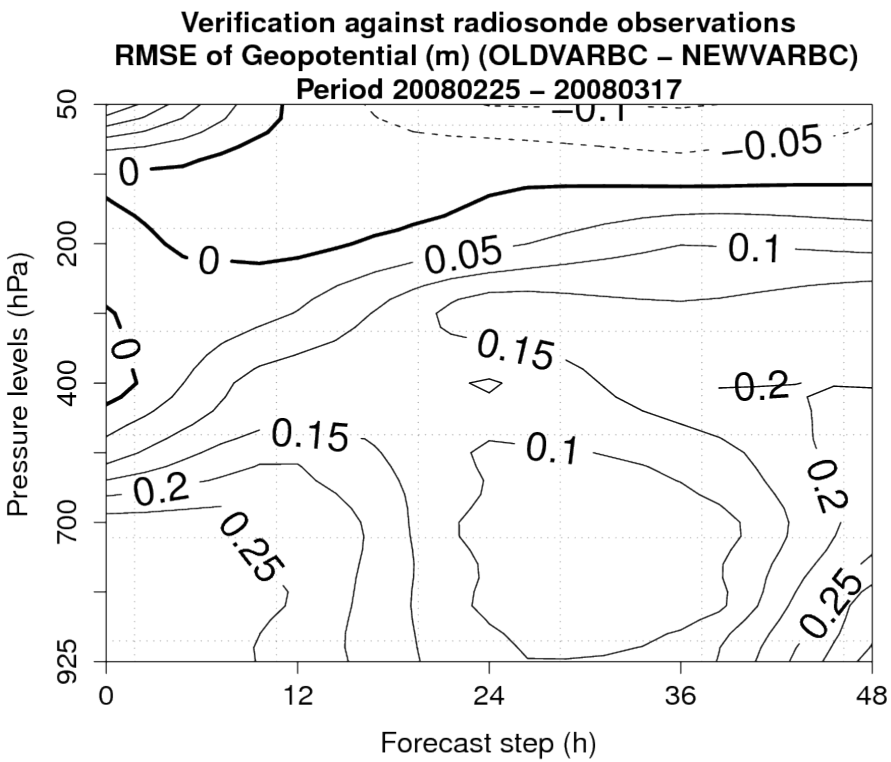
Cycling the bias coefficients

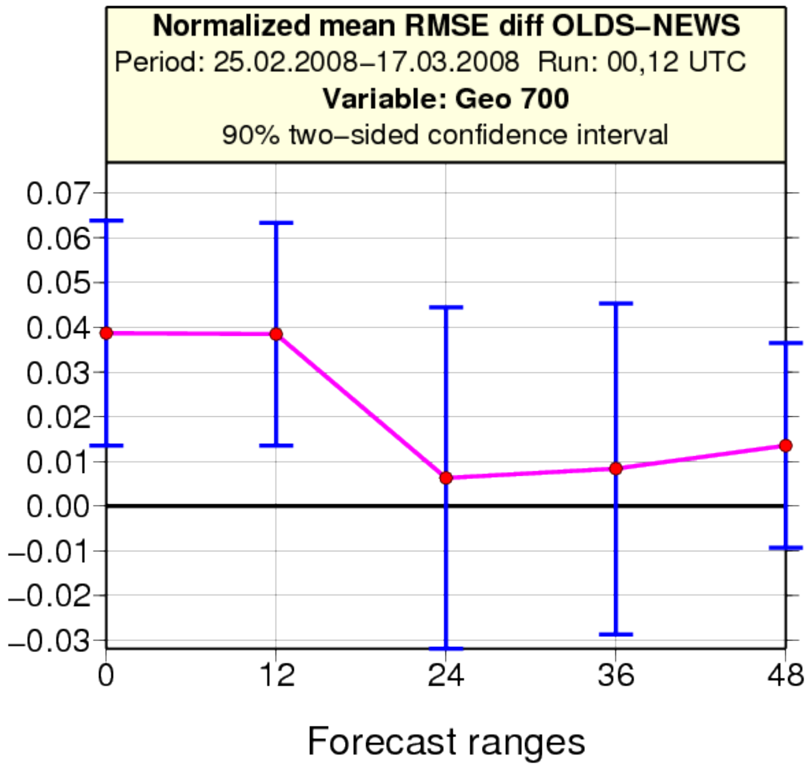


Estimating daily the bias coefficients



The impact on the analyses and forecasts:





Concluding remarks:

→ Not changing the namelist when doing cold-start push the model to use the NCSTART=2 (using the mode of the FG departure – not working well, recognized by Tony McNally (personal communication)). As consequence a very quick reduction of the bias is observed.

→ NCSTART=0 or NCSTART=1 can do the job ==> nice reduction and convergence of the bias to the nominal value

→ For “low-top models” avoiding the stratospheric predictors (5 and 6) may be worth (?)
→ In this case longer warming period is needed for both the cases warm- and cold-start

→ The simple experiments we have done so far showed that the channels are inter-anchoring each other, so the bias of IASI channels can be influenced by the Metop AMSU-A channels ! (not shown in this presentation)