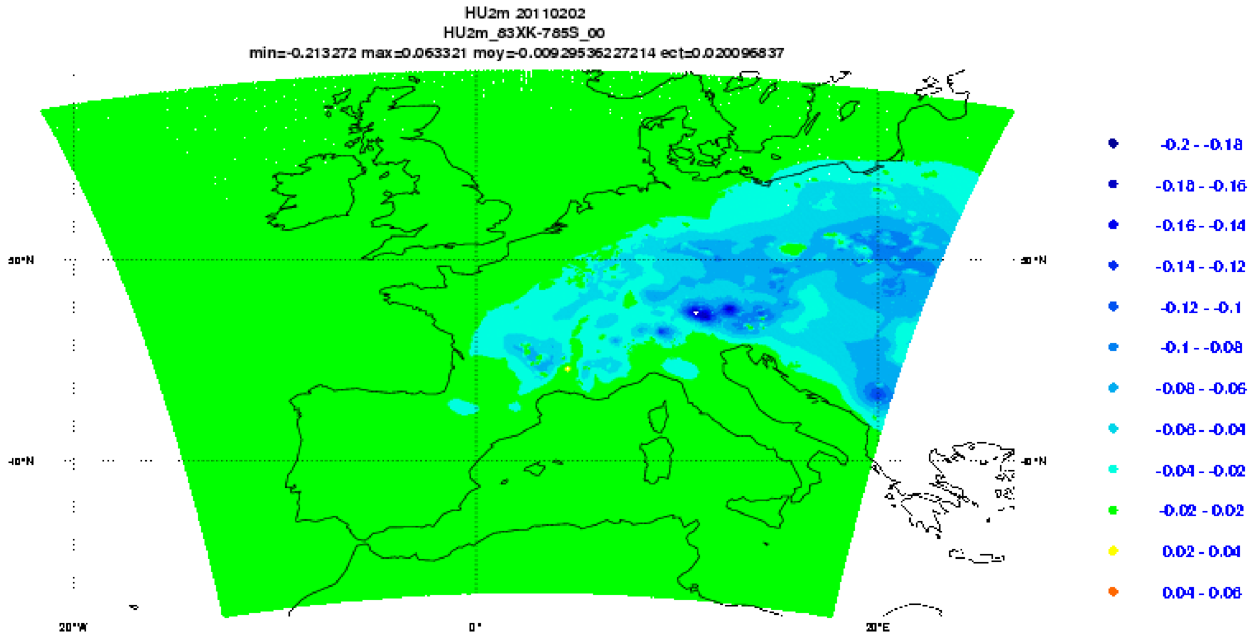
Phasing report for pre cycle 37t1
Stay at Météo-France, Toulouse 04/04/2011 - 13/05/2011
Mohamed Jidane (DMN, Casablanca)

1/ Aladin 3D-VAR validation for 37_bf :

The first part of my work was to contribute to validate 3DVAR assimilation + canari analysis on cycle 37_bf.
Two Olive experiments were done, 785S as a reference with cycle 36t1_op2.04 and 83XK with cycle 37_bf.
The first results were not so quiet good. Starting from the same guess, canari OBS-MOD were identicals between 785S (36t1_op2.04) and 83XK (cy37_bf) except for 2m relative humidity.



2M moisture fields differences over Europe in the analysis

The investigation shown that there were a modification made by Patrick Moll in bator_ecritures_mod, this modification is included in 36t1_op2 but not in 37_bf.
I have phased the modification with cy37_bf.02, and the routine can be recovered from my view : mrpe731_CY37_jidane

The comparaison of minimisation listings between 37_bf and 36t1_op2 for Aladin 3dvar shown that we lost a lot of METOP radiances with cycle 37_bf :

37_bf :

```
Obstype     7 === SATEM, Satellite sounding data
--------------------------------------------------
     Codetype   210 === METOP    2     4 SENSOR=IASI
        Variable      DataCount         Jo_Costfunction       JO/n      ObsErr      BgErr
           RAD        19965           2526.983359109          0.13   0.221E+01   0.100E+01
```

36t1_op2 :

```
Obstype     7 === SATEM, Satellite sounding data
--------------------------------------------------
     Codetype   210 === METOP    2     4 SENSOR=IASI
        Variable      DataCount         Jo_Costfunction       JO/n      ObsErr      BgErr
           RAD        24248           4311.392468304          0.18   0.229E+01   0.100E+01
```

The answer was that the two experiments does not use the same var.sat.misc.rtcoef file :

```
cy37_bf :  var.sat.misc_rtcoef.11.tgz
36t1_op2 : var.sat.misc_rtcoef.12.tgz
```

To be able to use in 37_bf the new file `var.sat.misc_rtcoef.12.tgz` and hence do a correct validation, I took two routines from 36t1_op2 :

```
sat/rttov/rttov_ec_tl.F90
sat/rttov/rttov_opdep_9_tl.F90
```

With this modification the two cycles are comparables :

```
Obstype     7 === SATEM, Satellite sounding data
--------------------------------------------------
     Codetype   210 === METOP    2     4 SENSOR=IASI
        Variable      DataCount         Jo_Costfunction       JO/n       ObsErr     BgErr
           RAD        24246           4314.359338626          0.18    0.229E+01  0.100E+01
```

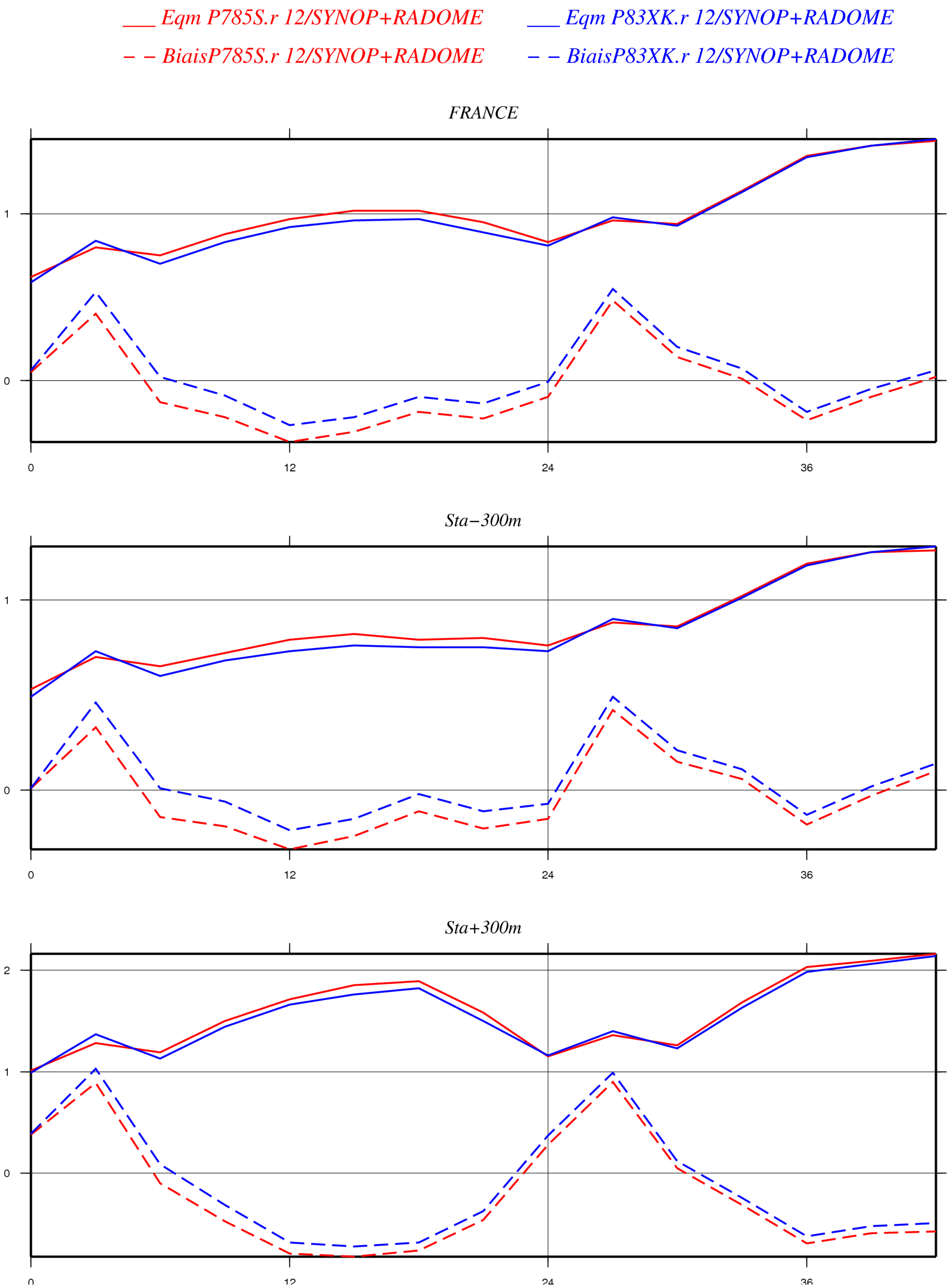
Since the check of listings (canari, screening and minimisation) between the two experiments shown that the results are quiet good, I decide to run about one month of 3D-VAR assimilation cycle comparing CY37_bf.02 with CY36T1_op2.

The scores look very similar. The biggest difference is a small bias on upper-troposphere temperature and MSLP, with respect to radiosondes and surface obs, mostly visible in the first 10 days (about 0.2 hPa and 0.1 K, resp.).

PRESSION MER (hPa)

(hPa)

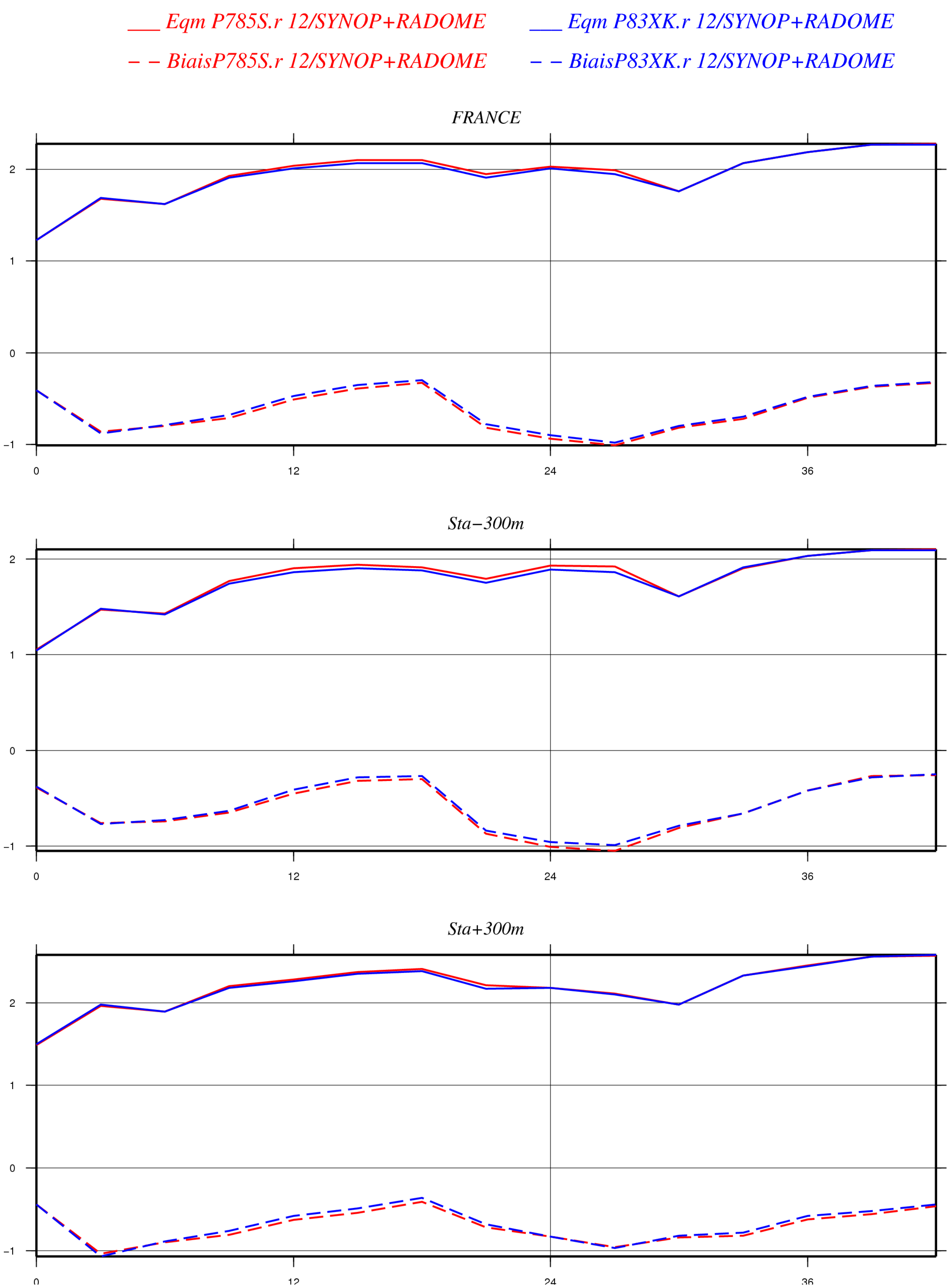
25 simulations de 42h contrôlées du 20110202 au 20110228



TEMPERATURE CORRIGEE (K)

(K)

25 simulations de 42h contrôlées du 20110202 au 20110228



PRECIPITATION SUR 6 HEURES (mm)

(mm)

25 simulations de 42h contrôlées du 20110202 au 20110228

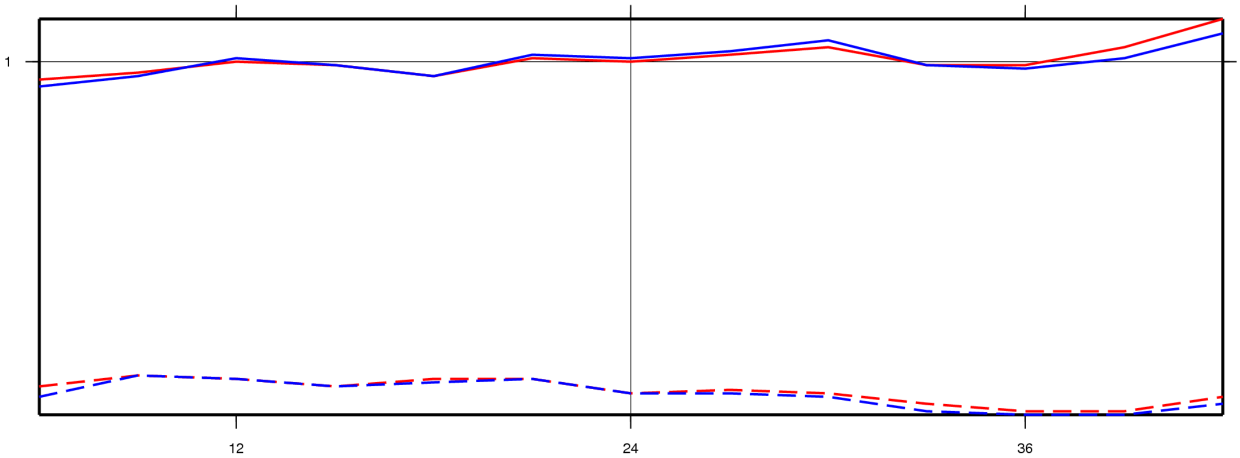
___ Eqm P785S.r 12/SYNOP+RADOME

– – BiaisP785S.r 12/SYNOP+RADOME

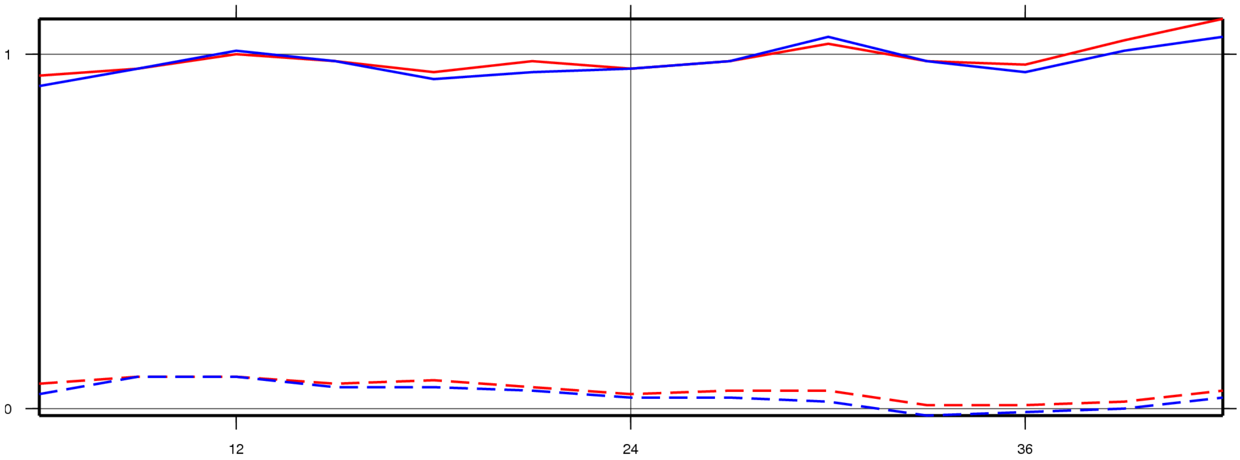
___ Eqm P83XK.r 12/SYNOP+RADOME

– – BiaisP83XK.r 12/SYNOP+RADOME

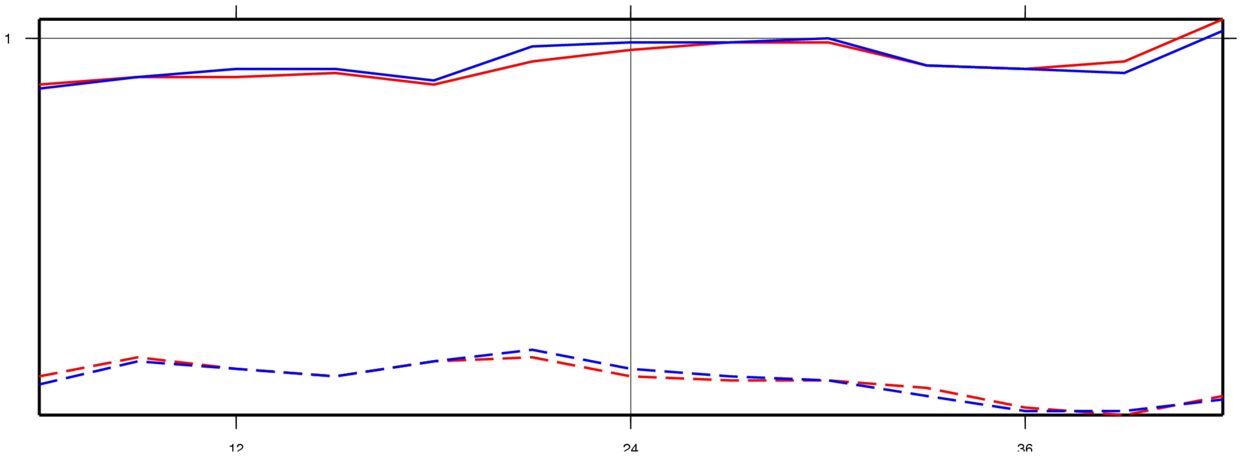
FRANCE



Sta−300m



Sta+300m



NEBULOSITE (%)

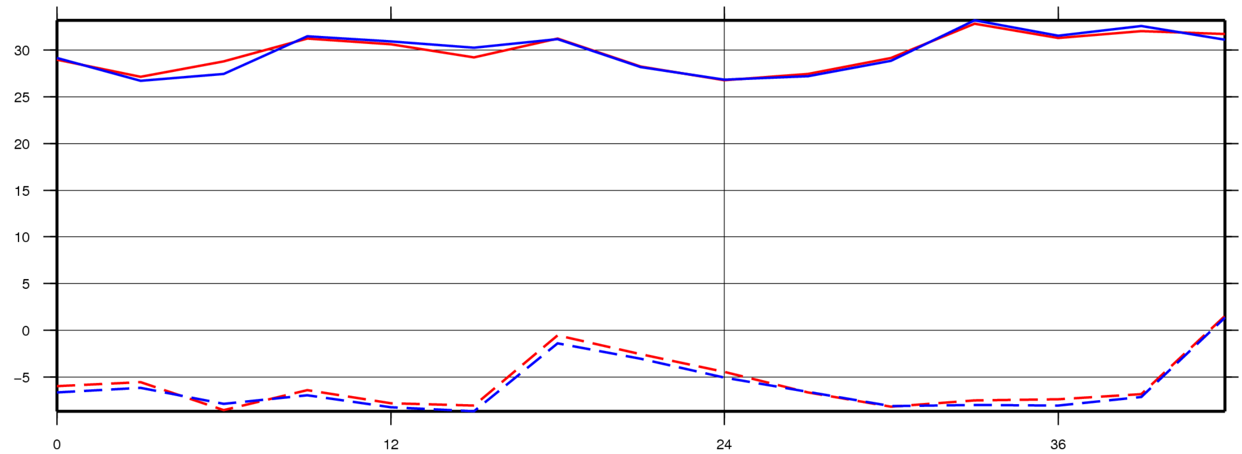
(%)

25 simulations de 42h contrôlées du 20110202 au 20110228

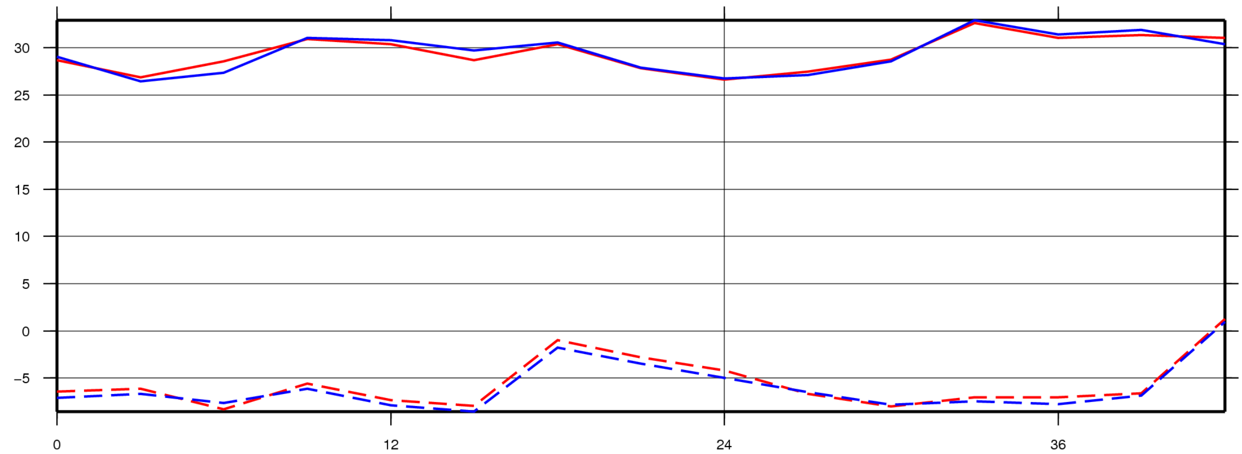
___ Eqm P785S.r 12/SYNOP+RADOME ___ Eqm P83XK.r 12/SYNOP+RADOME

– – BiaisP785S.r 12/SYNOP+RADOME – – BiaisP83XK.r 12/SYNOP+RADOME

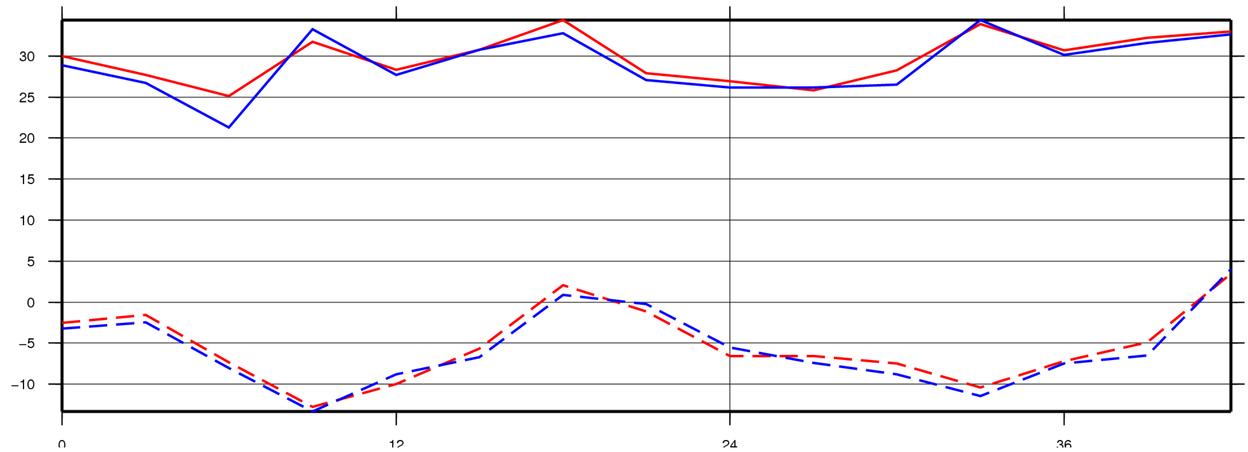
FRANCE



Sta−300m



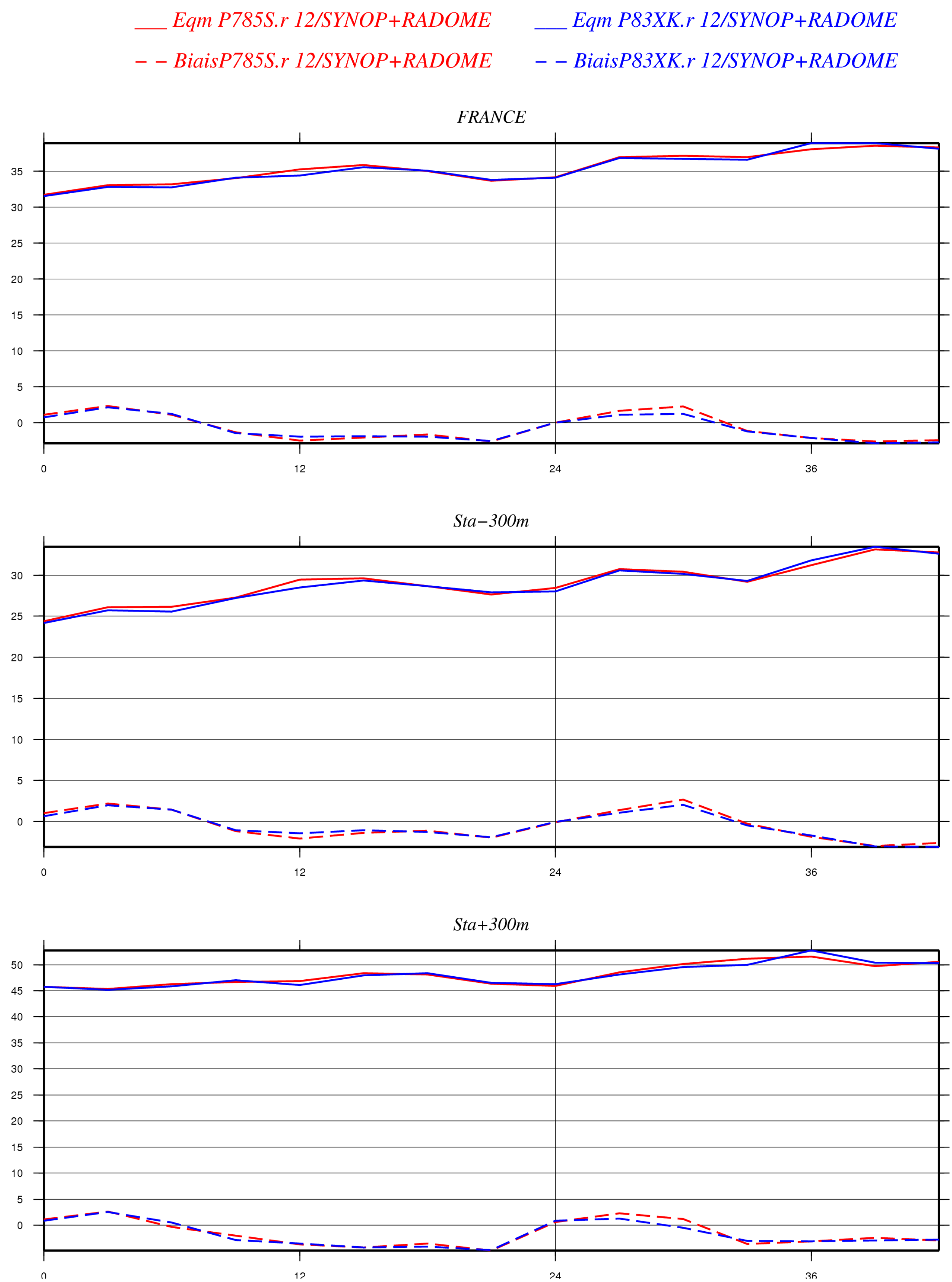
Sta+300m



DIRECTION DU VENT (Dg)

(Dg)

25 simulations de 42h contrôlées du 20110202 au 20110228



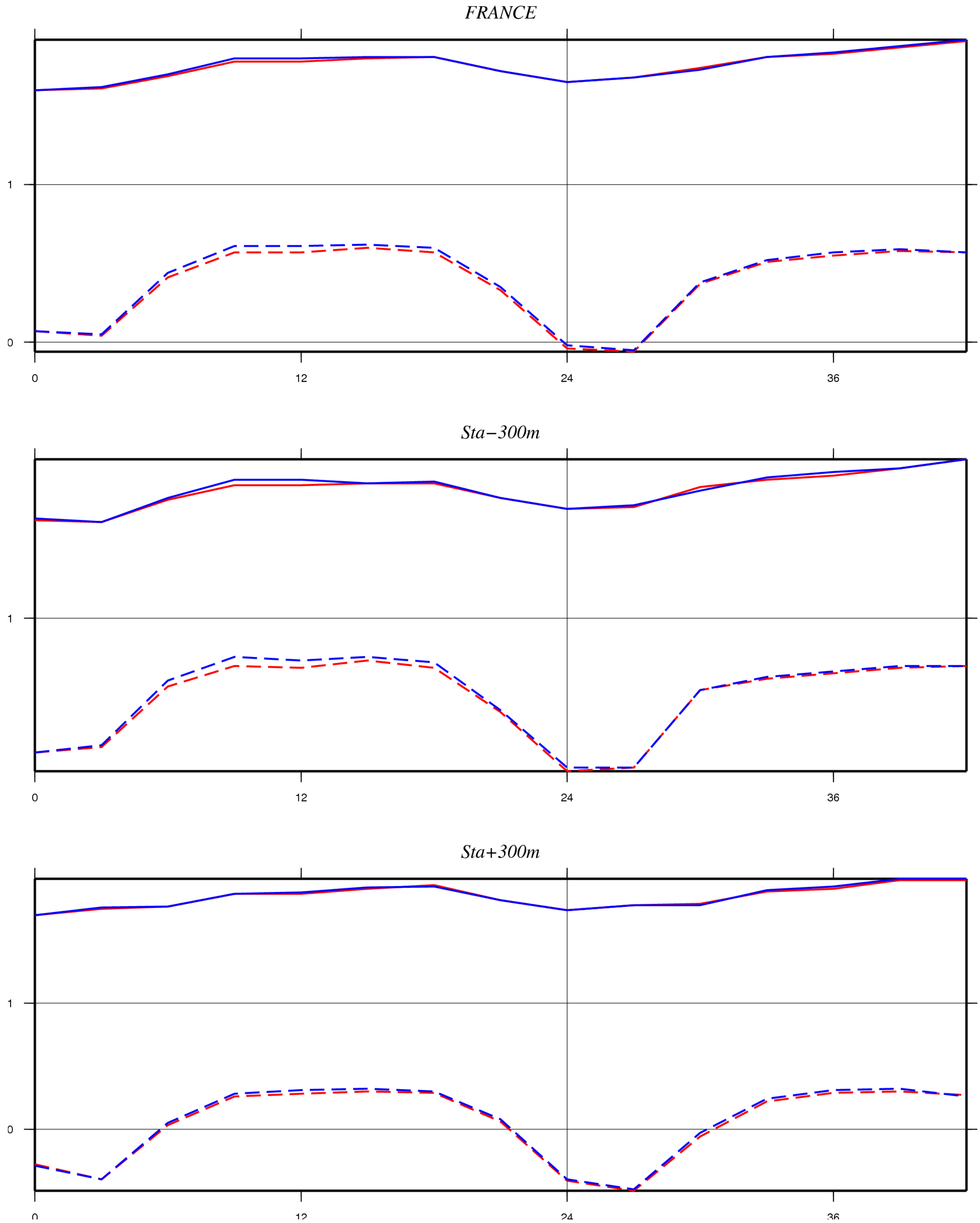
FORCE DU VENT (m/s)

(m/s)

25 simulations de 42h contrôlées du 20110202 au 20110228

___ Eqm P785S.r 12/SYNOP+RADOME ___ Eqm P83XK.r 12/SYNOP+RADOME

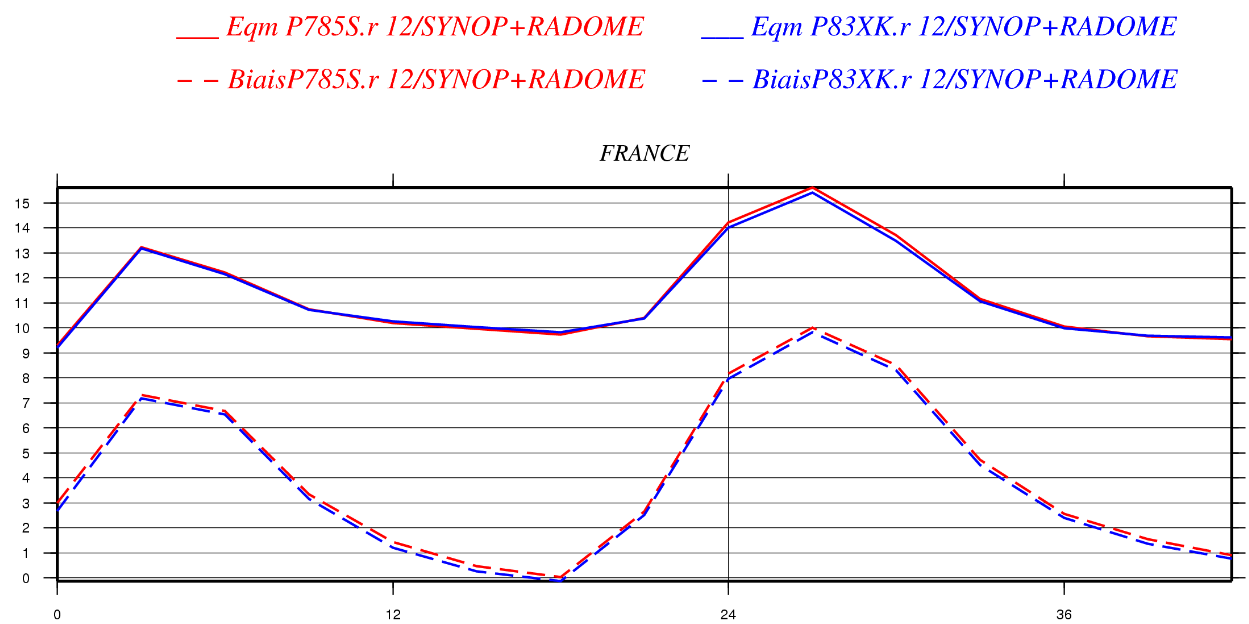
– – BiaisP785S.r 12/SYNOP+RADOME – – BiaisP83XK.r 12/SYNOP+RADOME

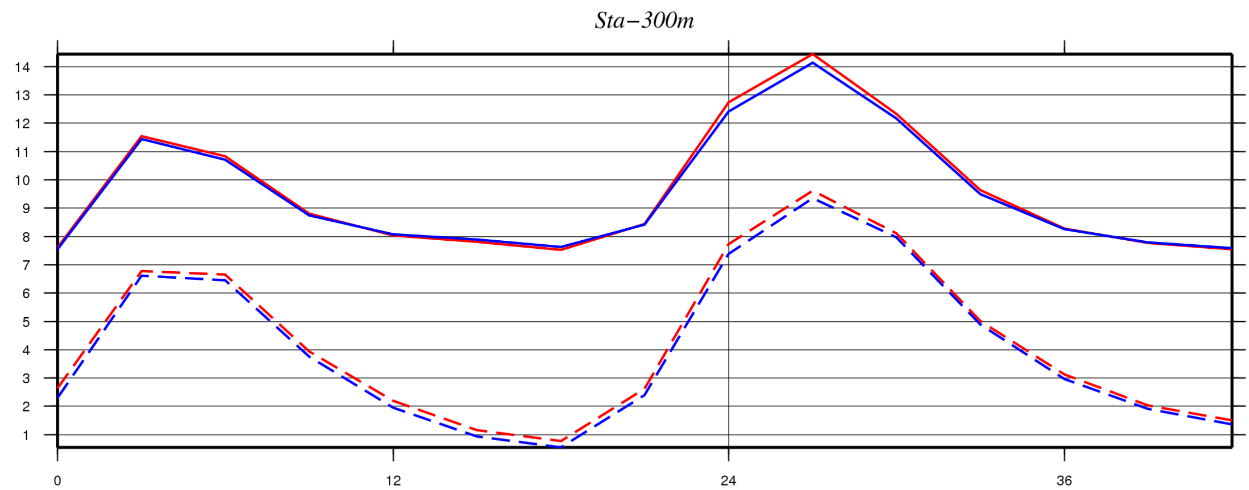


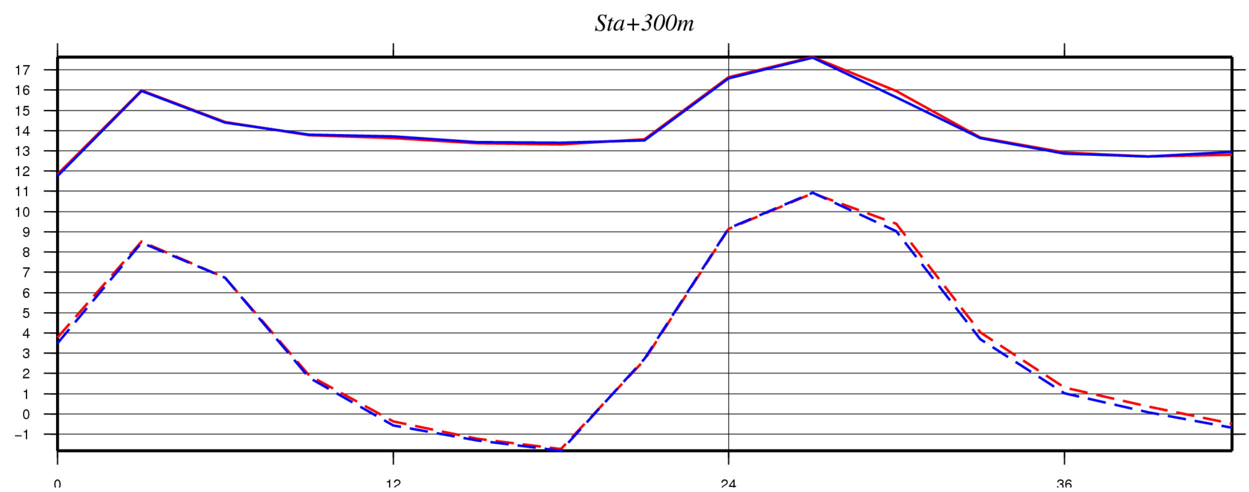
HUMIDITE (%)

(%)

25 simulations de 42h contrôlées du 20110202 au 20110228







2/ Aladin 3D-VAR validation for 37_t1 :

```
Olive experiments : server sxproc1, login mrpe731
Reference run :
785S : Cycle 37 Aladin France 3Dvar : exp 36t1_op2.04
37_t1 run :
787R : Cycle 37 Aladin France 3Dvar: exp 37_t1.03
```

The first tests were crashing.

Status of Aladin 3dvar validation with 37_t1.03 :
Crashs in canari :
cut-off court : * 252 Floating-point zero divide PROG=ppinitz ELN=106(4163af624)
cut-off long : * 252 Floating-point zero divide PROG=acntcls ELN=354(4163ad710)

I have notice that in 37_bf.02 there were a bug fix from Olivier Riviere in suemp concerning the use of ini_iostream.
(documentation of 37_bf.02 : Due to changes in iostream_mix in cy37, some initializations (now mandatory before reading grib files) were missing in LAM case. Now ini_iostream is called in suemp.F90 like it is done for global case in sump.F90.This prevents crash in Aladin 3DVAR.)

This modification is not included in 37_t1.03, nor the one from Patrick Moll concerning bator_ecritures_mod.

Even if I put those two modifications in a pack of mine based on 37_t1.03, I did have always this zero divide in canari.

To go further in the validation, I bypass canari by putting a good analysis from my reference.

Doing that, screening seems ok (just a little bit more cpu time).

But minimisation crashs :

```
cut-off court :
 ****  90 Fatal exception PROG=elascaw ELN=447(4164661b8)
 SIGSEGV: Segmentation violation
```

Hopefully, Karim YESSAD found a bug in slintad.f90 :

```
>
> with the attached version of slintad.F90 that may be better
> (add:
> ISPLTHOI=0
> LL3DTURB=.FALSE.
> IDIMK=1
> which were properly set-up in slint.F90 but forgotten in
> slintad.F90).
>
```

And with the correction of this routine, the results were better, no more crash in minimisation and it seems ok by comparing the listing with the reference run.

For canari crash, I successed to found where the problem come from.
It was a bug in ald/adiab/elascaw.F90.
The Correction was sent to Yann SEITY to put it in his branche for the next version '04' of 37_t1.

Scores between 785S and 787R are too close (cougar : ~mrpe731/201104/scores/).

3/ Aladin+Surfex forecast validation for 37_t1 :

Four experiments under Olive were done :

As a reference two experiments :

```
7880 : Aladin+Surfex forecast with cycle al36t1_op2
7890 : Aladin forecast without Surfex with cycle al36t1_op2
```

and their two counterparts for the pre-cycle :

```
789D : Aladin forecast without Surfex with pre cycle 37_t1.04
789F : Aladin+Surfex forecast with pre cycle 37_t1.04
```

The tests without Surfex were quite good. A plot of some fields after 24 H forecast could be found on cougar : ~mrpe731/201104/789D_7890.ps.gz

Some stuff missed from version 03 :
Routine à renommer :
`surfex/new/coupling_seaflux_sbln.F90 en`
`surfex/sea/phys/coupling_seaflux_sbl.F90`

Some modifications in namelists :
Leave LPWG at FALSE in namelist NAM_SEAFLUXn, which is not the case for the e-suite, if not Abort in `surfex/new/ecume_flux.F90` :

```
IF(LPWG) THEN
   CALL ABOR1_SFX('Ecume_flux : Correction of fluxes due to gustiness was removed, LPWG should be at false')
ENDIF
```

The first Surfex test did crash in "fpcica" around the computation of CAPE/CIN for the pre cycle. This is because diagnostic fields were incorrect at time step 0.
The bug was in cnt4 (a modification by climate team). I corrected it and no more crash in fpcica.
~mrpe731/pack/cy37_t1.04.SX20r411.x.pack/src/ > diff local/arp/control/cnt4.F90 inter.1/arp/control/cnt4.F90
353c353
< ! LCALLSFX=.FALSE.   ! Diagnostic step ==> no call to surfex
---
>   LCALLSFX=.FALSE.   ! Diagnostic step ==> no call to surfex

I did also some modification in arp/fullpos/endpos.F90 to prevent some « débordement de tableaux » :

/cnrm/gp/mrpe/mrpe731/pack/cy37_t1.04.SX20r411.x.pack/src/ > diff

```
local/arp/fullpos/endpos.F90 main/arp/fullpos/endpos.F90
319,322c319,320
< !REAL(KIND=JPRB) :: ZPTB(KPROMA,NFP3I)    ! Pressure of iso-T
< !REAL(KIND=JPRB) :: ZHTB(KPROMA,NFP3I)    ! Height of iso-T
< REAL(KIND=JPRB) :: ZPTB(KPROMA,MAX(NFLEVG,KOPLEV))    ! Pressure of iso-T
< REAL(KIND=JPRB) :: ZHTB(KPROMA,MAX(NFLEVG,KOPLEV))    ! Height of iso-T
---
> REAL(KIND=JPRB) :: ZPTB(KPROMA,NFP3I)    ! Pressure of iso-T
> REAL(KIND=JPRB) :: ZHTB(KPROMA,NFP3I)    ! Height of iso-T
759c757
<       IF (ILCL(JI) > 0 .AND. ILCL(JI) <= NFLEVG) THEN
---
>       IF (ILCL(JI) > 0) THEN
764c762
```

```
<       IF (IFCL(JI) > 0 .AND. IFCL(JI) <= NFLEVG) THEN
---
>       IF (IFCL(JI) > 0) THEN
769c767
<       IF (IEL(JI) > 0 .AND. IEL(JI) <= NFLEVG) THEN
---
>       IF (IEL(JI) > 0) THEN
```

I think this modification should be re checked by a more expert person.

For the forecast, it crashes (division by zero in `surfex/surf_atm/phys/sso_z0_friction_n.F90`) if you put nothing in XFRACZ0 (the default value (2.0) is erased after UPDATE_NAM_SSOn).
First solution was to put something in NAM_SSOn

```
&NAM_SSOn
  XFRACZ0=10.,
/
```

I put 10 which is the default value for `al36t1_op2`.

My investigation concerning the erasement of default values for NAM_SSOn, lead me to the logical variable LNAM_READ which is put to FALSE at the end of surfex/offlin/read_all_namelists.F90

For the COUPLINGSURF, I have :

```
sans NAM_SSOn (default values (NONE, 2.0):
[STDOUT] :  jidane modd_surf_atm_sson : XFRACZ0=  5.788693478492201D-04
[STDOUT] :  jidane modd_surf_atm_sson : XFRACZ0=  5.788693478492201D-04
[STDOUT] :  0 jidane, init_surf_atmn, CROUGH=
[STDOUT] :  1 jidane, init_surf_atmn, CROUGH=NONE XFRACZ0=  2.000000000000000
[STDOUT] :  LNAM_READ=  F
[STDOUT] :  jidane modn_sso:UPDATE_NAM_SSOn : CROUGH=
[STDOUT] :  jidane modd_surf_atm_sson : XFRACZ0=  0.000000000000000D+00

avec NAM_SSOn (Z01D, 10.):
[STDOUT] :  jidane modd_surf_atm_sson : XFRACZ0=  5.788693478492201D-04
[STDOUT] :  jidane modd_surf_atm_sson : XFRACZ0=  5.788693478492201D-04
[STDOUT] :  0 jidane, init_surf_atmn, CROUGH=
[STDOUT] :  1 jidane, init_surf_atmn, CROUGH=NONE XFRACZ0=  2.000000000000000
[STDOUT] :  LNAM_READ=  F
[STDOUT] :  jidane modn_sso:UPDATE_NAM_SSOn : CROUGH=Z01D XFRACZ0=
10.00000000000000
[STDOUT] :  jidane modd_surf_atm_sson : XFRACZ0=  10.00000000000000

sans la NAM_SSOn, mais en modifiant le code pour que LNAM_READ=.T.
(en desactivant LNAM_READ=.F. en fin du surfex/offlin/read_all_namelists.F90)

[STDOUT] :  jidane modd_surf_atm_sson : XFRACZ0=  5.788693478492201D-04
[STDOUT] :  jidane modd_surf_atm_sson : XFRACZ0=  5.788693478492201D-04
[STDOUT] :  0 jidane, init_surf_atmn, CROUGH=
[STDOUT] :  1 jidane, init_surf_atmn, CROUGH=NONE XFRACZ0=  2.000000000000000
[STDOUT] :  LNAM_READ=  T
[STDOUT] :  jidane modn_sso:INIT_NAM_SSOn : CROUGH=NONE XFRACZ0=
2.000000000000000
[STDOUT] :  jidane modn_sso:UPDATE_NAM_SSOn : CROUGH=NONE XFRACZ0=
2.000000000000000
```

Yann Seity has found that LNAM_READ must stay FALSE in our case (ALADIN and AROME). The case TRUE is for MesoNH when they run some nested models with different namelists.

The problem that I met (erasement of default values for NAM_SSOn) was caused by a lack of default initialization of CROUGH and XFRACZ0 (via a call to DEFAULT_SSO) in `surfex/new/read_namelists_surfn.F90`.

Yann has also modified slightly two routines in the spirit of what Stéphanie FAROUX has done for the V7 of Surfex :

```
surfex/surf_atm/module/modd_surf_atm_sson.F90
surf_atm/init/init_surf_atmn.F90
```

Even with this modification, the results from couplingsurf are not correct for the pre cycle.

A plot of the reservoirs (Temp, Water, Ice, Snow) from the output of couplingsurf between 36t1_op2 and 37_t1.04 could be found on delage :
~mrpe731/201104/couplingsurf_plots.pdf

I checked the fullpos files which are sent to Surfex in the PREP task between 36t1_op2 and the pre-cycle, and they are exactly the same. So the problem is clearly on SURFEX side or in the interface between surfex and fullpos.

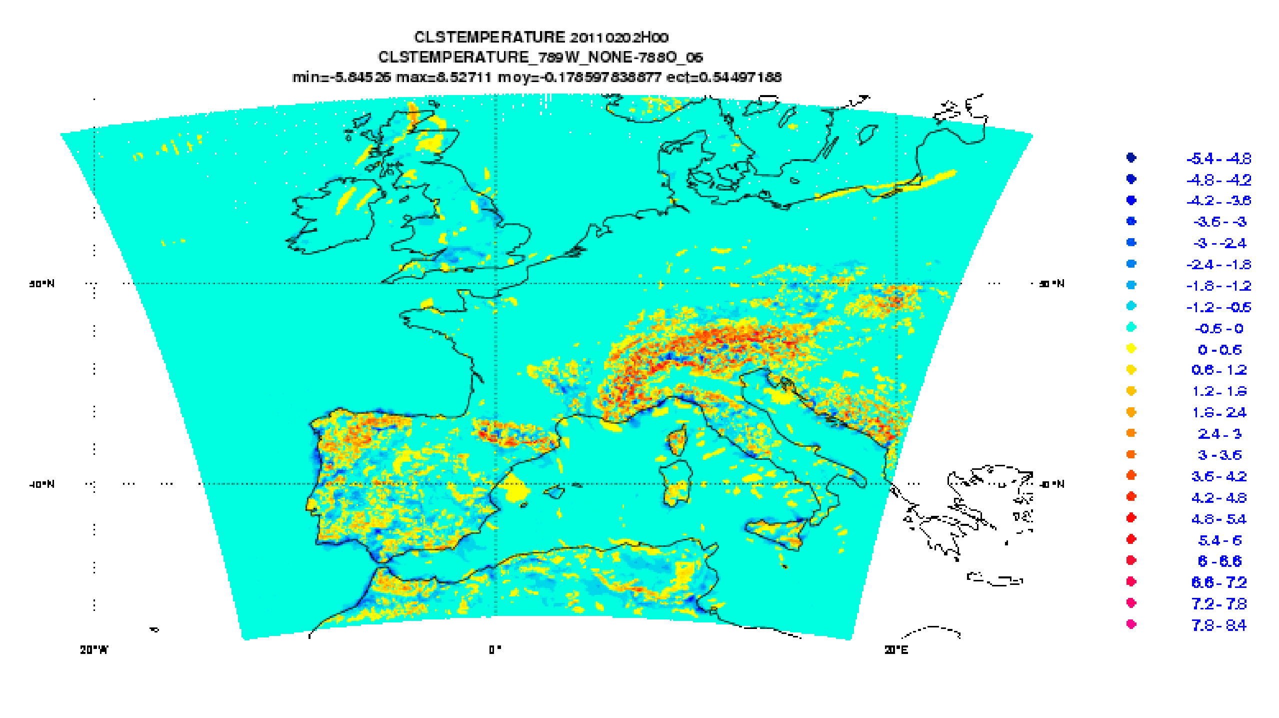
Since the couplingsurf is incorrect for the pre cycle, for the forecast, I decide to start from the surface file of 36t1_op2.
By plotting some fields (cougar : ~mrpe731/201104/789F_788O/*.pdf), we can say that there is no reproductibility with 36t1_op2.

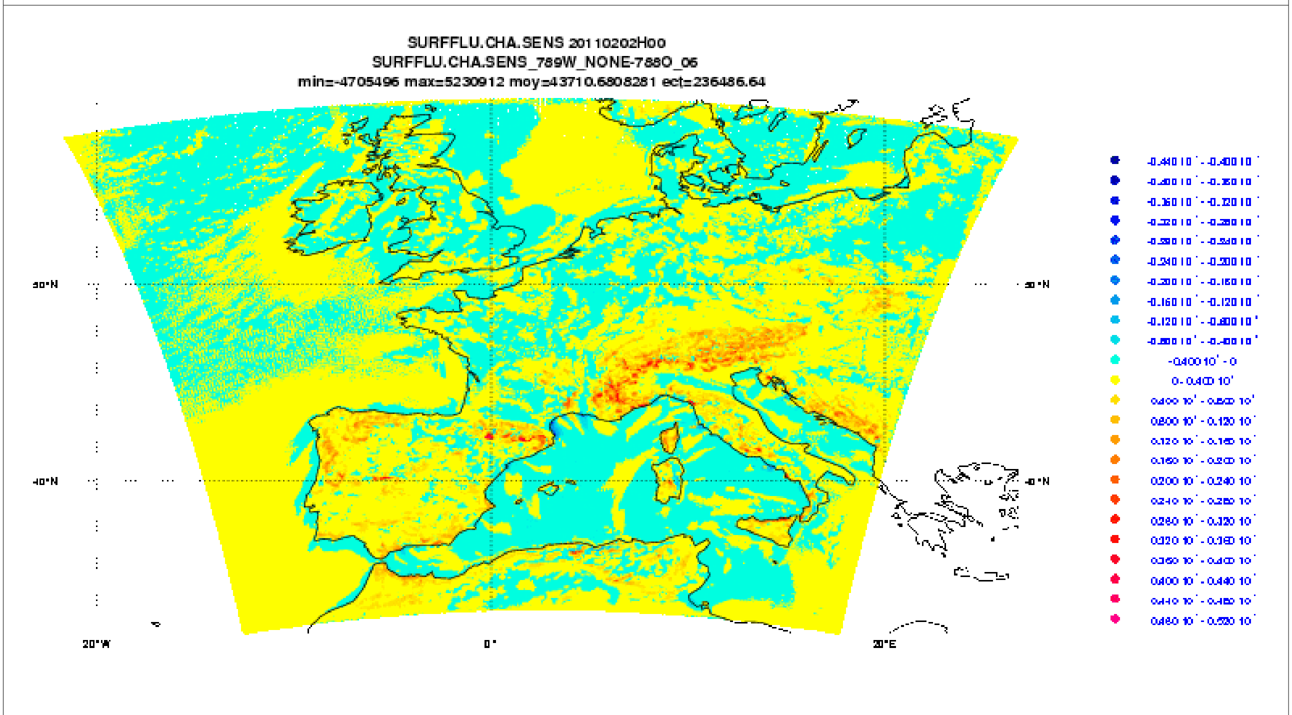
The problem with couplingsurf seems to disappear by commenting some lines that were added in v6 of Surfex in routine isba/init/read_prep_isba_conf.F90 which in our case, snow is initialized uniformly and not reading the field from the buffer.

With this modification, every things goes well in couplingsurf task (I mean the reservoirs between pre cycle and 36t1_op2 are exactly the same).

You will find, on my pack under yuki, all the last modset for Aladin+Surfex :
/cnrm/gp/mrpe/mrpe731/pack/cy37_t1.04.SX20r411.x.pack/

I tried several forecast experiments, with Fullpos inline, Fullpos offline, with CROUGH='NONE' and CROUGH='Z01D' in NAM_SSOn. None of this experiments could reproduce the 36t1_op2.
The differences on T2m seems to be correlated with Chaleur sensible flux.


CLSTEMPERATURE 20110202H00
CLSTEMPERATURE_789W_NONE-788O_06
min=-5.84526 max=8.52711 moy=-0.178597838877 ect=0.54497188
50°N
40°N
20°W
0°
20°E
-5.4 - -4.8
-4.8 - -4.2
-4.2 - -3.6
-3.6 - -3
-3 - -2.4
-2.4 - -1.8
-1.8 - -1.2
-1.2 - -0.6
-0.6 - 0
0 - 0.6
0.6 - 1.2
1.2 - 1.8
1.8 - 2.4
2.4 - 3
3 - 3.6
3.6 - 4.2
4.2 - 4.8
4.8 - 5.4
5.4 - 6
6 - 6.6
6.6 - 7.2
7.2 - 7.8
7.8 - 8.4


SURFFLU.CHA.SENS 20110202H00
SURFFLU.CHA.SENS_789W_NONE-788O_06
min=-4705496 max=5230912 moy=43710.6808281 ect=236486.64
50°N
40°N
20°W
0°
20°E