Coupling SURFEX_V7.2 to ALARO-1 baseline version (CY38T1OP3)

Rafiq Hamdi
Royal Meteorological Institute of Belgium

Stay at the CHMI: 22 February - 6 March 2015

1. Compilation issues

This work is based on the reference (OP3) cycle 38T1OP3 from Ivan:

A copy is created under my account **/worklocal/mma202/CY38T1OP3**

No issue in the compilation but I should put a copy of the reference Sfx directory into my account in order to be able to execute SURFEX.

Finally you should run **/worklocal/mma202/CY38T1OP3/link_38_z** in order to create the executable.

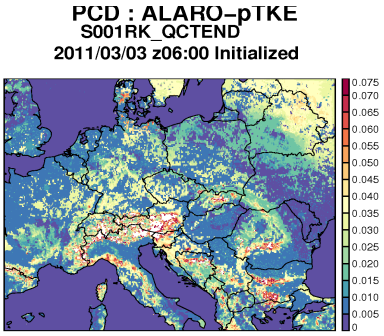
Test has been done for the 03/03/2011 r06

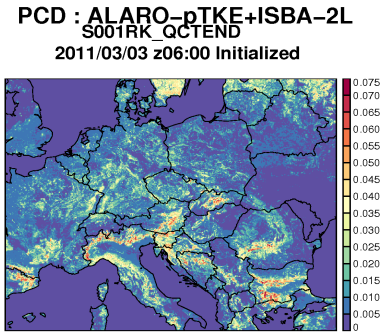
2. Run SURFEX coupled to ALARO with the pTKE scheme

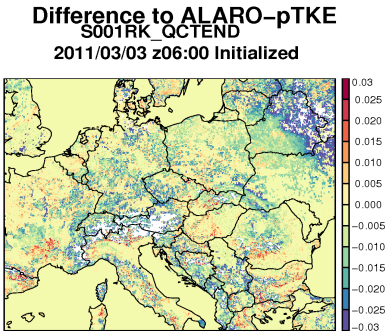
To run ALARO (pTKE) with SURFEX the issue of the exchange coefficient should be solved. The solution that I proposed for CY38T1 is now introduced in this new cycle interfacing the average drag coefficient PCD calculated from SURFEX and to initialize its value for the first time step to the PCDN calculated from the upper air.

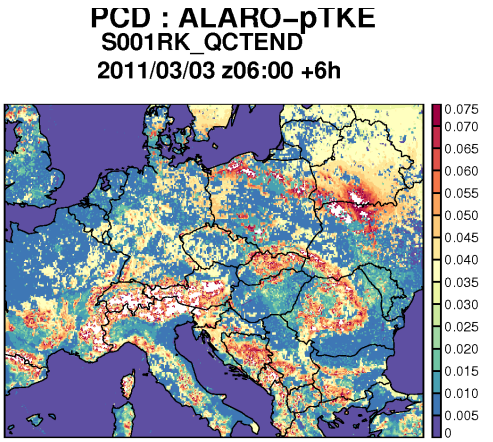
2.1 ALARO-pTKE Versus ALARO-pTKE+SURFEX (ISBA 2L)

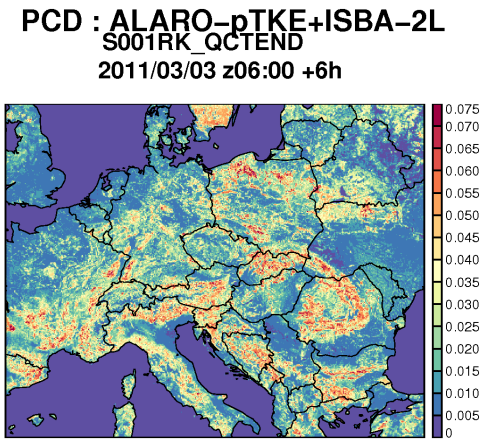
2.1.1 Using the stability function in SURFEX to compute the PCD

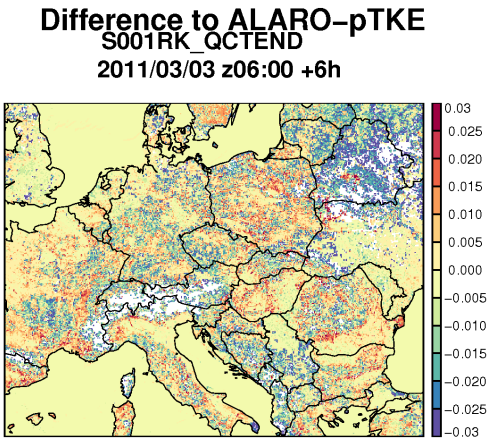












We can see that the drag coefficient over **orographic** ans **snow** covered areas is different, with and without SURFEX, were SURFEX seems to underestimate its values.

These test are done using

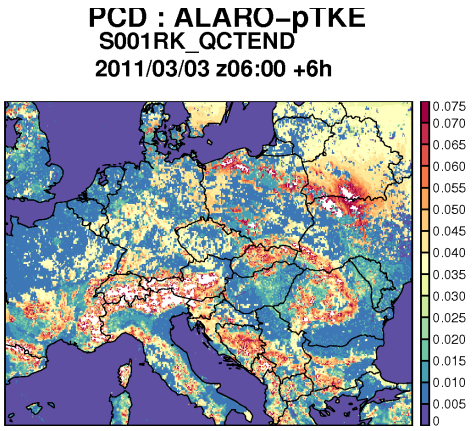
&NAM_SSOn
CROUGH="Z01D",
XFRACZ0=15.,
/

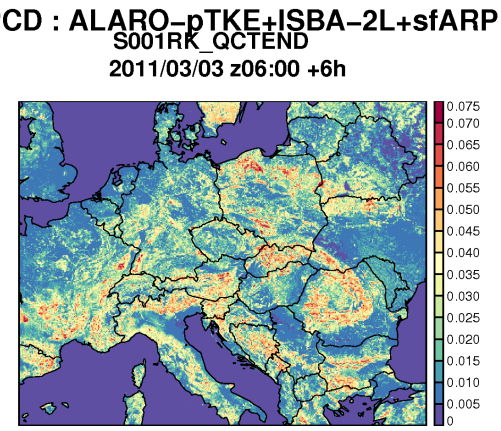
A test should be done with the different options within SURFEX in namelist **NAM_SSOn** and compare with the one in ALARO.
Note this test **CROUGH="Z04D", did not work.**

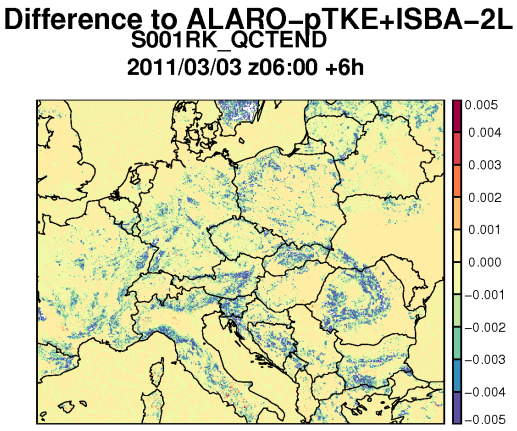
2.1.2 Using the stability function in SURFEX to compute the PCD and LDRAG_COEF_ARP=.T.

With this option we will use the same coefficient in the stability function as in ARPEGE ALADIN and not the ones by default within SURFEX.

But this did not reduce the differences but rather increase the underestimation of the orographic drag coefficient.



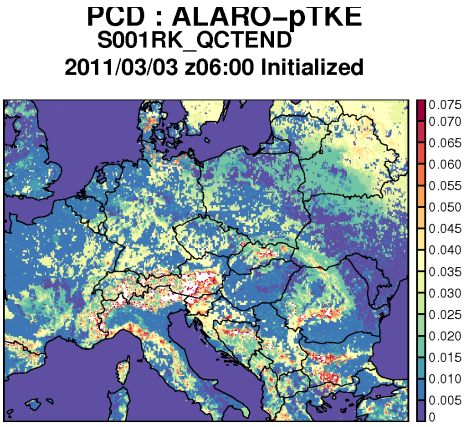


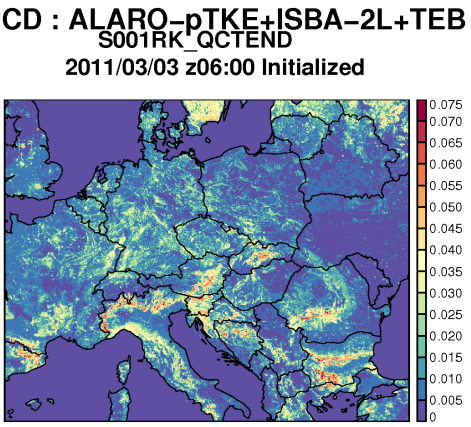


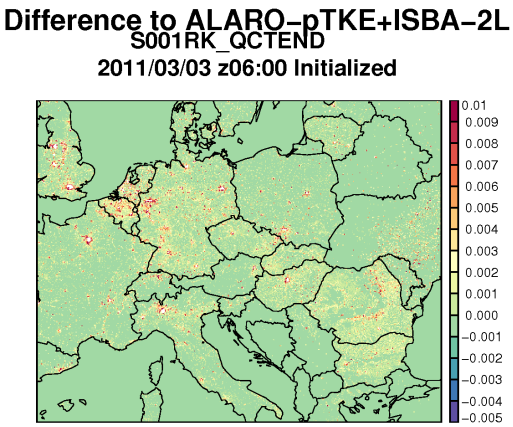
2.2 ALARO-pTKE Versus ALARO-pTKE+ISBA 2L+TEB

This test is done with **LDRAG_COEF_ARP=.F.** And therefore with the default value in SURFEX.

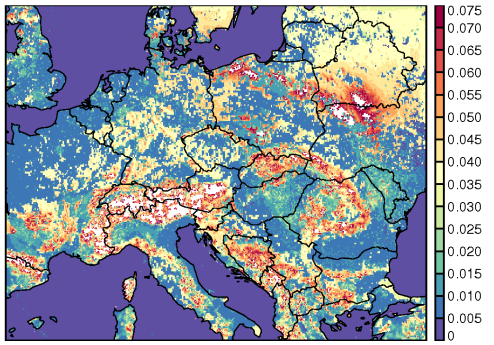
As we can clearly see now the PCD takes into account the additive drag effect of the different big cities within the LACE domain.



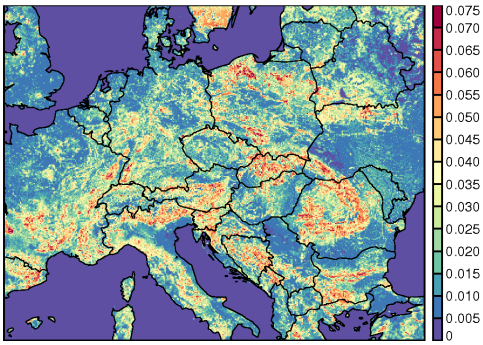




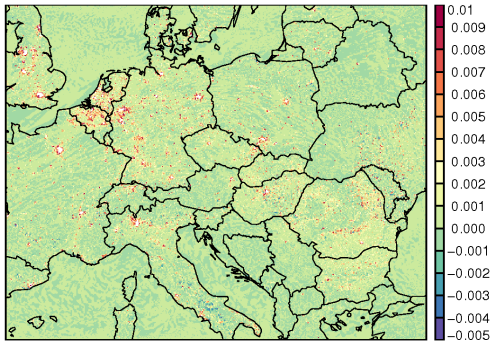
PCD : ALARO-pTKE
S001RK_QCTEND
2011/03/03 z06:00 +6h



PCD : ALARO-pTKE+ISBA-2L+TEB
S001RK_QCTEND
2011/03/03 z06:00 +6h



Difference to ALARO-pTKE+ISBA-2L
S001RK_QCTEND
2011/03/03 z06:00 +6h



3. Run SURFEX coupled to ALARO with TOUCANS scheme

In order to be able to run TOUCANS with SURFEX we have now to interface both the PCD as in the pTKE scheme but also the PCDN. However, since with TOUCANS one should use the same stability function at the surface as well as in the upper air, the new stability functions of TOUCANS are now coded within key LDRAG_COEF_ARP of SURFEX and the PCD is now computed with these new stability functions. All these switches has been added in EXSEG1.nam namelist:

```
&NAM_SURF_ATM
  XRIMAX=0.2,
  LRRGUST_ARP=.FALSE.,
!---------TOUCANS stability functions
 LDRAG_COEF_ARP=.FALSE.,
  LXCOEFKTKE=.FALSE.,
  LXCOEFK_F1=.FALSE.,
  CXGTURS='MD2',
  CX3TKEFREE=1.183,
  EXTKE_OLAM=0.29,
  NXUPTKE=0.5265,
  RXLOUIS_S0=0.136,
  PXLOUIS_S0=0.130,
  RXLOUIS_GU1=-2.67,
  RXLOUIS_GU2=-6.15,
  PXLOUIS_GU1=-1.13,
  PXLOUIS_GU2=-3.80,
  RXLOUIS_GS1=1.0,
  RXLOUIS_GS2=2.08,
  RXLOUIS_GS3=1.0,
  RXLOUIS_GS4=2.7,
  PXLOUIS_GS1=1.0,
  PXLOUIS_GS2=1.93,
  PXLOUIS_GS3=1.1,
  PXLOUIS_GS4=3.55,
  EFBX_AZ0=0.2,
  EFBX_UR=0.4545,
  RXEFB_1=9.0,
  RXEFB_2=5.0,
  RXEFB_3=-11.0,
  RXQNSE_S0=0.359,
  RXQNSE_GU1=-0.24,
  RXQNSE_GU2=-0.53,
  RXQNSE_GS1=8.8,
  RXQNSE_GS2=0.13,
  RXQNSE_GS3=20.0,
```

RXQNSE_GS4=0.5,
The following routines has also been modified:
Arp/phys_dmn/aplpar.F90
Arp/phys_dmn/apl_arome.F90
Arp/phys_dmn/actkezotls.F90

Mse/externals/aro_ground_diag.F90
Mse/interface/aro_ground_diag.h
Mse/programs/driver_off_omp.F90

Sfx/interfaces/modi_get_fluxn.F90
Sfx/interfaces/modi_diag_tebn.F90
Sfx/interfaces/modi_diag_watfluxn.F90
Sfx/interfaces/modi_diag_flaken.F90
Sfx/interfaces/modi_diag_naturen.F90
Sfx/interfaces/modi_diag_isban.F90
Sfx/interfaces/modi_diag_sean.F90
Sfx/interfaces/modi_diag_seafluxn.F90
Sfx/interfaces/modi_average_diag.F90
Sfx/interfaces/modi_diag_townn.F90
Sfx/interfaces/modi_diag_inland_watern.F90
Sfx/interfaces/modi_default_surf_atm.F90
Sfx/interfaces/modi_surface_cdch_1darp.F90
Sfx/SURFEX/get_fluxn.F90
Sfx/SURFEX/get_surf_varn.F90
Sfx/SURFEX/diag_inline_seafluxn.F90
Sfx/SURFEX/diag_seafluxn.F90
Sfx/SURFEX/diag_inline_tebn.F90
Sfx/SURFEX/diag_tebn.F90
Sfx/SURFEX/diag_inline_watfluxn.F90
Sfx/SURFEX/diag_watfluxn.F90
Sfx/SURFEX/modd_diag_idealn.F90
Sfx/SURFEX/diag_isba_initn.F90
Sfx/SURFEX/modd_diag_isban.F90
Sfx/SURFEX/average_diag_isban.F90
Sfx/SURFEX/unpack_diag_patchn.F90
Sfx/SURFEX/modd_diag_seafluxn.F90
Sfx/SURFEX/modd_diag_surf_atmn.F90
Sfx/SURFEX/alloc_diag_surf_atmn.F90
Sfx/SURFEX/dealloc_diag_surf_atmn.F90
Sfx/SURFEX/diag_surf_atmn.F90
Sfx/SURFEX/modd_diag_tebn.F90
Sfx/SURFEX/modd_diag_watfluxn.F90

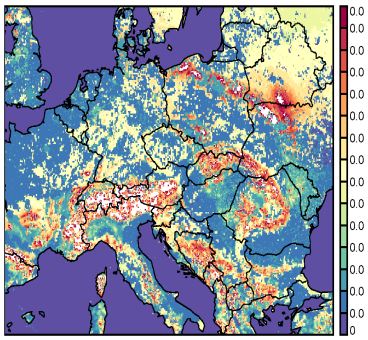
Sfx/SURFEX/modd_diag_flaken.F90
Sfx/SURFEX/diag_inline_flaken.F90
Sfx/SURFEX/diag_inline_isban.F90
Sfx/SURFEX/diag_naturen.F90
Sfx/SURFEX/diag_isban.F90
Sfx/SURFEX/diag_sean.F90
Sfx/SURFEX/average_diag.F90
Sfx/SURFEX/diag_townn.F90
Sfx/SURFEX/diag_inland_watern.F90
Sfx/SURFEX/diag_flaken.F90
Sfx/SURFEX/diag_ideal_initn.F90
Sfx/SURFEX/diag_flake_initn.F90
Sfx/SURFEX/diag_seaflux_initn.F90
Sfx/SURFEX/diag_teb_initn.F90
Sfx/SURFEX/diag_watflux_initn.F90
Sfx/SURFEX/drag.F90
Sfx/SURFEX/surface_cdch_1darp.F90
Sfx/SURFEX/ice_sea_flux.F90
Sfx/SURFEX/modd_surf_atm.F90
Sfx/SURFEX/modn_surf_atm.F90
Sfx/SURFEX/read_namelists_surf.F90
Sfx/SURFEX/default_surf_atm.F90
Sfx/SURFEX/init_surf_atmn.F90
Sfx/SURFEX/isba_flood_properties.F90
Sfx/SURFEX/water_flux.F90
Sfx/SURFEX/urban_exch_coef.F90

3.1 ALARO-TOUC Versus ALARO-TOUC+SURFEX (ISBA 2L)

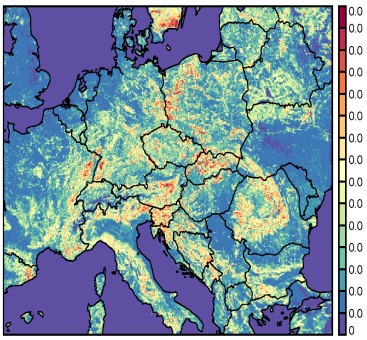
Using the stability function of TOUCANS in SURFEX to compute the PCD

```
&NAM_SURF_ATM
 LDRAG_COEF_ARP=.TRUE.,
 LXCOEFKTKE=.TRUE.,
 LXCOEFK_F1=.TRUE.,
 CXGTURS='MD2',
```

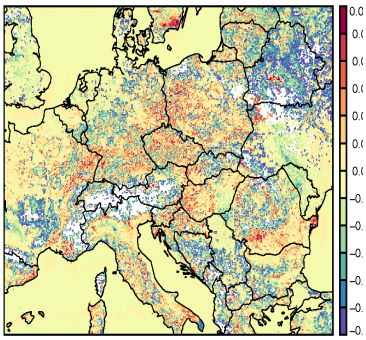
PCD : ALARO-TOUC
S001RK_QCTEND
2011/03/03 z06:00 +6h



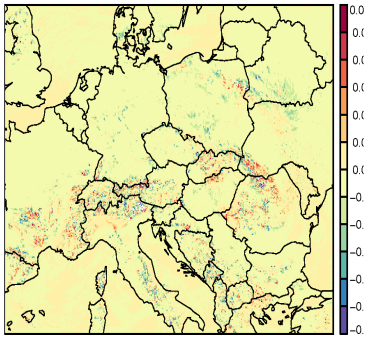
PCD : ALARO-TOUC+ISBA-2L
S001RK_QCTEND
2011/03/03 z06:00 +6h



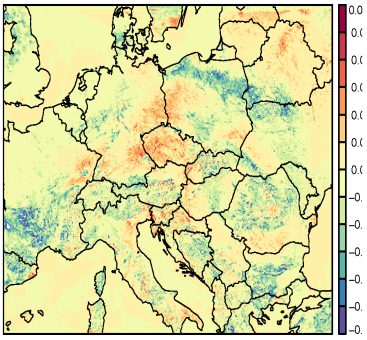
Difference to ALARO-TOUC
S001RK_QCTEND
2011/03/03 z06:00 +6h



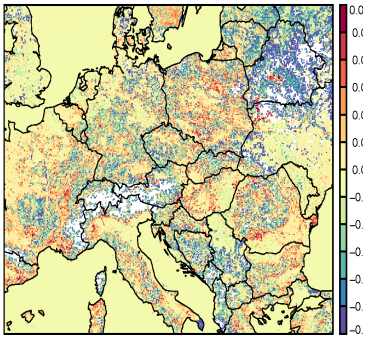
Difference to ALARO-pTKE
S001RK_QCTEND
2011/03/03 z06:00 +6h



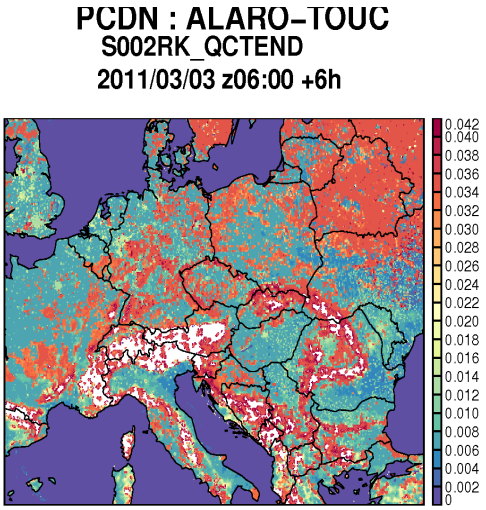
Difference to ALARO-pTKE+ISBA-2L
S001RK_QCTEND
2011/03/03 z06:00 +6h

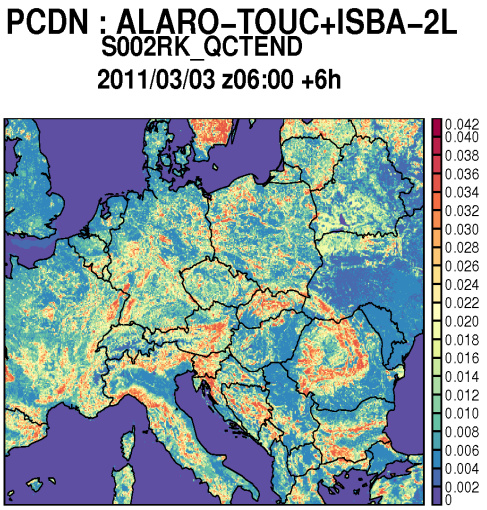


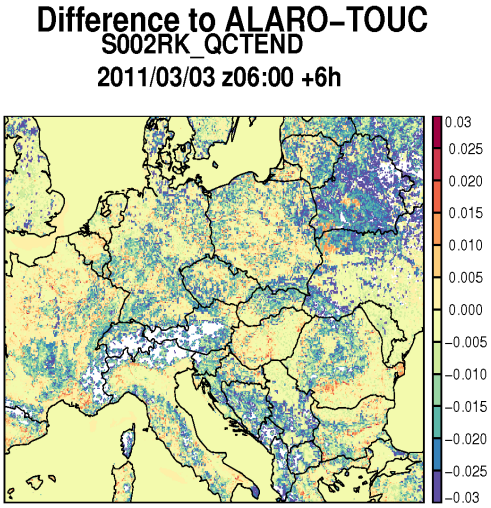
Difference to ALARO-pTKE
S001RK_QCTEND
2011/03/03 z06:00 +6h



and the PCDN:



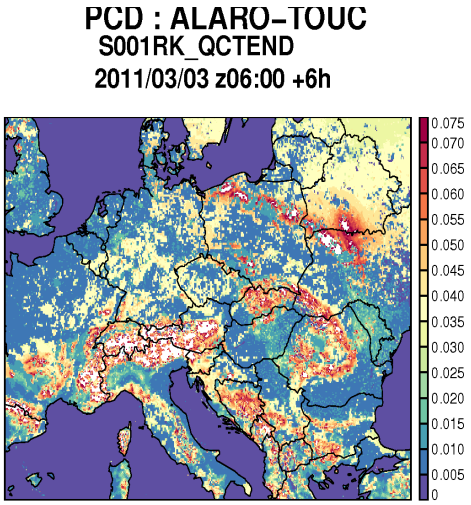


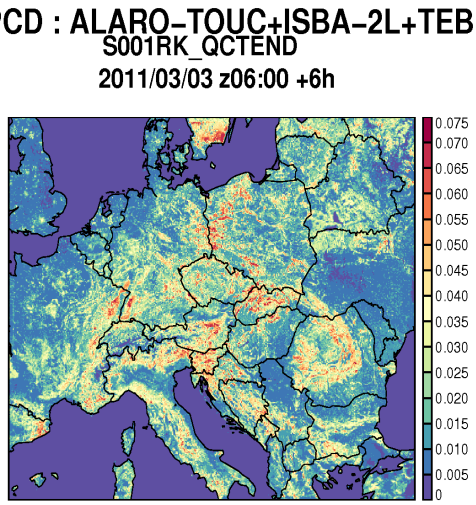


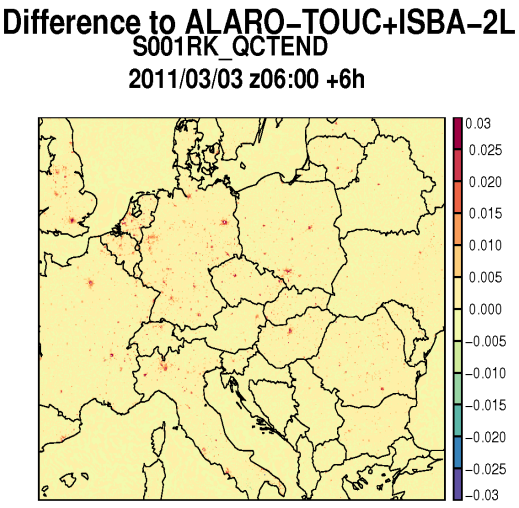
Still the differences of drag over orographic areas.

3.2 ALARO-TOUC Versus ALARO-TOUC+ISBA 2L+TEB

This test is done with **LDRAG_COEF_ARP=.T.** And therefore with the TOUCANS stability functions used for ISBA and TEB within SURFEX.







3.3 ALARO-TOUC Versus ALARO-TOUC+ISBA 2L+TEB++

This last test is done putting all the logical keys related to ARPEGE/ALADIN computation TRUE in namelist:

&NAM_SURF_ATM

LALDTHRES=.TRUE.,

XCISMIN=0.5500E-03,

XVMODMIN=0.,

LALDZ0H=.TRUE.,

LVZIUSTAR0_ARP=.TRUE.

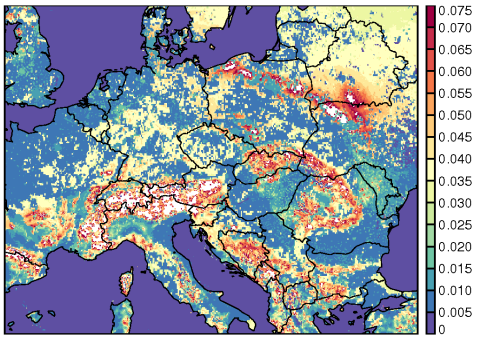
LRRGUST_ARP=.TRUE.,

LCPL_ARP=.TRUE.

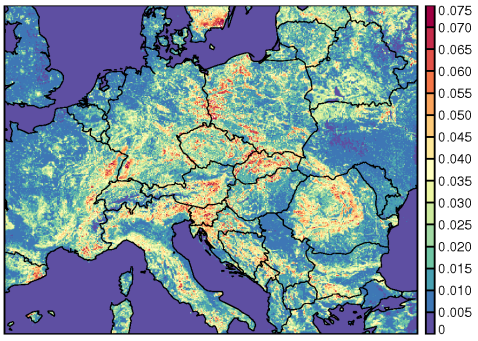
LDRAG_COEF_ARP=.TRUE.,

This should reduce the differences in the way of the computation of roughness length and the drag coefficient.

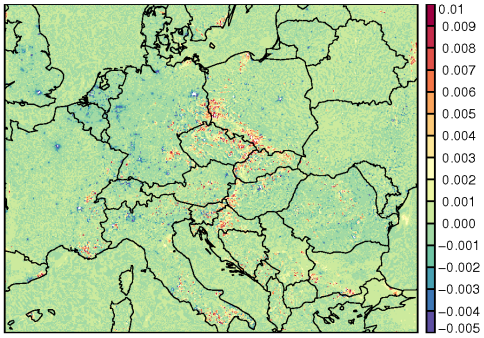
PCD : ALARO−TOUC
S001RK_QCTEND
2011/03/03 z06:00 +6h



PCD : ALARO−TOUC+ISBA−2L+TEB
S001RK_QCTEND
2011/03/03 z06:00 +6h

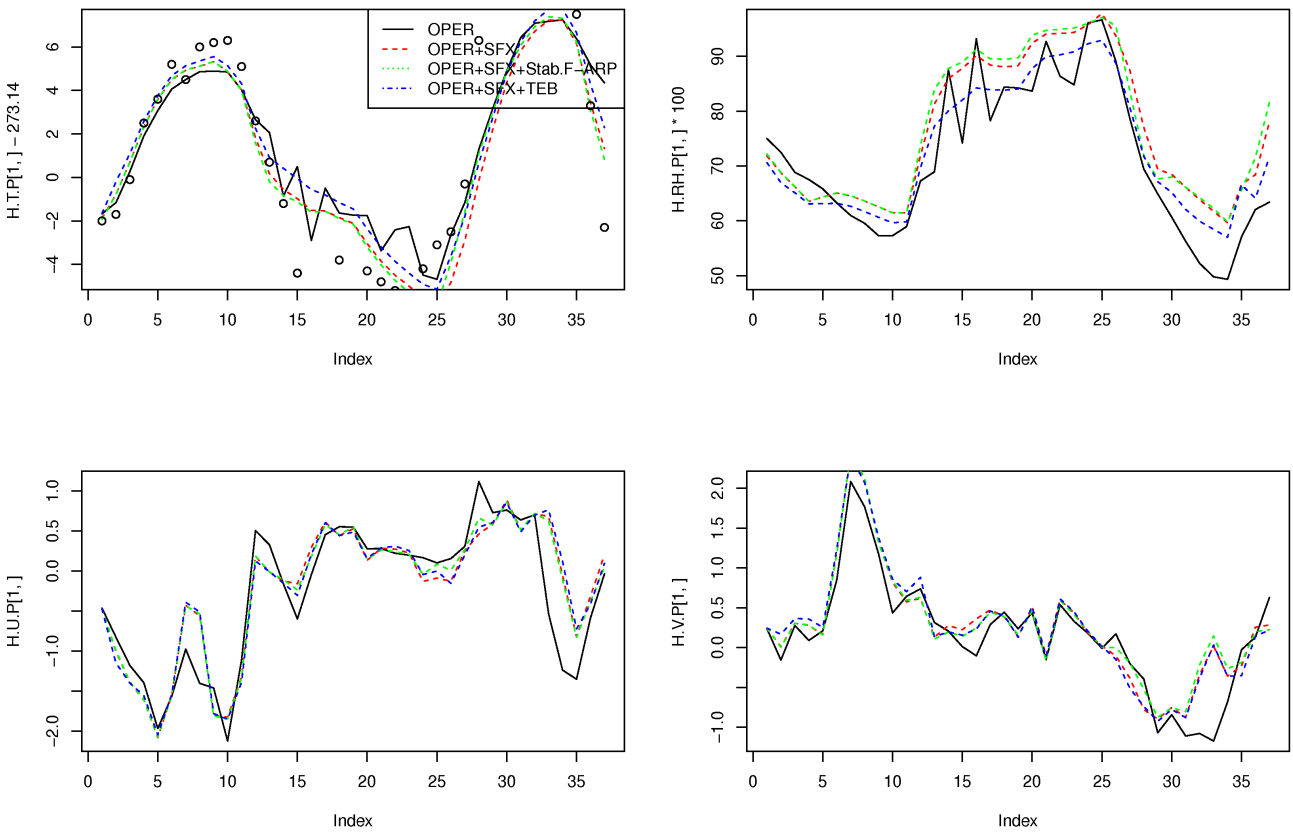


Difference to ALARO−TOUC+ISBA−2L
S001RK_QCTEND
2011/03/03 z06:00 +6h

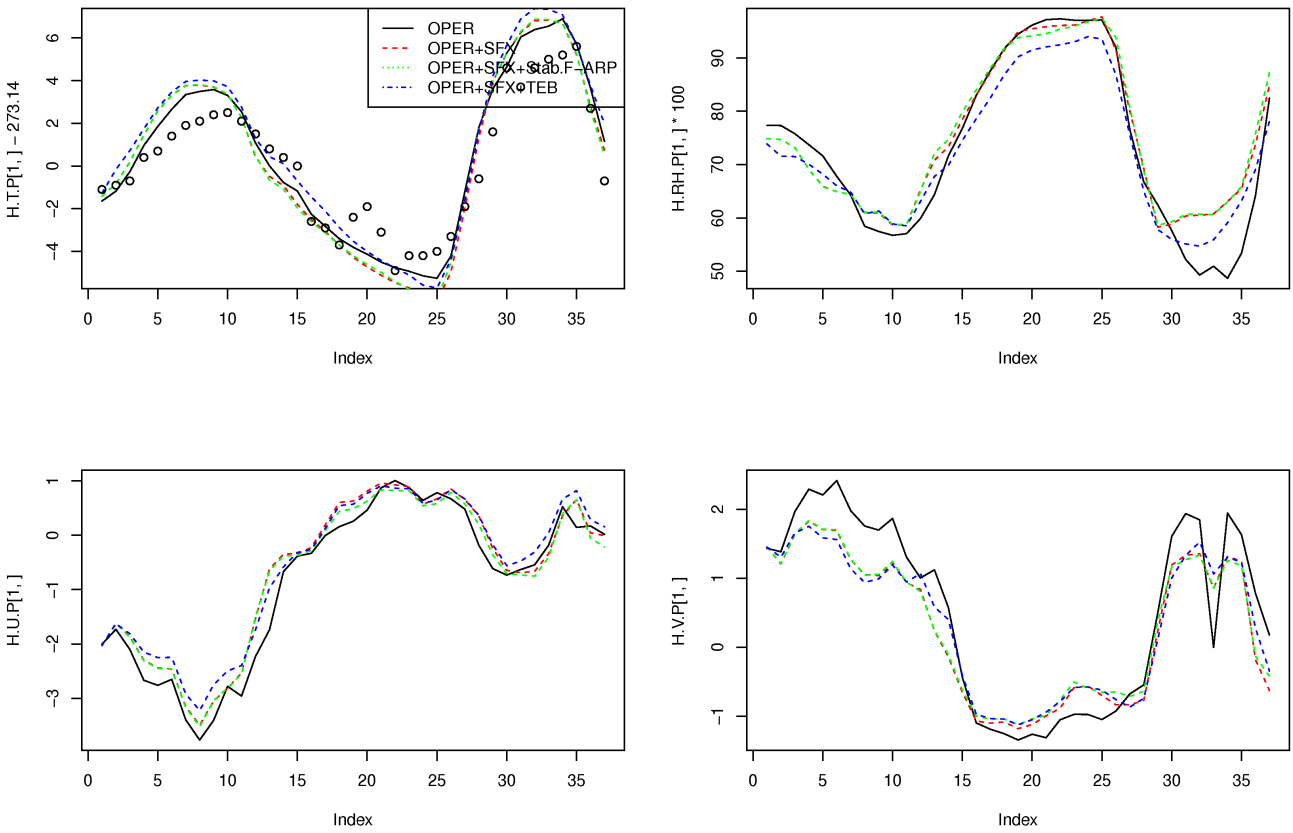


4. Time series 03.03.2011
4.1. pTKE

4.1.1 Station Kromeriz

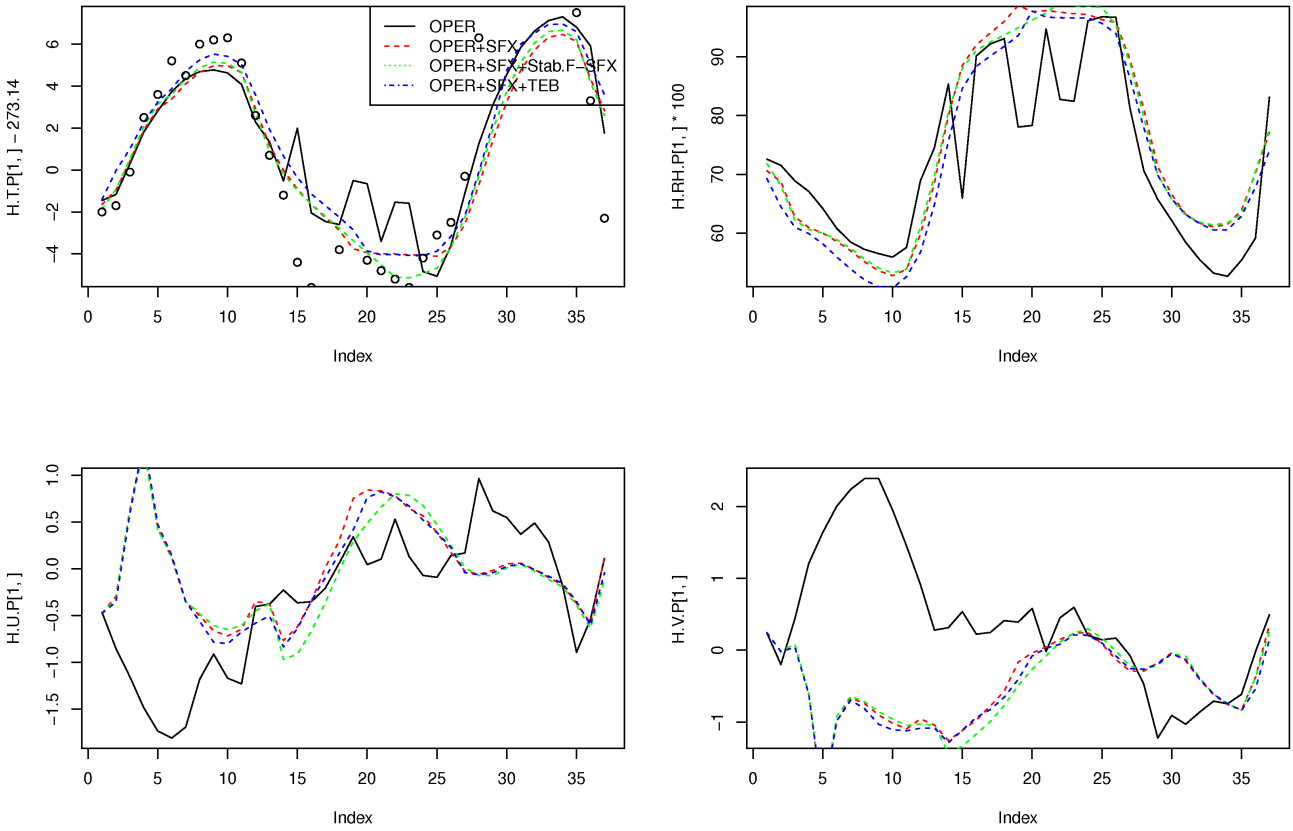


4.1.2 Station Brno



4.2. TOUCANS

4.2.1 Station Kromeriz



4.2.2 Station Brno