Coupling SURFEX_V8 to ALARO-1 for CY43T2

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This work is based on CY43T2 a copy is on my directory:
/data/users/ext002/pack/sfx1

No compilation issue related to SURFEX_V8.
Below are the following steps to be done for running SURFEX coupled to ALARO

1. PGD

This is to create the climate file for surfex and it should be **FA format** and called **Const.Clim.sfx.**
The compilation script is:
/data/users/ext002/pack/sfx1/ics_pgd
The working directory is:
/work/users/ext002/pgd
The namelist is /work/users/ext002/pgd/OPTIONS.nam
There is a now a possibility to have the output directly in FA format:
NAM_IO_OFFLINE
CSURF_FILETYPE = 'FA '
CPGDFILE='Const.Clim.sfx.2L.LACE'

But the output is not compatible with the upper air files: problem of the extension zone definition.
Action: to be investigated

Second solution is to have the output in LFI format and to use a tool to convert from LFI to FA:
CSURF_FILETYPE = 'LFI '
CPGDFILE='Const.Clim.sfx.2L.LACE.lfi'

Then convert it into FA with the LFITOOLS and SFXTOOLS, the compilation script is:
/data/users/ext002/pack/sfx1/ics_sfxtools
/data/users/ext002/pack/sfx1/ics_lfitools

The command line are the following:

/data/users/ext002/pack/sfx1/bin/LFITOOLS faempty const.clim.SHMU Const.Clim.sfx
This is in order to create first an empty FA file with the correct header from an existing FA file (**const.clim.SHMU**)

/data/users/ext002/pack/sfx1/bin/SFXTOOLS sfxlfi2fa --sfx-fa--file Const.Clim.sfx --sfx-lfi-file PGD_LACE_2L.lfi

Note that **NHALO** should be tuned for your domain, for LACE domain 26 is the minimum value:

&NAM_IO_OFFLINE
CSURF_FILETYPE = 'FA '
CPGDFILE='Const.Clim.sfx.2L.LACE'
NHALO=26,

2. PREP

This is to create the initial state for SURFEX, and it should be **FA format** and called **ICMSHXXXXINIT.sfx.**
The compilation script is:
`/data/users/ext002/pack/sfx1/ics_prep`
The working directory is:
`/work/users/ext002/prep`
The namelist is /work/users/ext002/prep/OPTIONS.nam

There is a now a possibility to have the output directly in FA format:

```
&NAM_IO_OFFLINE
            LPRINT  = T ,
            CSURF_FILETYPE = "FA",
            NHALO=5,
```

But the output is not compatible with the upper air files: problem of the extension zone definition.
Action: to be investigated

Second solution is to have the output in LFI format and to use a tool to convert from LFI to FA, as shown in the PGD step.

The input files for the PREP step are the PGD file created previously and an upper air file for the initialisation, and this later should be only in **GRIB** format:

```
&NAM_PREP_SURF_ATM
            CFILE  = 'GRIB4PREP',
            CFILETYPE = 'GRIB  ',
            CFILEPGD = 'PGD.lfi',
            CFILEPGDTYPE = 'LFI',
```

Unfortunately, I did not succeed to use the initial file created by PREP , may be because of the GRIB conversion which was not correct I think. This routine has been modified and should be checked again: **mode_read_grib.F90**
A bug-fix that Francoise Taillefer send me related to the use of the 1-D snow scheme was used but did not solve the problem:
prep_hor_snow_fields.F90
prep_snow_buffer.F90
Action: to be investigated

3. Forecast

In your working directory, these surfex related files should be present:

- **Const.Clim.sfx** the pgd file created in step 1.
- **ICMSHAG1TINIT.sfx** the init file created in step 2.
- **ecoclimapI_covers_param.bin** pgd related binary file
- **ecoclimapII_eu_covers_param.bin** pgd related file
- **EXSEG1.nam** the forecat namelist for surfex

In order to turn on SURFEX, the following namelists should be adapted in the forecast namelist as follow:

For acraneb-2 and surfex **NSW and NSWB_MNH should be equal to 1**

&NAERAD
LRRTM=.F.,
LSRTM=.F.,
!switch for surfex
NSW=1,
/

&NAMPARAR
!surfex switch
NSWB_MNH=1
/

HIRLAM introduced a key in order to be able to use 6 bands, but I did not test this option.

&NAMPHY
LHLRADUPD=.F. ! should be T for NWS=NSWB_MNH=6
Action: to be investigated

&NAMARPHY
CCOUPLING='V', ! for runing surfex inline
LMSE=.TRUE., ! for runing surfex inline

&NAMCT0
!switch for surfex output
NSFXHISTS(0)=-25,
NSFXHISTS(0)=-0,-1,-2,-3,-4,-5,-6,-7,-8,-9,-10,-11,-12,-13,-14,-15,-16,-17,-18,-19,-20,-21,-22,-23,-24,

&NAMCT1
!switch for surfex output
N1SFXHIS=1,

The EXSEG1.nam namelist has been updated in order to be able to run alaro-1 with surfex by interfacing the exchange coefficient for drag PCD using the stability function of TOUCANS within SURFEX.

The TOUCANS stability functions has been introduced in SURFEX within the key LDRAG_COEF_ARP and therefore should be at TRUE.

&NAM_SURF_ATM
XRIMAX=0.2,
LNOSOF=.TRUE.,
LDRAG_COEF_ARP=.TRUE.,
/

In order to be able to use the drag coefficient from SURFEX the key LCOEF should be at TRUE:

&NAM_DIAG_SURFn
N2M=2,
LSURF_BUDGET=.TRUE.,
LCOEF=.TRUE.,
LSURF_VARS=.TRUE.,
/

Two aborts call has now been introduced in SURFEX in the routine **diag_surf_atmn.F90**

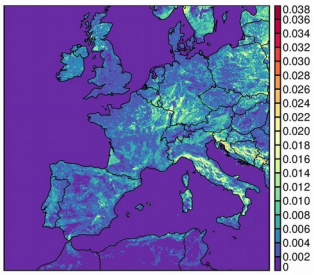
IF ((LPTKE.OR.LCOEFKTKE).AND.LMSE.AND.(.NOT.DGU%LCOEF)) CALL ABOR1_SFX('ALARO-0-1 PTKE+SURFEX then LCOEF should be T in EXSEG1.nam namelist')

IF ((LPTKE.OR.LCOEFKTKE).AND.LMSE.AND.(.NOT.LDRAG_COEF_ARP)) CALL ABOR1_SFX('TOUCANS Stab.Fun in SURFEX LDRAG_COEF_ARP should be at T')

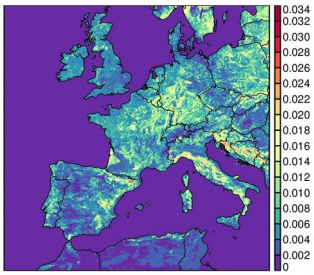
The list of routine that has been modified is:
SURFEX/diag_surf_atmn.F90
SURFEX/drag.F90
SURFEX/ice_sea_flux.F90
SURFEX/isba_snow_agr.F90
SURFEX/preps_for_meb_drag.F90
SURFEX/surface_cdch_1darp.F90
SURFEX/urban_exch_coef.F90
SURFEX/water_flux.F90
arpifs/phys_dmn/actkezotls.F90
arpifs/phys_dmn/aplpar.F90

The followings testes has been done using the set-up from Meteo-France (Mitraillette) used for the validation of aladin with surfex.

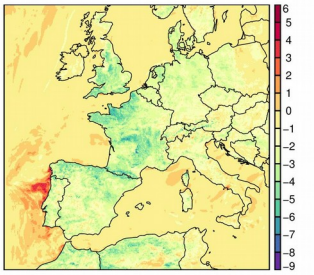
PCD−DIFF : PTKE−SURFEX
S001RK_QCTEND
2011/10/15 z00:00 +2h



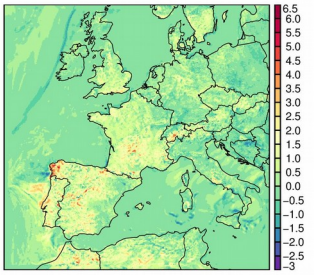
PCD−DIFF : TOUCANS−SURFEX
S001RK_QCTEND
2011/10/15 z00:00 +2h



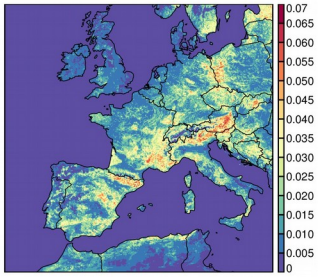
T2M−DIFF : PTKE−SURFEX
SFX.T2M
2011/10/15 z00:00 +2h



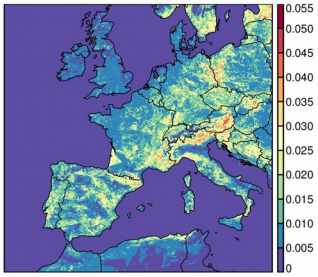
T2M−DIFF : TOUCANS−SURFEX
SFX.T2M
2011/10/15 z00:00 +2h



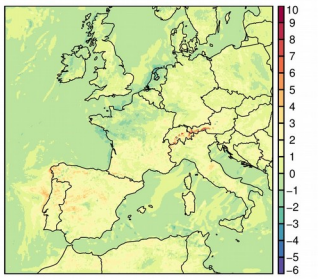
PCD−DIFF : PTKE−SURFEX
S001RK_QCTEND
2011/10/15 z00:00 +9h



PCD−DIFF : TOUCANS−SURFEX
S001RK_QCTEND
2011/10/15 z00:00 +9h



T2M−DIFF : PTKE−SURFEX
SFX.T2M
2011/10/15 z00:00 +9h



T2M−DIFF : TOUCANS−SURFEX
SFX.T2M
2011/10/15 z00:00 +9h