MUSC export version, Status of the cy37t1

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MUSC but previously SCUM

- SCUM (Single Column Unified Model) was not really "commercial" = dirt, dross, rubbish so now…MUSC for Modèle Unifié Simple Colonne in French

- MUSC exists since the cy32 (developed by S. Malardel) but since her departure the maintenance and the development have been postponed or done for specific 1D intercomparison GABLS3 or physics validation (TKE+KFB)

- The main advantage of MUSC should be **"to be fully integrated"** in the 3D model but unfortunately for several reasons (time, manpower, surfex version, forcing options etc ..) it is not the case !

**The current status : almost integrated excepted for
78 routines in src/local but …..for MUSC cy35t2**

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mse/internals/coupling_ideal_flux.mnh
mse/internals/coupling_tsz0_n.mnh
mse/internals/write_surft1.mnh
mse/internals/write_cover_tex_water.mnh
mse/internals/init_ideal_flux.mnh
mse/internals/read_default_seaflux_n.mnh
mse/internals/z0v_from_lai_1d.mnh
mse/internals/write_seaflux_n.mnh
mse/internals/coupling_seaflux_n.mnh
mse/internals/read_seaflux_conf_n.mnh
mse/internals/writesurf_pgd_seaf_par_n.mnh
mse/internals/read_pgd_seaflux_par_n.mnh
mse/internals/read_surft1_aro.mnh
mse/internals/write_gridtype_cartesian.mnh
mse/internals/ini_data_param.mnh
mse/internals/aroopen_namelist.mnh
mse/internals/albedo_mk10.mnh
mse/internals/prep_ver_isba.mnh
mse/module/modi_albedo_mk10.mnh
mse/module/modd_surf_par.mnh
recopie.F90
xrd/ddh/recpol.F90
xrd/ddh/const_ther.F90
xrd/ddh/fonctions.F90

arp/phys_dmn/acmicros.F90
arp/phys_dmn/wrarom.F90
arp/phys_dmn/acsol.F90
arp/phys_dmn/arocldia.F90
arp/phys_dmn/sutoph.F90
arp/phys_dmn/acturb.F90
arp/phys_dmn/actke.F90
arp/phys_dmn/mf_phys.F90
arp/phys_dmn/acvppkf.F90
arp/namelist/namtoph.h
arp/namelist/namlsforc.h
arp/adiab/cp_forcing.F90
arp/adiab/gpcty_forc.F90
arp/phys_ec/radheat.F90
arp/phys_ec/radlsw.F90
arp/setup/su0phy.F90
arp/setup/suarg.F90
arp/setup/sugridspa.F90
arp/setup/sulsforc.F90
arp/setup/suspsp.F90
arp/phys_dmn/acdifv2.F90
arp/phys_dmn/acpluiz.F90
arp/phys_dmn/recopie.F90
arp/phys_dmn/open_output_lfa.F90
arp/phys_dmn/acevolet.F90
arp/phys_dmn/acntcls.F90
arp/phys_dmn/aplpar.F90
arp/phys_dmn/wrscmr.F90

arp/adiab/cpphinp.F90
arp/adiab/cpg_gp.F90
arp/adiab/cpg.F90
arp/adiab/cpg_dyn.F90
arp/module/yomtoph.F90
arp/module/yomlsforc.F90
arp/module/yom_ygfl.F90
mpa/turb/externals/aro_shallow_mf.mnh
mpa/turb/internals/turb_ver_dyn_flux.mnh
mpa/turb/internals/turb_ver_thermo_flux.mnh
mpa/turb/internals/prandtl.mnh
mpa/turb/internals/shallow_mf.mnh
mpa/conv/internals/convect_trigger_shal.mnh
mpa/conv/internals/convect_closure_shal.mnh
mpa/conv/internals/convect_updraft_shal.mnh
mse/externals/aro_ground_diag.mnh
mse/externals/aroini_surf.mnh
mse/internals/isba_flood_properties.mnh
mse/internals/write_surfx1_aro.mnh
mse/internals/init_seaflux_n.mnh
mse/internals/read_surft1.mnh
mse/internals/z0v_from_lai_0d.mnh
mse/internals/tsz0.mnh
mse/internals/write_surft1_aro.mnh
mse/internals/z0v_from_lai_patch.mnh
mse/internals/z0v_from_lai_2d.mnh

MUSC already used by several countries ..

- MUSC-cy35t2 has been extensively used and updated (2010) for the two EUCLIPSE case : ASTEX Lagrangian and COMPOSITE case

- Several modifications in SURFEX v4.4 have been done for the forcing specification (varying SST, albedo)

- MUSC-cy35t2 has been already exported even if no "official" export version exists:
  - AEMET J. Calvo
  - KNMI C. de Bruijn, W de Roy
  - CHMI, P. Vana
  - SMHI L. Bengtsson

ARPEGE/ALADIN/AROME/IFS/HARMONIE/MUSC
A NWP unified sofware

GLOBAL (variable mesh or not) or LAM (choice made by NAMELIST) or 2D

Two dynamical cores (choice made by namelist)

Hydrostatic	Non hydrostatic

A set of physical packages (choice made by NAMELIST)

Hirlam	ALARO	ARPEGE-NWP ARPEGE/CLIMAT ALADIN	AROME	IFS

3D/4D Variational Algorithmic structure

Obs operators

OI assimilation scheme Used only for surface

Thanks to Y. Bouteloup.

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Physics package in MUSC

	ARPEGE/ALADIN	AROME	ARPEGE GIEC AR5	ALARO0
Coeff K diffusion	TKE – CBR2000 (HL) modified for Ku	TKE – CBR2000 (FL) modified for Ku	TKE-2.0/Mellor-Yamada 82 (Ricard Royer-93)	E-TKE
L Mixing length	BL89	BL 89	Profil quadratique (Lenderink et Holtslag, 2004)	Int. HCLA Ayotte
Shallow convection	KFB Bechtold et al 2000 (or EDKF from AROME)	EDKF Pergaud et al 2009	Via les TKE-2.0 + PDF humides (RR 93)	Geleyn 87 With e-TKE
Clouds	Smith(90) (or f0, f1, f2 Bougeault (82))	f0, f1, f2 Bougeault (82)	RR-93: PDF/f0,f1, f2; Bougeault (82)	Xu & Randall
Micro-Physics	Lopez mod ql,qi,qr,qs (PCS)	Ice3 5 variables	Kessler-Smith (1990)	ql,qi,qr,qs (PCS)
Convection	Bougeault 85 with modifications	No	Bougeault, 85 (figé V3: cycle 18)	3MT-deep
Radiation	ECMWF: LW=RRTM SW=Morcrette (93)	ECMWF: LW=RRTM SW=Morcrette (93)	ECMWF: LW=RRTM SW=Morcrette (93)	New-Geleyn

Current status (cy37t1_bf1)

- September 2011 : MUSC_export version based on cy37t1_bf1 with 22 modified routines only for the atmospheric part and lfa files:

arp/setup/sugridspa.F90

arp/setup/suspsp.F90

arp/setup/sulsforc.F90

arp/namelist/namlsforc.h

arp/namelist/namtoph.h

xrd/ddh/open_output_lfa.F90

xrd/ddh/const_ther.F90

xrd/ddh/recpol.F90

xrd/ddh/wrscmr.F90

xrd/ddh/wrarom.F90

xrd/ddh/fonctions.F90

arp/adiab/cpphinp.F90

arp/adiab/cp_forcing.F90

arp/adiab/cpg_dyn.F90

arp/adiab/gpcty_forc.F90

arp/module/yomtoph.F90

arp/module/yomlsforc.F90

arp/module/yom_ygfl.F90

arp/phys_dmn/sutoph.F90

arp/phys_dmn/mf_phys.F90

arp/phys_dmn/writemusc.F90

arp/phys_dmn/writephysio.F90

- **In Cy37t1_bf1, the SURFEX version is 6.0**

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Current status (cy37t1_bf1)

- Only validated on GABLS3 for ARPEGE/AROME with and without SURFEX and on an idealized deep convection case (for PCMT development used by Jean-Marcel Piriou)

- But for several cases (ASTEX and COMPOSITE for the EUCLIPSE project) we should phase the SURFEX modifications done on V4.4 used with cy35t2 on a new version.

- SURFEX v7.1 is now available and the validation in ALADIN/AROME is still ongoing but …

- For MUSC the new "export" will be based on cy37t1_bf3 with SURFEX v7.1 + MUSC modifications = v7.2 → may be available at the end of this Working week ?!

- The final topic is to have MUSC fully integrated in the CY38T1 with SURFEX v7.2 (Feb 2008). It is already the case for the atmospheric part (the 22 routines are already included in CY38)

SURFEX V6.0 → V7.1

- cy37t1_bf.01.MUSC with SURFEX V6.0
  1. mse : interface with the model : dummy/ externals/ interface/ internals/ module/ new/ programs/
  2. surfex : aux/ flake/ include/ new/ pgd/ sea/ teb/ water/ canopy/ ideal/ isba/ offlin/ prep/ surf_atm/ trip/

- cy37t1_bf.03.MUSC with V7.1
  1. mse : interface with the model : dummy/ externals/ interface/ internals/ module/ new/ programs/
  2. surfex : OFFLIN/ SURFEX/ TRIP/

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Structure and usage

- GMKPACK : Version 6.5.10 with GFORTRAN 4.4.2 or 4.5.1
- Main pack contains the reference source code WITHOUT modifications
- Working pack for example MUSC:

pxgmap9:/home/bazile/pack/37t1_bf03_MUSC_7_1.01.GFORTRAN451.x => ll

total 32

drwxr-xr-x 2 bazile gmap 4096 2011-11-25 13:06 sys/

-rwxr-xr-x 1 bazile gmap 7741 2011-11-25 13:11 ics_master~*

-rwxr-xr-x 1 bazile gmap 7741 2011-11-25 16:52 ics_master*

drwxr-xr-x 5 bazile gmap 4096 2011-11-25 17:29 src/

drwxr-xr-x 2 bazile gmap 4096 2011-11-25 17:30 lib/

drwxr-xr-x 2 bazile gmap 4096 2011-11-25 17:30 bin/

/home/bazile/pack/37t1_bf03_MUSC_7_1.01.GFORTRAN451.x => cd src

total 8

drwxr-xr-x 4 bazile gmap 4096 2011-11-16 17:25 unsxref/

drwxr-xr-x 22 bazile gmap 4096 2011-11-22 14:18 local/

lrwxrwxrwx 1 bazile gmap   54 2011-11-25 13:06 main ->
/home/bazile/pack/37t1_bf03.01.GFORTRAN451.x/src/local/

pxgmap9:/home/bazile/pack/37t1_bf03_MUSC_7_1.01.GFORTRAN451.x/src =>

Structure and usage

pxgmap9:/home/bazile/pack/37t1_bf03_MUSC_7_1.01.GFORTRAN451.x/src => cd local

pxgmap9:/home/bazile/pack/37t1_bf03_MUSC_7_1.01.GFORTRAN451.x/src/local => ls

aeo/ arp/ bla/ mse/ odb/ sct/ surfex/ tfl/ xla/

ald/ bip/ mpa/ obt/ sat/ sur/ tal/   uti/ xrd/

pxgmap9:/home/bazile/pack/37t1_bf03_MUSC_7_1.01.GFORTRAN451.x/src/local =>scanpack
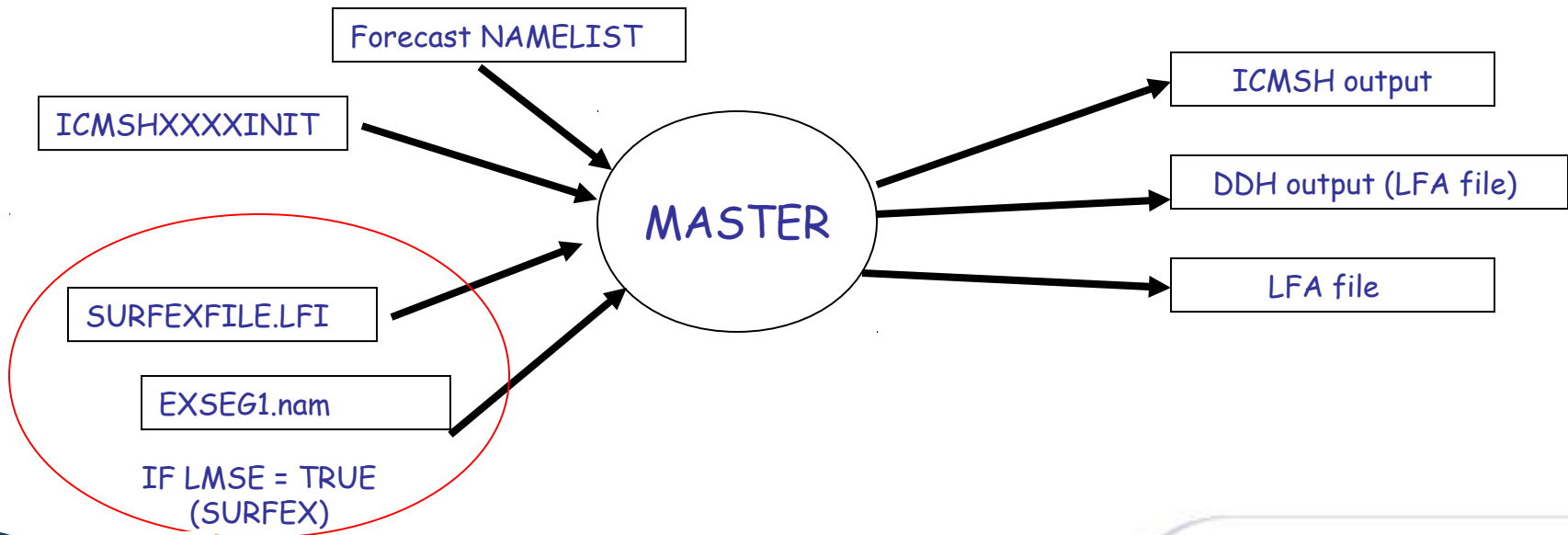
List of the modified routine :

arp/adiab/cpphinp.F90

arp/adiab/cp_forcing.F90

arp/adiab/cpg_dyn.F90

arp/adiab/gpcty_forc.F90

arp/module/yomtoph.F90

arp/module/yomlsforc.F90

arp/module/yom_ygfl.F90

arp/dia/ppsydh.F90

arp/dia/ppsydh.F90

arp/phys_dmn/open_output_lfa.F90

arp/phys_dmn/wrscmr.F90

arp/phys_dmn/wrarom.F90

arp/phys_dmn/sutoph.F90

arp/phys_dmn/acevolet.F90

arp/phys_dmn/mf_phys.F90

arp/phys_dmn/writemusc.F90

arp/phys_dmn/writephysio.F90

arp/setup/sugridspa.F90

arp/setup/suspsp.F90

arp/setup/sulsforc.F90

arp/namelist/namlsforc.h

arp/namelist/namtoph.h

mse/externals/aroini_surf.F90

xrd/ddh/const_ther.F90

xrd/ddh/recpol.F90

xrd/ddh/fonctions.F90

Modified routine for SURFEX

surfex/SURFEX/read_namelists_io.F90

surfex/SURFEX/dealloc_ideal_flux.F90

surfex/SURFEX/read_pgd_teb_parn.F90

surfex/SURFEX/read_buffer.F90

surfex/SURFEX/open_aux_io_surf.F90

surfex/SURFEX/modd_ideal_flux.F90

surfex/SURFEX/close_aux_io_surf.F90

surfex/SURFEX/init_ideal_flux.F90

surfex/SURFEX/read_namelists_ideal.F90

surfex/SURFEX/read_isba_confn.F90

surfex/SURFEX/get_default_namn.F90

surfex/SURFEX/read_all_namelists.F90

surfex/SURFEX/read_teb_canopyn.F90

surfex/SURFEX/modn_ideal_flux.F90

surfex/SURFEX/read_isba_conf.F90

surfex/SURFEX/sum_on_all_procs.F90

surfex/SURFEX/read_surf_isba_parn.F90

surfex/SURFEX/write_surf.F90

surfex/SURFEX/init_io_surfn.F90

surfex/SURFEX/get_luout.F90

surfex/SURFEX/read_pgd_isba_parn.F90

surfex/SURFEX/close_namelist.F90

surfex/SURFEX/get_size_fulln.F90

surfex/SURFEX/subscale_z0eff_1d.F90

surfex/SURFEX/open_namelist.F90

surfex/SURFEX/detect_field.F90

surfex/SURFEX/read_pgd_teb_gardenn.F90

surfex/SURFEX/coupling_ideal_flux.F90

surfex/SURFEX/read_ideal_flux_conf.F90

surfex/SURFEX/write_cover_tex_end.F90

surfex/SURFEX/write_cover_tex_start.F90

surfex/SURFEX/end_io_surfn.F90

surfex/SURFEX/read_surf.F90

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How to run MUSC ?

• The binary is the same for the 3D and the 1D model: the geometry and the atmospheric forcing are in the initial file ICMSH……
• The forcing options are specified in the namelist: NAMLSFORC
• For the output : ICMSH or DDH file + lfa files with LMUSCLFA

Forecast NAMELIST

ICMSHXXXXINIT

SURFEXFILE.LFI

EXSEG1.nam

IF LMSE = TRUE
(SURFEX)

MASTER

ICMSH output

DDH output (LFA file)

LFA file

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NAMELIST

```
&NAMCT0
   LSFORC=.TRUE.
/
&NAMGFL
  NGFL_FORC19,
  YFORC_NL(1)%CNAME='FORC001',
  YFORC_NL(2)%CNAME='FORC002',
  YFORC_NL(3)%CNAME='FORC003',
..
..
  YFORC_NL(48)%CNAME='FORC019',
 /
```

```
&NAM_SURF_ATMn /

&NAM_ISBAn  /

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

&NAM_DIAG_ISBAn LSURF_EVAP_BUDGET=.TRUE.,
LSURF_MISC_BUDGET=.TRUE., LPGD=.TRUE. /

&NAM_CH_ISBAN CCH_DRY_DEP='NONE' /

&NAM_READ_DATA_COVER LREAD_DATA_COVER=.FALSE. /
```

```
&NAMLSFORC

 LMUSCLFA=.T.,

 LGEOST_UV_FRC=.T.,

 RCORIO_FORC=1.E-4,

 NL_GEOST_UV_TIME(1)=0 ,

 NL_GEOST_UV_TIME(2)=21600 ,

 NL_GEOST_UV_TIME(3)=39600,

 NL_GEOST_UV_TIME(4)=54000 ,

 NL_GEOST_UV_TIME(5)=64800 ,

 NL_GEOST_UV_TIME(6)=86400 ,

 NGEOST_U_DEB=1,

 NGEOST_U_NUM=6,

 NGEOST_V_DEB=7,

 NGEOST_V_NUM=6,
```

```
 LT_ADV_FRC=T,

 NL_T_ADV_TIME(1)=0 ,

 NL_T_ADV_TIME(2)=46800 ,

 NL_T_ADV_TIME(3)=46860 ,

 NL_T_ADV_TIME(4)=64800 ,

 NL_T_ADV_TIME(5)=64860 ,

 NL_T_ADV_TIME(6)=86400 ,

 NT_ADV_DEB=13 ,

 NT_ADV_NUM=6,

 /
```

LFA files with LMUSCLFA (NAMLSFORC)

- In mf_phys.F90 (file created at each time step)=Out.0hh.5000.lfa

```
#include "open_output_lfa.intfb.h"
!    ----------------------------------------------------------------
IF (LHOOK) CALL DR_HOOK('CPG',0,ZHOOK_HANDLE)
IF (LMUSCLFA) CALL OPEN_OUTPUT_LFA)
..
..
IF(LGSCM.OR.LMUSCLFA)
      CALL WRITEPHYSIO ( (KEND,  KST, KGL1, KGL2, KSTGLO,
NSTEP  , NTSSG  , & &YSP_SBD%NLEVS   ,PGELAM, PGEMU, PGM, ZMU0,
POROG, POROGL, …… )
..

..
IF (LMUSCLFA) CALL LFAFER(86)
!    ----------------------------------------------------------------
```

If LMUSCLFA

CALL WRITEMUSC (…..)
write common diagnostic for AROME and ARPEGE fluxes, variables etc …

1D Cases potentially available in MUSC

- **Convective Boundary Layer**: IHOP (2002), Wangara, Ayotte, AMMA 5/06/2006

- Cumulus: **ARM (21/06/1997), BOMEX**, RICO-composite

- Stratocumulus : **FIRE-I (juillet 1987)**

- Oceanic Deep Convection : Idealized Case (Derbyshire et al 2004), TOGA-COARE

- **Continental Deep Convection** :ARM (27-28/06/1997), AMMA 10/07/ 2006 (project FP7/EMBRACE; ANR/DECAF)

- Stratocumulus transition → cumulus :**Astex + COMPOSITE case**

- Stable Boundary Layer : GABLS cases (**GABLS 1, 2 et 3**)

- •Available at least in one MUSC version

- •Will be done soon

- •Not available in MUSC but used in the old 1D model or in Meso-NH 1D

Conclusions

- MUSC has now almost all the forcings necessary for several cases : ARMCu, BOMEX, GABLS(1-3), ASTEX Lagrangian and COMPOSITE and deep convection

- SURFEX v7.1 is not running with ARPEGE/AROME some bugs have already been corrected but needs more validation on several 1D Case.

- Put the modifications done on SURFEX v4.4 for the ASTEX and COMPOSITE case in the version 7.1 → v7.2

- For the diagnostics: needs to put on each new version the diagnostics necessary for the 1D case (Km, wthl, etc ...) or use the logical LMUSCLFA

- Since yesterday MUSC-cy37t1_bf3 (with SURFEX V7.1) has been validated on GABLS3, ARMCU

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Thanks for your attention
Questions ?