SCUM or MUSC

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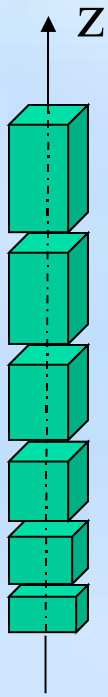
SCUM : Single Column Unified Model

1. Single Column
   - No horizontal terms

   (advection=0, div_h=0 →w=0)
   - If no large scale forcing,

   no surface forcing and no physics

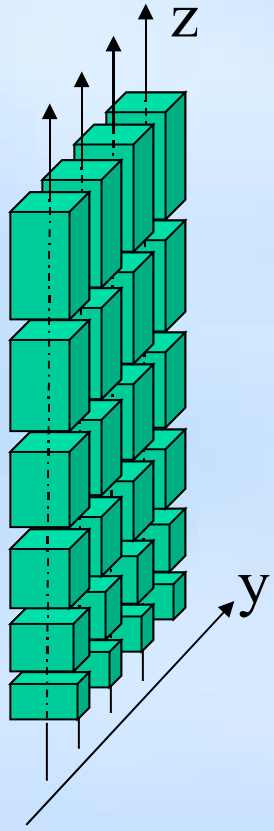
   → Stationary solutions
2. Unified Model
   - Same dynamics for 3D, 2D **and 1D** version of IFS/ARPEGE/ALADIN/ALARO/HIRLAM/AROME/HIRALD



✓ **A tool to pre-validate and compare physical packages**

SCUM : Pseudo-1D

- A 2D (meridional vertical plane) already existed for ALADIN (NSMAX=0)
- If used with only one meridional wave number (NMSMAX=1), 4 identical columns, no coupling and no E zone → a « 1D » model (advection=0, div_h=0 → w=0)



The Large Scale forcings (1)

- The introduction of LS forcing in the IFS/ARPEGE systeme is the main modification needed for the 1D model
  - LS tendency (usually LS advection) for temperature, moisture (and now wind)
  - Geostrophic wind (large scale pressure gradient forcing)
  - LS vertical advection (LS w and now LS Omega)

The Large Scale forcings (2)

- Routine CP_FORCING
  - Linear interpolation of prescibed LS temperature, moisture and wind tendencies :

$$X_{t+dt} = X_t + dt\left[LSdX_{t1} + \frac{LSdX_{t2} - LSdX_{t1}}{\left(t_2 - t_1\right)}\left(t - t_1\right)\right]$$

  - Linear interpolation of geostrophic wind (Coriolis and LS pressure gradient tendency) :

$$U_{t+dt} = U_t + dt\,.\,f\left(V_t - \left[Ug_{t1} + \frac{Ug_{t2} - Ug_{t2}}{t_2 - t_1}\left(t - t_1\right)\right]\right)$$

The Large Scale forcings (3)

- Routine GPCTY_FORC
  - Linear interpolation of prescibed LS vertical velocity w (m/s) or Omega (Ps/s) and computation of hybrid coordinate and pressure coordinate vertical velocities.

The Large Scale forcings in practice

- Prescribed forcings are given for each time step in the initial file
- They are read in the setup and stored in the GFL structure YFORC

```
&NAMGFL
NGFL_FORC=14
```

- The detail of the composition of YFORC is given in the namelist NAMLSFORC

```
&NAMLSFORC
LGEOST_UV_FRC=T      LT_ADV_FRC=T       LQ_ADV_FRC=T       LSW_FRC=F
NCORIO_FORC=8.5E-5
NGEOST_U_DEB=1       NT_ADV_DEB=3       NQ_ADV_DEB=9
NGEOST_U_NUM=1       NT_ADV_NUM=6       NQ_ADV_NUM=6
NGEOST_V_DEB=2       NT_ADV_TIME=10800  NQ_ADV_TIME=10800
NGEOST_V_NUM=1
```

What to do with the 1D model

- Ideal cases usually prepared in the context of international intercomparisons exercice. The cases are designed to test specific processus or parametrisation (Shallow convection :Bomex, Eurocs/Arm/Cu ; Sc : Eurocs/Fire ; stable layer : GABLS I ,II,III)
- Maybe soon : run the 1D model with a profile and forcings extracted from the 3D ARPEGE or ALADIN or AROME.

Running SCUM in practice

- You need :
  - An IFS/ARPEGE/AROME executable after CY31T1 (included)
  - An initial (FA) file (+ initial SURFEX files)
  - A namelist corresponding to your cycle, the physics you want to use and the forcing specified for your case
- You get :
  - Output (FA) historical files
- You may also get :
  - DDH files, LFA files with some more diagnostics

Probleme if you are not using Surfex

- **Case without surface forcing** : initialise the surface as you would do it in a 3D model (ascii2fa does it for Aladin with « old » ISBA)
- **Case with surface forcing** : modification have to be done in the code to be able to take into account the surface forcing properly (some of these modifications should be introduced in a next cycle for the « old » ISBA)

Usefull companion tools for SCUM

- ascii2fa : a basic tool to transform a namelist/ascii file containing profiles into a FA initial file for SCUM

- fa2ascii (or fa2netcdf etc) : a basic tool to transform SCUM FA output files into ascii profiles (or netcdf files)

Plan after the last SCUM/MUSC meeting

As soon as possible :

- Develop the code necessary to be able to use extracted profile from a 3D model
- Improve the availability of the « case data base », especially for Aladin and Hirlam collegues, improve de documentation
- Work on the output file format and content (more format, more diagnostics)
- Improve the asci2fa tool
- Prepare other cases for SCUM (deep convection, radiation)
- Work on 2D configurations

Practical exercice 1

Run the model on HPCE and plot the results on a local PC

Use the same reference binary for 1D and 3D

Exercice 1 :

Create a local pack on HPCE with a few modifications necessary for running MUSC with this new cycle + SURFEX modifications for GABLS1

Test the pack with the GABLS1 case

GMKPACK on HPCE

To use gmkpack with the Arome libraries as reference, you have to be in the hirald group. If not, you have to ask Claude Fischer at Météo-France and then Dominique Lucas at ECMWF.

Before creating a pack, you need to create a .user_profile with the following commands in it and do . ./.user_profile

```
export GMKROOT=/hpce/ms_perm/hirald/tools/gmkpack
export ROOTPACK=/hpce/ms_perm/hirald/pack
export HOMEPACK=/home/ms/fr/YOU/pack
export HOMEBIN=$TEMP/pack
export GMKFILE=IBMP690.HPCE
export GMKTMP=$TMPDIR
export PATH=.:$PATH:$GMKROOT/util
export PATH=$PATH:/hpce/ms_perm/hirald/tools
export MANPATH=$MANPATH:$GMKROOT/man
```

GMKPACK on HPCE

Then, create a pack with

/hpce/ms_perm/hirald/tools/gmkpack.6.2.4/util/gmkpack
-r 32t2 -b t3lisbonne -u training -p arome

Compile your own pack for GABLS1

Copy the file ~to9/TRAINING/local_GABLS1.tar in the directory src of you new pack
In the directory src, do

tar xvf local_GABLS1.tar

You can check that some sources are now in the directories of your local directory(for example, do scanpack in the local directory, you should see some surfex sources in src/mse/internals).

In the main directory of your pack, you can then send the compilation with

llsubmit ics_arome

If the compilation goes well, you should have a binary created in the bin directory of you pack (binary called AROME)

Run Musc for the GABLS1 case (1)

In your $HOME directory, create a directory RUN_pack
Copy the file ~to9/TRAINING/RUN_GABLS1.tar in this directory and de-tar the file.

In the directory GABLS1, you will find :
- the initial+forcing file for GABLS1 (file_GABLS1_L64_PG.1D)
- the initial SURFEX files for GABLS1 (PREPSURF_gabls.des/lfi)
- a namelist for surfex (EXSEG1.nam)
- a namelist to run Arome for Cy32t3 (nam_scum_32t3_ARO_gabls1_MF)
- a job to run MUSC with all these ingredients (job_MUSC_32t3)

Run Musc for the GABLS1 case (2)

In the job file, replace all the YOU by your user name
Then, llsubmit the job

If everything goes well, you should obtain on ECFS:
a tar file with all the output fa files
a tar file with the output in ascii format at the end of the simulation (9h=540min) (after fa2ascii)

You should then transfert the ascii files to your local PC for plotting with gnuplot or dd2met.

Practical exercice 2

Exercice 2 :

Modify the mixing coefficient for the wind in the turbulent scheme and reactivate the mixing length minimum value and rerun the GABLS1 case

Copy src/main/mpa/turb/internals/ini_cturb.mnh in src/local/mpa/turb/internals

chmod u+w ini_cturb.mnh

idem for turb.mnh

In ini_cturb.mnh, change from the CBR tuning to the Cheng-Canuto-Howard tuning for XCED and XCEP.

Practical exercice 2

In ini_cturb.mnh, change XLINF to 10. (m)

In turb, after the CALL of BL89, modify the code in order that the mixing lenght is at least XLINF.

Re-compile

Re-run the GABLS1 case

Check the new results

More cases….

Other MUSC cases are available on HPCE.

You can try ~:

EUROCS/FIRE/Sc
EUROCS/ARM/Cu
BOMEX
WANGARA
AYOTTE

ascii2fa : create the initial FA file

Copy ~to9/TRAINING/ascii2fa.tar

In the directory run, you'll find example of ascii files (nam1Dxxx) which were used to create the ascii files necessary to run different 1D cases.

Copy the namelist of the case you want to create on nam1D, and submit the job.

fa2ascii : create ascii files from FA output files

Copy ~to9:TRAINING/fa2ascii.tar

In the directory run, you'll find example of job to run different versions of fa2ascii.