Tutorial 2b: 1D-3D physics
LMDZ training course
December 6,2013

The primary aim of this tutorial is the installation and use of the 1D model that is associated with LMDz and itsconcurent use with the 3D model There are two main differences between the 1D and 3D models: firstly, the 1D model is more « homemade » than the 3D one (it has been designed just for that and it's an ideal tool to fiddle with). Switching from 1D to 3D can then be done with few changes so that the 1D install script can run with several 3D versions. Installing the model itself is done in a similar way than for the 3D model except that you have to install the 3D model before installing the 1D one.

How to execute the 1D install script ?

First step is to get the script and to run it *blindly* (don't forget to change rights and allow execution) in the same directory you ran install.sh.

```
wget http://www.lmd.jussieu.fr/~lmdz/DistribG95/instal1d.sh
chmod +x instal1d.sh
./instal1d.sh
```

The script should run smoothly without errors. If not, don't hesitate to ask for assistance.
While runing the script, which may take a few minutes, you'll see messages corresponding to the download of various elements via wget or informational messages from the compiler. The script ends with the execution of 3 test simulations: the first is 1 month long based on the field campaign TOGA-COARE 1992-1993, the second one is 7 hours long and based on a squall line case from the same campaign and the last one is one day long about continental cumulus based on ARM site measurements in the great plains of the midwest of the US.
During the install procedure, you are invited to explore the directories in another window.
The 1D model is installed in the 3D structure.

1/ In directory **LMDZtesting**, you'll find at the same level than modipsl, a directory **1dcases** in which are different directories with 1D test cases:

amma (diurnal cycle of convection over land in semi-arid conditions)
arm_cu (1 day continental cumulus)
ayotte (dry convection)
case_e (7 days squall line during Toga_Coare)
eq_rd_cv (radiative-convective equilibrium)
fire (diurnal cycle of stratocumulus)
hapex92_init (10 days squall line over ouest Africa)
rico (2 days oceanic cumulus)
sandufast (transition case from stratocumulus to cumulus, 3 options)
sanduref
sanduslow
toga (4 monthes of Toga_Coare campaign)
twpice (3 weeks during TWP-Ice campaign)

2/ In directory **LMDZ5/libf**, at the same level than the 3D physics **phylmd**, a new directory **phy1d**. It's a copy of phylmd in which are added files necessary to run the 1D model (main program lmdz1d.F, various routines concerning forcings for each case and some modifications allowing to « force » some part of the model).

3/ In directory **LMDZ5**, the 1D model executable lmdz1d.e.

Control files of the 1D model (*.def files) are the same than for 3D (note that we often use shorter timesteps for 1D than for 3D). With an extra file lmdz1d.def containing informations about case (latitude, longitude, type of surface, albedo ...) and files containing used forcings.
Each 1D case directory contains one compiling script **compile.x** and one execution script **xqt.x**.
Files physiq.def and gcm.def associated with different physics are put together in directory INPUT.
Script xqt.x automatically creates links alowing to run with correct version (see comments in xqt.x).

Test runs and analysis

Check that physiq.def files are the same in 3D simulations (you ran yesterday) and 1D version.
Then run the 1D cases rico and arm_cu. When results are avalaible, you can for instance:

- compare low cloud covers over ocean and continent in both types of simulations
- analyse diurnal cycle of convection over continent and ocean
- compare convective intensities of convection over ocean
- test sensitivity of new physics package to parameter wb (in physiq.def)
- test sensitivity to cld_lc_lsc and cld_lc_con: change these values from 6e-4 to 1e-4 and analyse differences. You can also compare to 3D runs with 2 different values.