

Tutorial 2b: 1D-3D physics
LMDZ training course
November 30,2016

This file can be downloaded as a pdf file here :

http://www.lmd.jussieu.fr/~lmdz/Distrib/TD2_1D_en.pdf

The primary aim of this tutorial is the installation and use of the 1D model that is associated with LMDz and its concurrent 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 ?

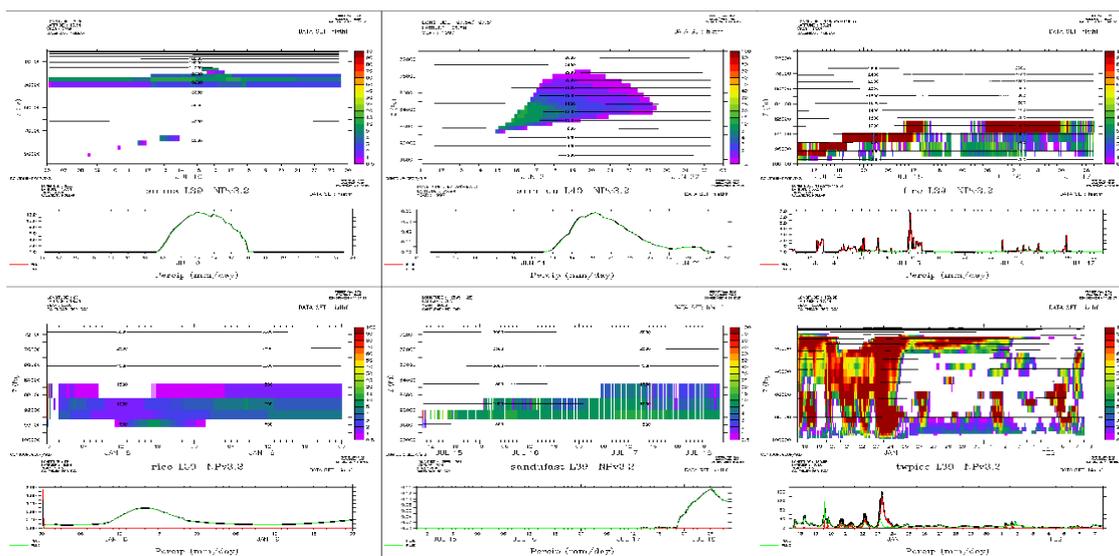
First step is to get the script and to run it *blindly* don't forget to change rights and allow execution in the same directory you ran install.sh.

```
wget http://www.lmd.jussieu.fr/~lmdz/Distrib/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 running 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 6 test simulations: arm_cu, rico, sandufast, fire, twipce, amma, with one option of the physical package : NPv5.4.

At the end and if everything goes well, a pdf file appears with the results `rneb` & `precip` of these six cases.



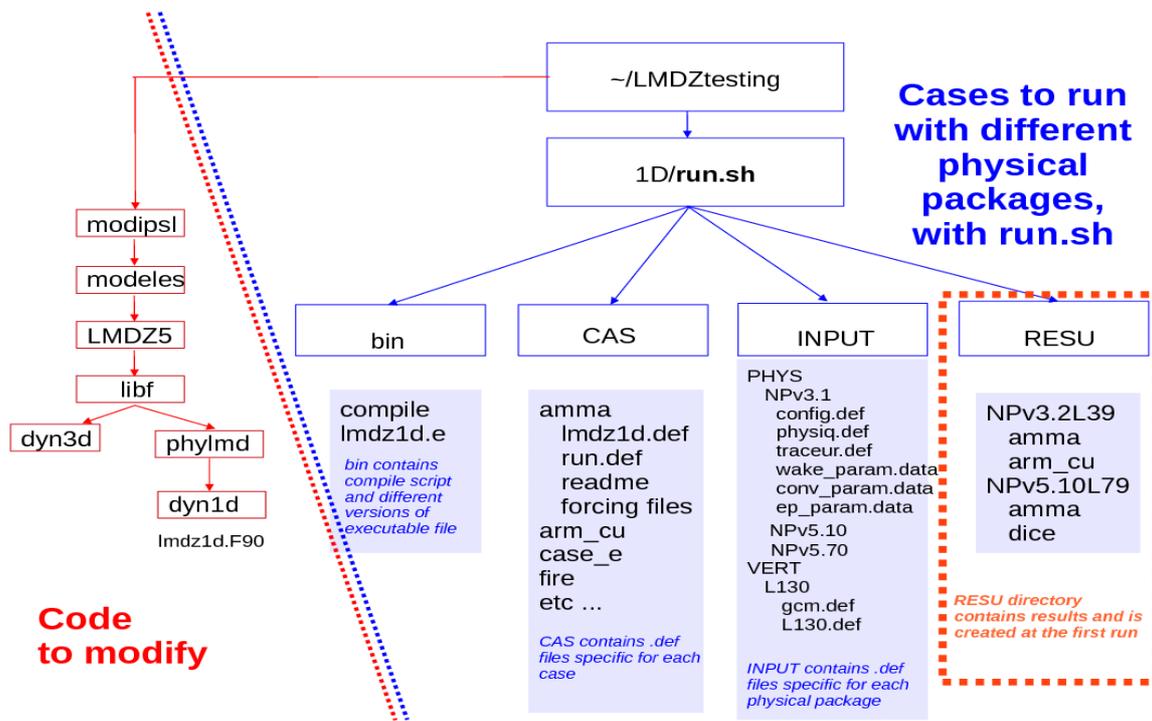
During the install procedure, you are invited to explore the directories in another window. The 1D model is installed in the 3D structure.

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

amma	diurnal cycle of convection over land in semi-arid conditions
arm_cons	
arm_cu	1 day continental cumulus
arm_cu2	same as arm_cu but with a different forcing file format
ayotte	dry convection
bomex	Trade wind cumulus over sea
case_e	7 days squall line during Toga_Coare
cindynamo	Dynamics of Madden Julian Oscillation, derived from field experiment
dice	Diurnal land/atmosphere coupling case
eq_rd_cv	radiative-convective equilibrium
fire	diurnal cycle of stratocumulus
gabls4	boundary layer with strong stability with a snow surface
hapex92_init	10 days squall line over ouest Africa
ihop	distribution of water vapor and improving the prediction of convection
rico	2 days oceanic cumulus
sandufast	transition case from stratocumulus to cumulus, fast option
sanduref	reference option
sanduslow	slow option
toga	4 monthes of Toga_Coare campaign
twpice	3 weeks during TWP-Ice campaign

2/ In directory **LMDZtesting/modipl/modeles/LMDZ5/libf/phylmd** (the same directory than for 3D) you will find subdirectory **dyn1d**. It contains files necessary to run the 1D model: main program lmdz1d.F90, various routines concerning forcings for each case and some modifications allowing to « force » some part of the model .

In the following diagram, you can vizualize where are stored the files characteristic of each case latitude, longitude, type of surface, albedo ... , the control files of different physics *def files and the results.



To run a case ; you have to execute **LMDZtesting/1D/run.sh** changing

listecas : you choose the list of cases you are interested in

listedef : you choose one or several physics

the vertical discretization is usually 79 levels

Test runs and analysis

Check that physiq.def files are the same in 3D simulations you ran yesterday and 1D version. Then re-run the 1D cases **rico** and **arm_cu** with **NPv3.2** and **NPv5.70** physical packages, modifying also config.def file to **get only histhf.nc file with a high phys_out_filelevels** (choose 10).

When results are available, 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.