Tutorial 2b: 1D-3D physics
LMDZ training course
December 8,2014

The primary aim of this tutorial is the installation and use of the 1D model that is assosiated with LMDz and its concurent 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 can be installed 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 install the 1D model ?
The 1D model is installed in the 3D structure =>
cd ~LMDZ/Distrib/LMDZ20151130.trunk
First step is to get the file 1D20151202.tar.gz either with
wget http://www.lmd.jussieu.fr/~lmdz/DistribG95/1D20151202.tar.gz (or from a stick)

tar xvzf 1D20151202.tar.gz
./run.sh

Now, in LMDZ20151130.trunk, you have:
1D
1D20151202.tar
modipsl
netcdf-4.0.1

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 or informational messages from the compiler. The script ends with the execution of 10 test simulations: amma, arm_cu, case_e, fire, rico, sandufast, sanduref, sanduslow, toga, twpice with 2 different versions of the physics : NPv3.2 and NPv5.17g.

At the end and if everything goes well, a all.pdf file is created with the results (rneb & precip) of all cases. You can visualize it with "evince all.pdf " and notice for each case the differences for the two physical packages.
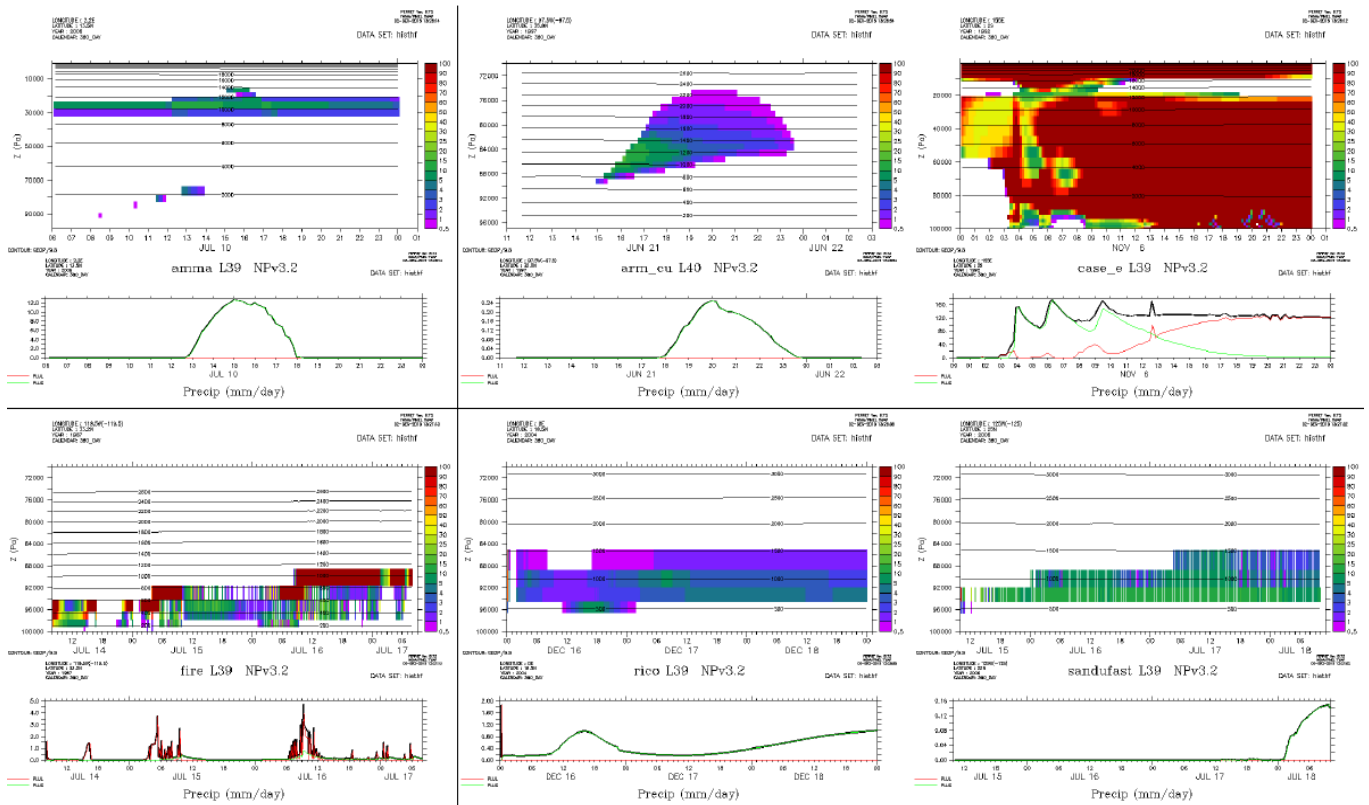
During the install procedure, you are invited to explore the directories in another window.

1/ In directory **LMDZ20151130.trunk**, you'll find at the same level than modipsl, a directory **1D/CAS** in which are different directories with 1D test cases:
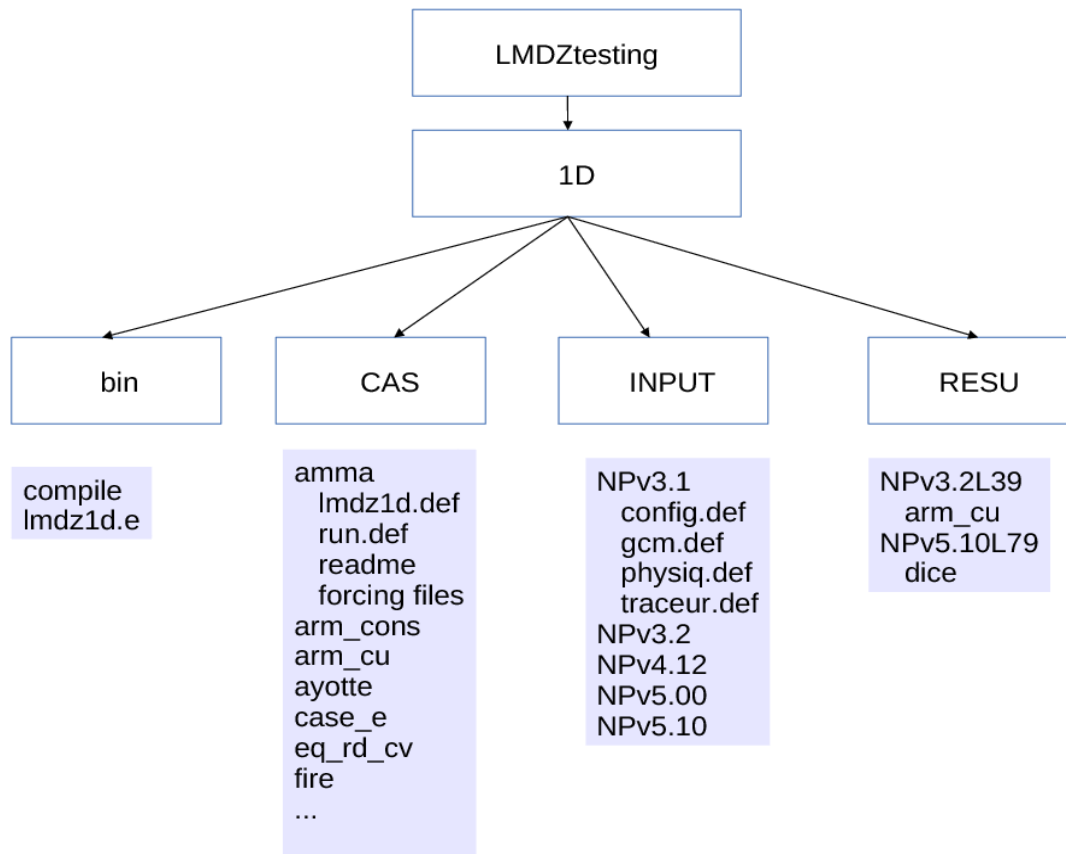
> amma (diurnal cycle of convection over land in semi-arid conditions)
> arm_cons
> arm_cu (1 day continental cumulus)
> ayotte (dry convection)
> case_e (7 days squall line during Toga_Coare)
> cindynamo (Dynamics of Madden Julian Oscillation, derived from field experiment)
> dice (Diurnal land/atmosphere coupling case)

eq_rd_cv (radiative-convective equilibrium)
eurocs_cvp_fg
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
LMDZ20151130.trunk/modipsl/modeles/LMDZ5/libf/phylmd/dyn1d are the 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
for each case (latitude, longitude, type of surface, albedo ...), the control files of
different physics (*def files) and the results.

LMDZtesting

1D

| bin | CAS | INPUT | RESU |

bin:
compile
lmdz1d.e

CAS:
amma
  lmdz1d.def
  run.def
  readme
  forcing files
arm_cons
arm_cu
ayotte
case_e
eq_rd_cv
fire
...

INPUT:
NPv3.1
  config.def
  gcm.def
  physiq.def
  traceur.def
NPv3.2
NPv4.12
NPv5.00
NPv5.10

RESU:
NPv3.2L39
  arm_cu
NPv5.10L79
  dice

To run a case, you have to execute LMDZ20151130.trunK/1D/run.sh changing:
  listecas : you choose the list of cases you are interested in
  listedef : you choose one or several physics

  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 cloud covers over ocean and continent in both types of simulations
- is there convective activity for these two cases ?
- compare thermal plumes activities over land and ocean
-

You can also run **amma case**:

- compare the rainfall diurnal cycle between NPv3.2 and NPv5.17g versions
- 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.