LDMZ tutorial: physics

LMDZ team

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This tutorial focuses on switching between different physics parametrizations in LMDZ.
This document can be downloaded as a pdf file:

```
wget http://www.lmd.jussieu.fr/~lmdz/pub/Training/Tutorials/Tutorial_Physics.pdf
```

which should ease any copy/paste of command lines to issue.

1 Prerequisits

You should be familiar with setting up simulations, as described in tutorials #1 and #2.

2 Switching between physics parametrizations

You can change the parameters of the model that are set up in the `.def` files and run new simulations without having the compile the model again. This is very convenient to test different parameterizations.
    You will run a simulation with modified `.def` files.

- Create a new simulation folder in `TUTORIAL` :

  ```
  mkdir SIMU1_test1
  ```

- Prepare the folder with the needed files (or links to files) :

  The simulation will start from initial files produced by SIMU1. If you performed another optional tutorial exercise, you might already have a start.nc and a startphy.nc file in SIMU1. If you don't have them, rename the SIMU1/restart* files :

  ```
  mv SIMU1/restart.nc SIMU1/start.nc
  mv SIMU1/restartphy.nc SIMU1/startphy.nc
  ```

  In `SIMU1_test1` , create links to the limit.nc and start* files that are in SIMU1:

  ```
  cd SIMU1_test1
  ln -s ../SIMU1/start.nc .
  ln -s ../SIMU1/startphy.nc .
  ln -s ../SIMU1/limit.nc .
  ```

  If you used `veget=1`, you must also create a link called `sechiba_rest_in.nc` pointing to the `../SIMU0/sechiba_rest_out.nc` file:

  ```
  ln -s ../SIMU0/sechiba_rest_out.nc sechiba_rest_in.nc+
  ```

  Copy from `SIMU1` all the `*.def` files from, except for those beginning with `used_` :

  ```
  cp ../SIMU1/*.def .
  rm -f used_*.def
  ```

  ATTENTION : In case you re-run the simulation (in the same folder), make sure to remove the `sechiba_rest_out.nc` file in the folder, or the model will stop with an error (`STOP 1`).

- In your new directory `SIMU1_test1`, in file `physiq.def`, change the boundary layer parameterization by deactivating the Mellor and Yamada scheme (a scheme for the boundary layer based on a prognostic equation for the Turbulent Kinetic Energy):

  `iflag_pbl = 1`

  instead of the nominal value 12 (which corresponds to the Mellor-Yamada variant for very stable planetary boundary layer and exact dissipation, with vertical diffusion off q2). Thus, you will switch to the "Standard Physics" (SP, LMDZ5A).

- Run the model in `SIMU1_test1`, using the executable `gcm.e` available in TUTORIAL :

  `../gcm.e`

- Compare the results of `SIMU1` and `SIMU1_test1`. You can use a convenient command called `ncdiff` to directly compute the difference between the two NetCDF files in a new file (provided that the 2 files have the same number of timesteps):

  `ncdiff ../SIMU1/histday.nc histday.nc histday_diff.nc`

- Another test you can try is to deactivate the thermal plume model:

  `iflag_thermals=0`

  instead of the nominal value 18.

Remember that you can modify the content or time frequency of the output files if you want to focus on a particular question.