LDMZ tutorial: physics

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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.

- Prepare for five more days of simulation: rename files `restart.nc` and `restartphy.nc` (created at the end of the first simulation) to `start.nc` and `startphy.nc`.

- Create a directory where you will run the model with modified `.def` files. In this new directory, you can create symbolic links to the files `start.nc`, `startphy.nc` and `limit.nc` which are in `TUTO/SIMU1`, and you need to copy the `*.def` files from `TUTO/SIMU1`, except those beginning with `used_`. If you used `veget=1`, don't forget to create a link called `sechiba_rest_in.nc` pointing to the `../SIMU0/sechiba_rest_out.nc` file. Here are the commands you will need:

  ```
  mkdir SIMU1_test1
  cd SIMU1_test1
  ln -s ../SIMU1/start.nc .
  ln -s ../SIMU1/startphy.nc .
  ln -s ../SIMU1/limit.nc .
  ln -s ../SIMU0/sechiba_rest_out.nc sechiba_rest_in.nc
  cp ../SIMU1/*.def .
  rm -f used_*.def
  ```

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

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

  ```
  iflag_pbl = 1
  ```

  instead of the nominal value 11 (which corresponds to the variant for very stable planetary boundary layer and exact dissipation). Thus, you will switch to the "Standard Physics" (SP, LMDZ5A).

- Run the model in the two directories and compare the results. You can use a convenient command called `ncdiff` to directly compute the difference between the two NetCDF files in a new file:

  ```
  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.