Hands on tutorial : installing, compiling and executing the model

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This first tutorial focuses on installing the model in sequential mode and making a simple bench run. We then install the model in parallel mode and run a simple test bench as well. This ensures that you will be ready for the hands-on tutorials of the training session starting on the 10th of December.

This document can be downloaded as a pdf file:

```
wget http://lmdz.lmd.jussieu.fr/pub/Training/Tutorials/Tutorial_simple.pdf
```

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

1 Prerequisites

To run LMDZ, you will need a significant amount of memory, so first ensure this is true. You can use the following command line

```
ulimit -Ss unlimited
```

but be advised we have encountered cases where this did not work and you had to specify a numeric amount.

2 Running the install_lmdz.sh script for a sequential version of LMDZ

The first step consists in downloading it from the LMD website and *blindly* running it (after having first set the access permissions to make it executable):

```
wget http://lmdz.lmd.jussieu.fr/pub/install_lmdz.sh
chmod +x install_lmdz.sh
./install_lmdz.sh -name LMDZTraining -rad oldrad
```

The "`-name LMDZTraining`" option to the script just insures that the model will be installed in a directory called `LMDZTraining` in the current directory.

WARNING : if you are using an older version of the gfortran compiler (older than version 9), some of the compiling options will not be understood and you will need to download some other configuration files. The procedure will then be:

```
wget http://lmdz.lmd.jussieu.fr/pub/install_lmdz.sh
chmod +x install_lmdz.sh
wget http://lmdz.lmd.jussieu.fr/pub/src_archives/misc/arch/LMDZ/arch-local-gfortran9.tar
tar xvf arch-local-gfortran9.tar
./install_lmdz.sh -name LMDZTraining -rad oldrad -arch local-gfortran9 -arch_dir $PWD/arch
```

If you have an altogether other fortran compiler, we will have to work on the configuration files, seek out help.

Launching the script as indicated above will download the latest "testing" version of the source code, compile it and run a simple bench test case at resolution 32×32-L39.
Compilation should take around five minutes. The test bench is then downloaded and the 1 day long test simulation on a regular 32×32-L39 grid is run ; messages about various downloads (via **wget**) and/or compiler informations are displayed.

The script should then run smoothly (if it isn't the case, immediately ask for some assistance) and end with messages such as:

```
 in abort_gcm
 Stopping in leapfrog
 Reason = Simulation finished
 Everything is cool
```

You can take advantage of the installation time to open a second terminal window and explore the downloaded directories and files.

`install_lmdz.sh` will check if some archives (LMDZ, NetCDF library, etc.) are on the disk (in the `~/LMDZ` directory and subdirectories) and if not, will try to retrieve them through the network using `wget` command. It will create the **LMDZ-Training** directory ; inside, you will find 2 main subdirectories **modipsl**, which contains the model, and **netcdf4_hdf5_seq**, which contains the NetCDF library and other ancillary files, scripts and log files.

In **modipsl**, you will find directory **modeles**, containing the **LMDZ** directory.

Once the test bench simulation has been launched (the final step of the **install_lmdz.sh** script), you will also find a **LMDZ/BENCH32x32x39/** directory from where you will be able to list the outputs of the run (even if the simulation is still running: it indeed takes a few minutes to complete the 1 day-long run on a single processor). Check out the contents of this directory and use your favorite software (Grads, Ferret,...) to browse the contents of the **histday.nc** file.

3 Running the install_lmdz.sh script for a parallel version of LMDZ with ORCHIDEE

We only need to change a few options when calling the `install_lmdz.sh` script to have LMDZ installed in parallel MPI+OMP mode (provided the corresponding libraries are installed on your computer) with the ORCHIDEE land-surface model. You should go back to the top directory where you copied the `install_lmdz.sh` script and launch it as (for the `"-netcdf 0"` option see NOTE below !)

```
./install_lmdz.sh -name LMDZORpar -parallel mpi_omp -veget CMIP6 -netcdf 0
```

where the options

- `-parallel mpi_omp` controls which parallel mode we choose to run
- `-veget CMIP6` indicates that we want to run with the version of ORCHIDEE used in CMIP6
- `-netcdf 0` indicates that we want to compile the model with the version of NetCDF installed on your machine. This should speed up the compilation provided the NetCDF librairies are installed on your computer

NOTE : If you're not sure whether NetCDF is indeed installed on your machine, you might try the following command:

```
./install_lmdz.sh -name LMDZORpar -parallel mpi_omp -veget CMIP6 \
                  -netcdf ‘pwd‘/LMDZTraining/netcdf4_hdf5_seq
```

here, the "`-netcdf ‘pwd‘/LMDZTraining/netcdf4_hdf5_seq`" tells the script to compile the model with the version of NetCDF that was compiled in the first step of this tutorial that can be found in the **LMDZTraining/netcdf4_hdf5_seq** directory.

WARNING: same comment about the fortran compiler used. If you have an older gfortran compiler, you will need to launch the install script as

```
./install_lmdz.sh -name LMDZORpar -parallel mpi_omp -veget CMIP6 \
                  -netcdf 0 \
                  -arch local-gfortran9-parallel -arch_dir $PWD/arch
```

or

```
./install_lmdz.sh -name LMDZORpar -parallel mpi_omp -veget CMIP6 \
                  -netcdf ‘pwd‘/LMDZTraining/netcdf4_hdf5_seq \
                  -arch local-gfortran9-parallel -arch_dir $PWD/arch
```

If everything goes to plan, you should get the same kind of messages as in the first part of this tutorial. If something does not work, don't hesitate to ask for our help.