

Tutorial N°2

Setting up a simulation
with a regular or zoomed grid

and options :
nudging, tracers, Orchidee, 1D, different physics,
XIOS, parallelism

LMDZ team

Practical guide :

Tutorial_2.pdf

Working directory (to be downloaded and unpacked) :

LMDZ/LMDZ20171119.trunk/modipsl/modeles/LMDZ/TUTORIAL

user's choice : *mkdir XXX*

user's choice : *./install_lmdz.sh -name XXX*

imposed

The diagram shows a directory path: LMDZ/LMDZ20171119.trunk/modipsl/modeles/LMDZ/TUTORIAL. Two arrows point from the path to user choices: one from 'LMDZ' to 'user's choice : mkdir XXX' and one from 'TUTORIAL' to 'user's choice : ./install_lmdz.sh -name XXX'. A green arrow points from 'modipsl/modeles/LMDZ/TUTORIAL' to the word 'imposed'.

```
[asima@ciclad-ng TUTORIAL]$ tree
.
├── DEF
│   ├── config.def
│   ├── gcm.def
│   ├── gcm.def_96x95x39_NPv3.1
│   ├── gcm_zoom_tuto.def
│   ├── guide.def
│   ├── L39.def
│   ├── L47.def
│   ├── L79.def
│   ├── orchidee.def
│   └── PHYS
│       ├── physiq.def_AR4
│       ├── physiq.def_NPv0.0
│       ├── physiq.def_NPv1.0
│       ├── physiq.def_NPv2.0
│       ├── physiq.def_NPv3.0
│       ├── physiq.def_NPv3.1
│       ├── physiq.def_NPv3.2
│       ├── physiq.def_NPv4.12
│       ├── physiq.def_NPv5.17h
│       ├── physiq.def_NPv5.4
│       ├── physiq.def_NPv5.5
│       ├── physiq.def_NPv5.65
│       ├── physiq.def_NPv5.67
│       ├── physiq.def_NPv5.70
│       ├── physiq.def_NPv5.80b
│       ├── physiq.def_NPv5.80bz0
│       ├── physiq.def_NPv6.0.10
│       ├── physiq.def_NPv6.0.10fallv
│       ├── physiq.def_NPv6.0.11trigB
│       ├── physiq.def_NPv6.0.12
│       ├── physiq.def_NPv6.0.12split
│       ├── physiq.def_NPv6.0.12ttop
│       ├── physiq.def_NPv6.0.7
│       ├── physiq.def_NPv6.0.8
│       ├── physiq.def_NPv6.0.9
│       └── physiq.def_NPv6.1
├── physiq.def
├── README
├── run.def
├── traceur.def
├── get_era.sh
├── init.sh
├── README
├── reb.sh
├── run_local.sh
└── run_X64_ADA.sh
```

Content of working directory TUTORIAL (1/3)

Readme

In the current directory, you may

- 1/ compile the model
- 2/ create initial and boundary conditions on a zoomed (or regular) grid
- 3/ run the model

Contains :

=====

`init.sh` : main script that

- 1/ creates initial state and boundary conditions -> INITIAL (if running with Orchidee land model : prepares a preliminary simulation to produce the corresponding initial state -> SIMU0)
- 2/ prepares a first simulation -> SIMU1

`DEF` : contains default files `.def` for setup parameters

`get_era.sh` : to interpolate ERA reanalysis on the model grid

`reb.sh` : to "rebuild" output file for parallel computation with IOPSL

`run_local.sh` : to run the model (important for parallel computers)

`run_X64_ADA.sh` : the same for ada supercomputer at idris.

NB: If you change the horizontal resolution of LMDZ you should

modify some parameters in `DEF/gcm.def` :

--> `day_step` and `iphysiq` (in order to satisfy the CFL criteria)

--> dissipation parameters : `tetagdiv`, `tetagrot`, `tetatemp`

Content of working directory TUTORIAL (2/3)

```
[asima@ciclad-ng TUTORIAL]$ tree
.
├── DEF
│   ├── config.def
│   ├── gcm.def
│   ├── gcm.def_96x95x39_NPv3.1
│   ├── gcm_zoom_tuto.def
│   ├── guide.def
│   ├── L39.def
│   ├── L47.def
│   ├── L79.def
│   ├── orchidee.def
│   └── PHYS
│       ├── physiq.def_AR4
│       ├── physiq.def_NPv0.0
│       ├── physiq.def_NPv1.0
│       ├── physiq.def_NPv2.0
│       ├── physiq.def_NPv3.0
│       ├── physiq.def_NPv3.1
│       ├── physiq.def_NPv3.2
│       ├── physiq.def_NPv4.12
│       ├── physiq.def_NPv5.17h
│       ├── physiq.def_NPv5.4
│       ├── physiq.def_NPv5.5
│       ├── physiq.def_NPv5.65
│       ├── physiq.def_NPv5.67
│       ├── physiq.def_NPv5.70
│       ├── physiq.def_NPv5.80b
│       ├── physiq.def_NPv5.80bz0
│       ├── physiq.def_NPv6.0.10
│       ├── physiq.def_NPv6.0.10fallv
│       ├── physiq.def_NPv6.0.11trigB
│       ├── physiq.def_NPv6.0.12
│       ├── physiq.def_NPv6.0.12split
│       ├── physiq.def_NPv6.0.12ttop
│       ├── physiq.def_NPv6.0.7
│       ├── physiq.def_NPv6.0.8
│       ├── physiq.def_NPv6.0.9
│       └── physiq.def_NPv6.1
│   ├── physiq.def
│   ├── Readme
│   ├── run.def
│   └── traceur.def
├── get_era.sh
├── init.sh
├── Readme
├── reb.sh
├── run_local.sh
└── run_X64_ADA.sh
```

DEF directory : Parameter files *.def for 3D simulations

run.def : general configuration file :
*.def files to use, calendar type (*earth_360d,365d,366d*),
restart year, number of days to run *nday* etc

config.def : output, coupling, RRTM, orb. par., GHG, aerosol eff, O₃ etc

gcm.def : grid-dependent param. (day_step, iphysiq, zoom, dissipation) etc.

physic.def : version-specific set of param. (here the 'NPv6.1')

PHYS/physic.def_XXX : available versions of physic.def

guide.def : nudging param.

traceur.def : tracer nb., transport processes, name

orchidee.def : parameters for land model Orchidee

L39, L47, L79.def : vertical discretization etc.

Also seen in **run.def** : ../DefLists/**output.def** : output configuration (variables)

See **DEF/Readme** for details on **physic.def_XXX** files and references !

Hourdin et al., Clim. Dyn (2006, 2013a, 2013b)

```
[asima@ciclad-ng TUTORIAL]$ tree
.
├── DEF
│   ├── config.def
│   ├── gcm.def
│   ├── gcm.def_96x95x39_NPv3.1
│   ├── gcm_zoom_tuto.def
│   ├── guide.def
│   ├── L39.def
│   ├── L47.def
│   ├── L79.def
│   ├── orchidee.def
│   └── PHYS
│       ├── physiq.def_AR4
│       ├── physiq.def_NPv0.0
│       ├── physiq.def_NPv1.0
│       ├── physiq.def_NPv2.0
│       ├── physiq.def_NPv3.0
│       ├── physiq.def_NPv3.1
│       ├── physiq.def_NPv3.2
│       ├── physiq.def_NPv4.12
│       ├── physiq.def_NPv5.17h
│       ├── physiq.def_NPv5.4
│       ├── physiq.def_NPv5.5
│       ├── physiq.def_NPv5.65
│       ├── physiq.def_NPv5.67
│       ├── physiq.def_NPv5.70
│       ├── physiq.def_NPv5.80b
│       ├── physiq.def_NPv5.80bz0
│       ├── physiq.def_NPv6.0.10
│       ├── physiq.def_NPv6.0.10fallv
│       ├── physiq.def_NPv6.0.11trigB
│       ├── physiq.def_NPv6.0.12
│       ├── physiq.def_NPv6.0.12split
│       ├── physiq.def_NPv6.0.12ttop
│       ├── physiq.def_NPv6.0.7
│       ├── physiq.def_NPv6.0.8
│       ├── physiq.def_NPv6.0.9
│       └── physiq.def_NPv6.1
├── physiq.def
├── Readme
├── run.def
├── traceur.def
├── get_era.sh
├── init.sh
├── Readme
├── reb.sh
├── run_local.sh
└── run_X64_ADA.sh
```

Content of working directory TUTORIAL (3/3)

Scripts

init.sh : main script

run_local.sh :

run in parallel & rebuild output on local machine

run_X64_ADA.sh :

same thing on “ADA” supercomputer at IDRIS

reb.sh : rebuild output, if running in parallel mode

get_era.sh : for nudging :

retrieve and interpolate ERAI reanalysis files

Content of main script *init.sh*

Remember from TUTORIAL/Readme :

```
init.sh : main script that
1/ creates initial state and boundary conditions for LMDZ -> INITIAL
   (if running with Orchidee land model : prepares a preliminary
     simulation to produce the corresponding initial state -> SIMU0)
2/ prepares a first simulation -> SIMU1
```

init.sh (1/2)

```
#####
# 0. Setup
#####
# standards : 96x95x39, 144x142x79
grid_resolution=48x36x39
an=clim
veget=0
parallel=0
mpi=4
omp=2
machine=local
rrtm=1

#####
# 1. Model Compilation (parallel/sequential; consistent with install)
#####
```

init.sh (2/2)

```

# 2. Creating initial state and boundary conditions
#####
    2.1 Getting input files from the web
    .....
    In TUTORIAL, it creates the directory INITIAL
    It copies in it the necessary files : ECDYN.nc, Albedo.nc, Relief.nc, Rugos.nc,
    landiceref.nc, amipbc_sic_YYYY.nc, amipbc_sst_YYYY.nc
    .....
    2.2 Running ce01.e (output listing in ce01.out) :
    It produces initial files start.nc, startphy.nc, and boundary cond. limit.nc
    .....
    2.3 Creating a figure for the grid : grid.pdf
    .....
    (2.4 : if veget=1 -> creating preliminary simulation SIMU0
    to produce the initial files start, startphy and sechiba_rest_in)

# 3. Creating a simulation directory
#####
    In TUTORIAL, it creates the directory SIMU1
    It copies in it the DEF/*def files, and creates links to other necessary files
    (TUTORIAL/gcm.e, TUTORIAL/INITIAL :start.nc, startphy.nc and limit.nc )

# 4. Issuing instructions for running the simulation SIMU1 (and SIMU0 if veget=1)
#####

```

Steps for setting up a simulation

- 0) Download and unpack tutorial.tar
- 1) Check *.def files, set your desired parameters
Here in particular : the zoom parameters in `gcm.def`
- 2) Check/modify setup parameters in `init.sh` script : `grid_resolution`, `veget`, `parallel`
- 3) run : `./init.sh` ; pay attention at its final instructions about how to run the model
- 4) check the results :
 - visualize `grid.pdf` , or plot "grille_s" variable from `INITIAL/grilles_gcm.nc`
 - verify that `start.nc`, `startphy.nc` and `limit.nc` files were created in
`TUTORIAL/INITIAL`
and the links to those files in `TUTORIAL/SIMU1` are OK
IF NOT : Ask for Help

(Possible Solution : `ulimit -s unlimited` , and in `TUTORIAL/INITIAL` run : `./ce0l`)

Now you can run the model : in `SIMU1`, run : `./gcm.e`
and visualize the results : output files in `SIMU1`: `histhf.nc` and `histday.nc`

Proposed exercises :

Nudging

Orchidee

1D

Parallelism

XIOS

Tracers

Different physics