

# *The LMDZ Code*



Code structure : general principles, ...



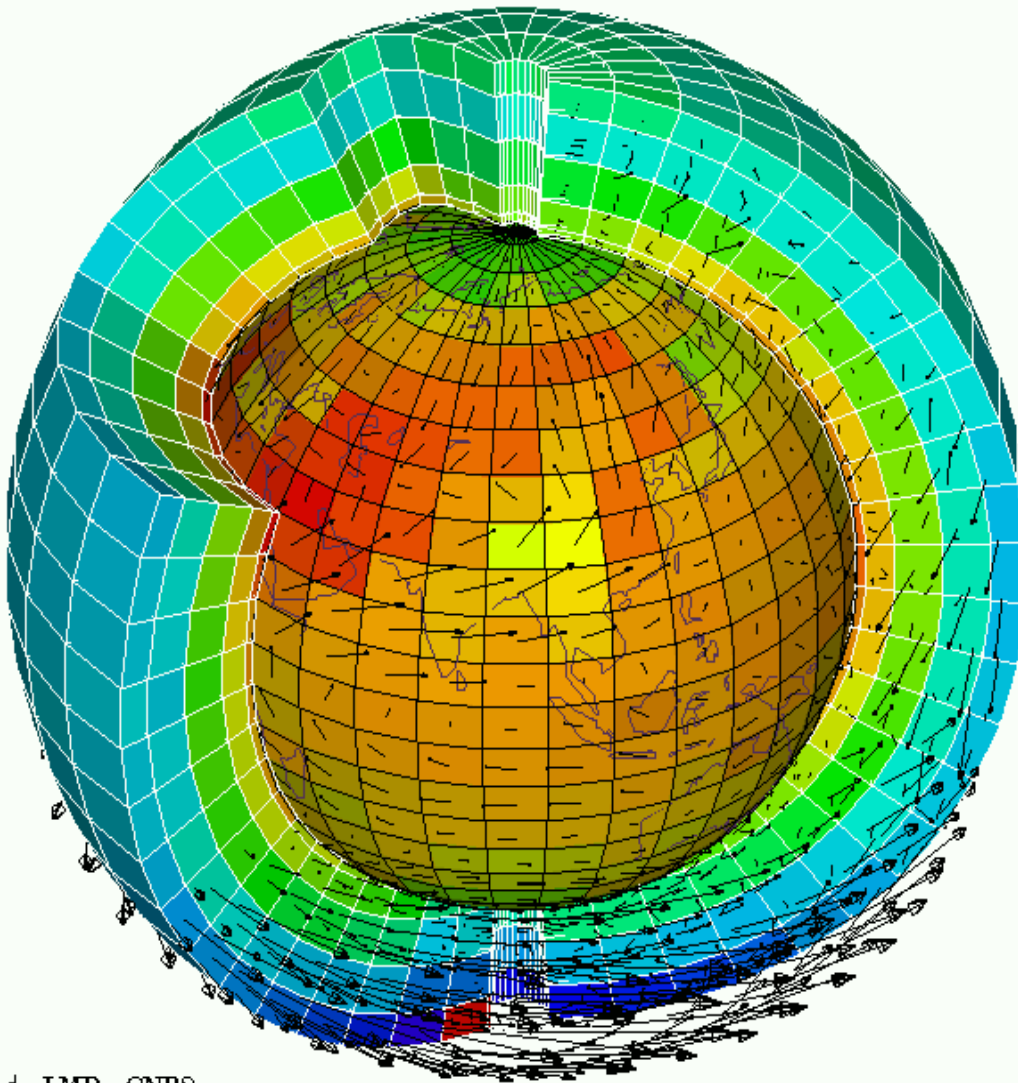
## Code structure

Main principle : clear separation between the dynamical and physical modules

The dynamical module solves the general equations for atmospheric circulation

The physics module gathers all the physical parametrizations which compute the physical forcings of circulation and the details of the climate at each point of the grid  
(radiation, precipitation, interfaces with surfaces, ...)

# The LMDZ Code



id - LMD - CNRS

From a numerical standpoint : equations are solved on two types of grid

- a 3D grid for the dynamics
- a 2D grid for the physics

The interface between the two modules (and the two types of grids) is accomplished in a specific routine :  
« calfis.F/calfis\_loc.F »

# The LMDZ Code



The clear partition between two modules (the dynamics and the physics of the model) enables us to use the same dynamical package with different physics packages :  
physics describing other planetary atmospheres  
other terrestrial physics package (WRF/MAR/simplified/parametrised/idealised, ...)

This partition also allows the use of other dynamical packages (DYNAMICO, WRF, parallelised, ...) with a common physics package, the 1D LMDz model being a special case of this substitution.

The layout of the source code reflects this partition between modules and facilitates the use of the LMDz code in different configurations.

Switching between different dynamical cores and physics packages is facilitated by a clearly defined interface.

The code is written in Fortran. It started life as Fortran IV code, some major parts are still in « F77 » Fortran but a F90 compiler is used and all present developments are coded in F90 (at the least). In all, it represents some 760000 lines of code in some 2100 routines.

# *The LMDZ Code*



<https://trac.lmd.jussieu.fr/LMDZ/browser/LMDZ6/trunk#libf>

or look here

`.../LMDZ20211102.trunk/modipsl/modeles/LMDZ`

# The LMDZ Code



## DYNAMICS

dyn3d  
dyn3dpar  
dyn3dmem  
filtrez  
grid

## DYNAMICS-PHYSICS INTERFACE

dynphy\_lonlat

phylmd  
phymars  
phyvenus  
phy...

## PHYSICS

phy\_common  
phylmd  
phymars  
phyvenus  
phy...

dyn1d

misc

## UTILITIES

(phy/dyn independent)

# The LMDZ Code



## phy\_common

- contains routines common to all physics packages phy... , e.g.:
  - `mod_phys_lmdz_[mpi|omp]*` (MPI/OpenMP organization)
  - `ioipsl_getin_p_mod` (getin\_p)
  - `abort_physic`
  - `print_control` (lunout, prt\_level)
  - `geometry_mod` (lon,lat,cell\_area)
  - `regular_lon_lat_mod` (info on global lon-lat grid for outputs)
  - `mod_grid_phy_lmdz` (nbp\_lon, nbp\_lat, nbp\_lev, klon\_glo, grid\_type, nvertex)

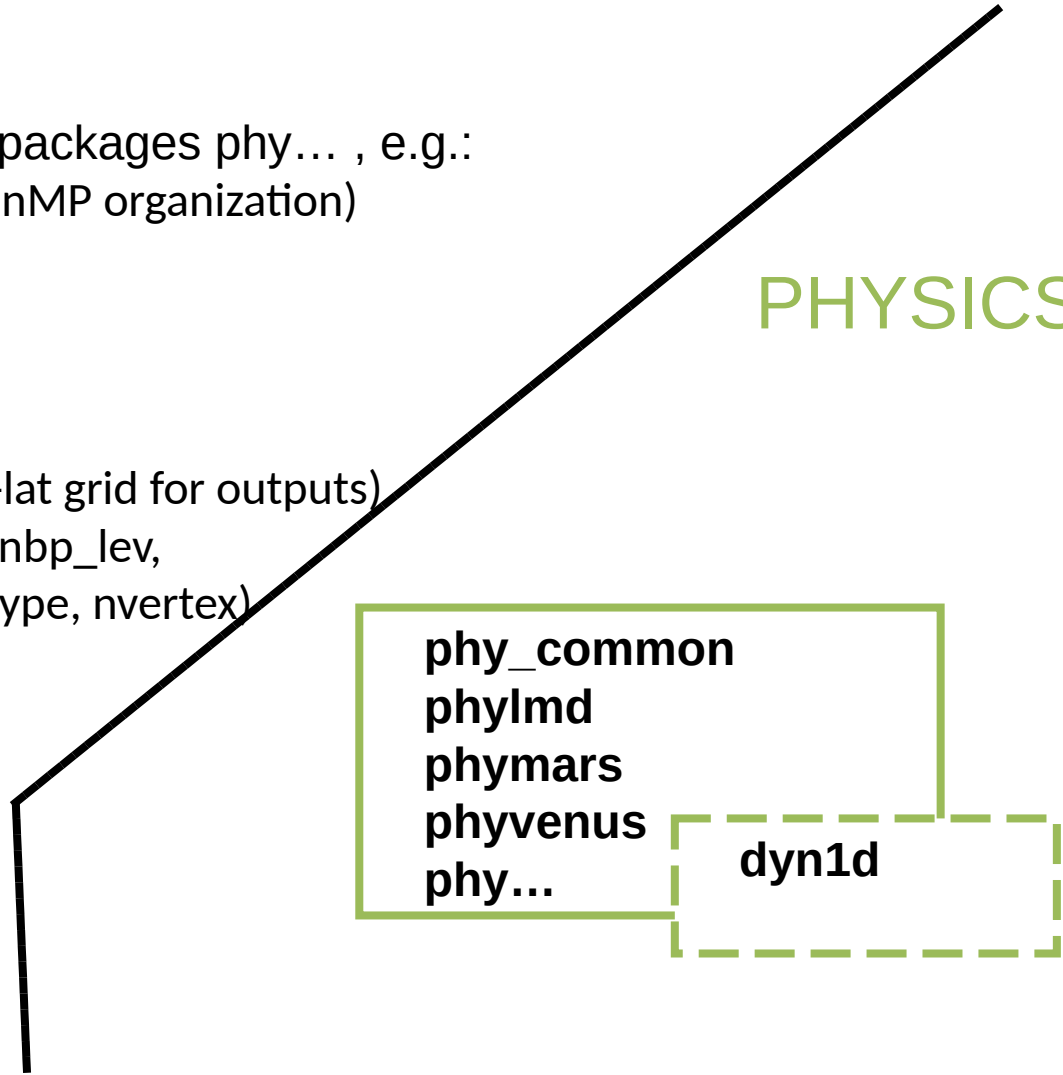
PHYSICS

## dyn1d (subdir of phy...)

- contains 1d main program (lmdz1d.F90 or testphys1d.F or rcm1d.F...) and a couple of relevant dynamical routines (links from dyn3d)
- Uses physics routines from ../phy...

phy\_common  
phylmd  
phymars  
phyvenus  
phy...

dyn1d



# The LMDZ Code



## DYNAMICS-PHYSICS INTERFACE

**dynphy\_ionlat**

**phylmd  
phymars  
phyvenus  
phy..**

### **dynphy\_ionlat**

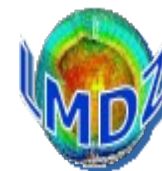
•Relies on both  
dynamics and  
physics:

calfis[\_p|\_loc]  
gr\_dyn\_fi[\_p]  
gr\_fi\_dyn[\_p]  
mod\_interface\_dy  
n\_phy

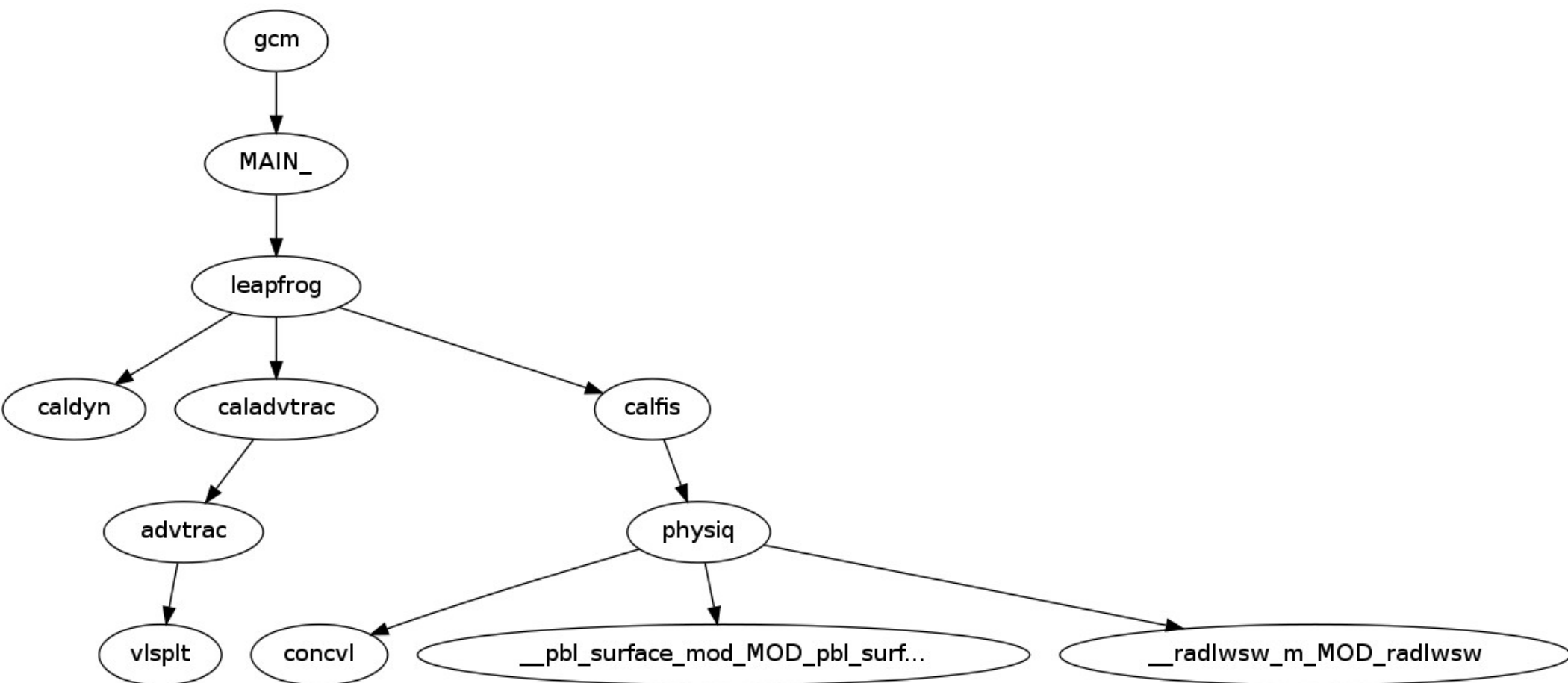
**phy...** (subdir of  
dynlonlat\_phylonlat)  
•contains **iniphysiq\_mod**  
which transfers all information from  
the dynamics to the physics required  
to initialize the physics (r, g, tracer  
names, global grid layout, etc.)  
•contains utility programs to  
generate/modify/process initial  
conditions, e.g. **ce0l newstart**



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Also see [http://www.lmd.jussieu.fr/~lmdz/LMDZ5/doxy\\_201512/html/em\\_2gcm\\_8\\_f90.html](http://www.lmd.jussieu.fr/~lmdz/LMDZ5/doxy_201512/html/em_2gcm_8_f90.html)



# The LMDZ Code



55 % in physics  
 20 % in dynamics  
 25 % in internal routines

