LMDZ - Planets

Some specificities about the planetary atmospheres GCMS

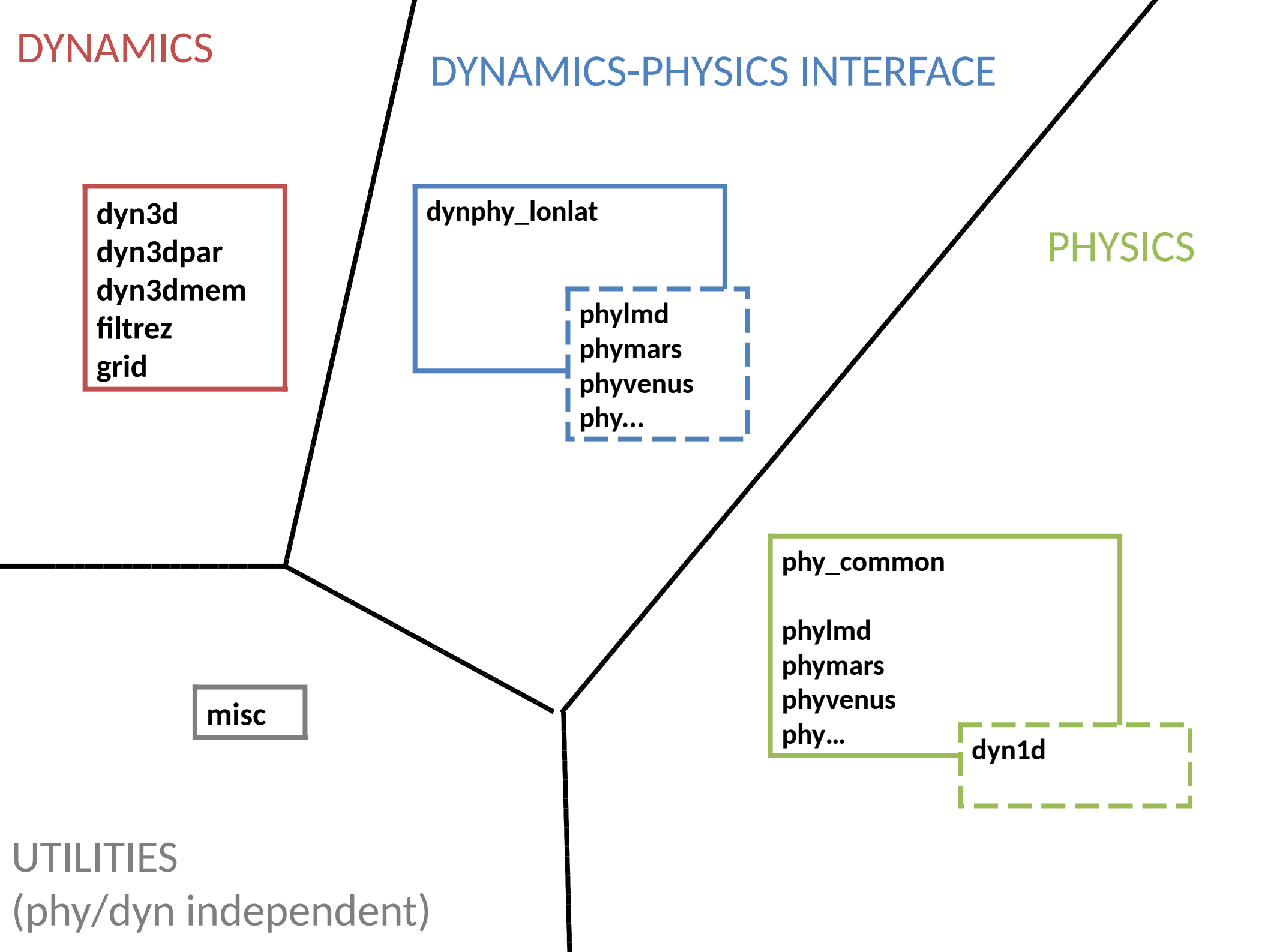
LMDZ courses, December 15, 2020

Overview of available GCMs

- Mars => Derived from LMDZ3
- Venus => Derived from LMDZ4
- Generic => Derived from Mars GCM, for Exoplanets or Gas giants or even Earth
- Titan => First derived from Venus, but now from the Generic GCM
- Pluto/Triton (no really integrated with the rest) => derived from the Generic GCM

Generalized planetary GCMs framework

- Share the same dynamics LMDZ.COMMON, and now also DYNAMICO (for Generic and Venus physics, Mars on the way) and WRF.
- Importance of a clean physics/dynamics separation to handle switching from a dynamics or physic package to another => see libf


DYNAMICS
DYNAMICS-PHYSICS INTERFACE
PHYSICS
dyn3d
dyn3dpar
dyn3dmem
filtrez
grid
dynphy_lonlat
phylmd
phymars
phyvenus
phy...
phy_common
phylmd
phymars
phyvenus
phy...
dyn1d
misc
UTILITIES
(phy/dyn independent)

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…

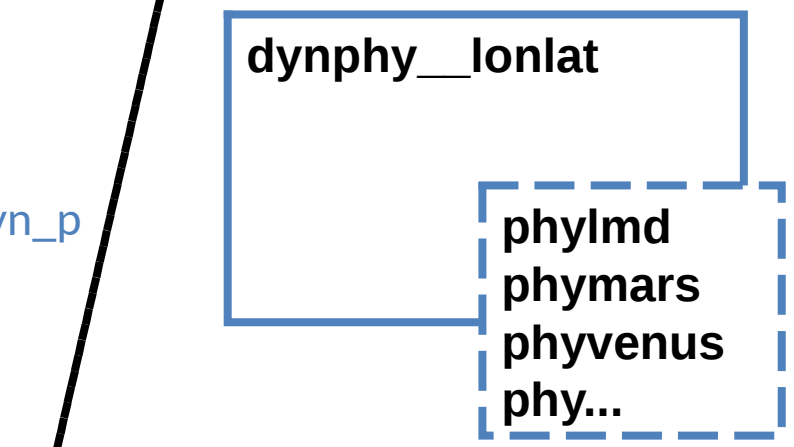
phy_common

phylmd
phymars
phyvenus
phy…

dyn1d

DYNAMICS-PHYSICS INTERFACE

dynphy_lonlat
•Relies on both dynamics and physics:
- calfis[_p|_loc]
- gr_dyn_fi[_p]
- gr_fi_dyn[_p]
- inigeomphy_mod
- mod_interface_dyn_phy



phy… (subdir of dynphy_lonlat)
•contains iniphysiq_mod , the routine 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, …

Planetary GCMs test cases (1)

- Download the install scripts from:

  http://www.lmd.jussieu.fr/~lmdz/planets/
- Like install_lmdz.sh, these scripts (install_*.bash) download the required NetCDF library, install it, download the model, compile it (as well as the IOIPSL library), download a testcase and run it.
- Look for the documentation in LMDZ.***/*** and the trac : https://trac.lmd.jussieu.fr/Planeto
- Check out the *.def (text) input files
- Check out the NetCDF outputs (diagfi.nc, stats.nc, ...)

Planetary GCMs test cases (2)

- Redo some extended simulations (change nday in run.def) and select outputs in diagfi.nc using a diagfi.def file. Also check out the stats.nc output.
- Adapt the arch files to compile in MPI (see the LMDZ model tutorial, very straightforward to adapt to planetary GCMs) and learn to run using “mpirun”
- Play with start2archive and newstart to change resolution (but it is easier to ask around for adequate initial conditions and def files)
- If interested: Try to use the 1D version of the model

Mixed bag of comments & advice

- The scripts we provide are (mostly) for illustrative examples. You will most likely need to develop your own (no need to re-install the NetCDF, IOIPSL or XIOS library every time) and adapt to your machine's settings (e.g. write your own "arch" files to use "module load ..." and/or an existing installed MPI distribution… and/or...)
- Remember the "svn" (subversion) is your friend! Use it to regularly check for updates and check what you changed (if anything) wrt the reference code.