

Simplified physics

LMDZ training session
January 2024
Lionel GUEZ

Contents

- Aqua-planet or all-land planet
- Relaxation to a 3D-temperature field

Aqua-planet or all-land-planet

Definition

- Flat relief
- Only one type of surface globally : either land or ocean
- Surface temperature is:
 - forced for an aqua-planet
 - computed for a land-planet (we still have to choose an initial field)

Selecting the aqua- or land-planet (1/3)

- Run-time parameter **iflag_phys** (integer) in gcm.def
Choose $\text{iflag_phys} \geq 100$ (instead of default value 1 for Earth surface, full physics)
- $\text{iflag_phys} = 101$ to 107, 109 to 114, 120, 121: aqua-planet
 $\text{iflag_phys} = 201$ to 207, 209 to 214, 220, 221: land-planet

Selecting the aqua- or land-planet (2/3)

- Different T_s fields, constant for aqua-planet,
initial value only for land-planet
- See (analytic) definition of the 15 T_s fields in procedure `profil_sst` (file `phylmd/phyaqua_mod.F90`)

Selecting the aqua- or land-planet (3/3)

- Note: all the T_s fields are uniform in longitude and symmetrical with respect to the equator.

Initial state and boundary conditions

- You do not go through the ce0l step
 - Set run-time parameter `read_start` to FALSE in `gcm.def`
gcm creates an initial state
 - gcm also creates a file `limit.nc` for boundary conditions
- gcm creates `restart.nc` and `restartphy.nc` so switch `read_start` to TRUE for the next run

Forcing data

- For an aquaplanet, it may be a good idea to use adapted sun position, ozone and aerosol fields, symmetrical about the equator
- `read_climoz = - 1` and `solarlong0 = 1000`
- No symmetrical aerosol field ready so either create it yourself or set:
`flag_aerosol = 0`

Idealized physics: relaxation to a given
3-dimensional temperature field

Selecting temperature relaxation (1/2)

- Set run-time parameter `iflag_phys=2` in `gcm.def`
- Analytic definition of the 3D equilibrium temperature field
- Damping of low-level wind to represent boundary-layer friction
- From Held and Suarez (1994)

Selecting temperature relaxation (2/2)

- Some run-time tuning parameters (relaxation time...), see `dyn3d/iniacademic.F90`

Initial state, no boundary condition

- You do not go through the ce0l step
 - Set run-time parameter `read_start` to FALSE in `gcm.def`
gcm creates an initial state
 - No file `limit.nc`
- gcm creates `restart.nc` (no `restartphy.nc`)
so switch `read_start` to TRUE for the next run

Note

- No other forcing data
- You do not use `physiq.def`, `config.def` nor `output.def`
- You can bypass compilation of physics files with option `-p nophys` of `make lmdz_fcm` → much quicker compilation