Simplified physics

LMDZ tutorial
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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 iflag_phys ≥ 100 (instead of default value 1 for Earth surface, full physics)
- iflag_phys = 101 to 107, 109 to 114, 120, 121: aqua-planet
  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 `makelmdz_fcm` → much quicker compilation