

Documentation for LMDZ, Planets version

How to modify the initial state: the newstart tool

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1 First step: start_archive.nc

The initial state of a simulation is read by the GCM in the files `start.nc` and `startphy.nc`. A first step to change these files is first to change them into a `start_archive.nc` file. This is coming from the Mars GCM, where this file can include all the `start*.nc` files for the 12 months of one complete Martian Year.

To do this conversion, you need to use the `start2archive` tool. Currently, this tool is well adapted for Venus and Titan, so the corresponding routine is called `start2archive-VT.F`. It is located in the `dyn3d` directory, and compiled the same way as the GCM. As inputs, it will need the same `*.def` files as those used during the simulation that created the `start*.nc` files. It then creates the `start_archive.nc` file from `start.nc` and `startphy.nc`.

2 Second step: the newstart tool

This tool allows many changes in the initial state:

- change in resolution
- change in zoom characteristics
- change in surface characteristics (topography, albedo)
- change in planetary constants

Currently, this tool is well adapted for Venus and Titan, so the corresponding routine is called `newstart-VT.F`, located in the `dyn3d` directory. As for the `start2archive` tool, it is compiled the same way as the GCM (in sequential only).

As inputs, it takes the `start_archive.nc` file with the initial state to be modified, and the `traceur.def` and `z2sig.def` files. It also needs a specific `run.def` file, tailored to include only the needed changes.

To change the resolution, compile `newstart-VT` in the new resolution. For the topography, the default behaviour will be to use the previous one (from `start_archive.nc`) and to interpolate it to the new resolution. You may want to use the highest resolution topography file you have to get a finer topography when increasing the resolution. In that case, you can add the line

```
topoflag=y
```

in the tailored `run.def` file. Your topography file should be called `Relief.nc`. This file must include the variable `RELIEF`, which is the topography in meters. It will be read by `newstart` and the new surface geopotential will be computed. This may also be used to modify the topography the way you want.

One point concerning Venus topography: it should be reversed in the `Relief.nc` file, so that the GCM runs as if it was looking at Venus with the South pole upward.

3 Specific `run.def` file

Zoom

To make a simulation with a zoom, the grid has to be altered. This needs to be done through `newstart`, using zoom parameters that will be read from the `run.def` file. These parameters include (see specific zoom documentation ?):

- *clon,clat*: coordinates of the zoom center (in degrees)
- *grossismx,grossismy*: resolution increase factor within the zoom area
- *fxyhypb*: logical. If "y" (True) then hyperbolic function for the transition.
- *dzoomx,dzoomy*: fraction of the total domain used in the zoom area (used only if *fxyhypb=y*)
- *taux,tauy*: zoom stiffness (in the transition area ?) (used only if *fxyhypb=y*)
- *ysinus*: logical (used only if *fxyhypb=n*). Use sinus of latitude instead of latitude for the transition.

For Venus, the topography being reversed, *clat* and *clon* must take this into account when targeting a specific feature !

Albedo

If you want to change the value of the albedo, you can add the lines

```
albedoflag=y
```

```
albedo=<value>
```

in `run.def` to input the new value.

For the albedo, we may want to use a map. This is not yet implemented. When it will be, the file containing this map can be used to change the albedo (as for the topography).

Other parameters

It could be possible to include other parameters in the change (, just by adding optional lines in `run.def`. The reading has to be hardcoded in `newstart-VT.F` first, but it's easy.

The specific heat is already implemented (*cpp*).

4 Technical aspects

The subroutines used for the `start_archive.nc` and `newstart` tools are located in the `phy<planet>` directory, since they may slightly vary from one planet to the other.

For start_archive.nc, these routines are:

- ini_archive.F
- readstart.F
- readstartphy.F
- write_archive.F

For newstart, they are:

- interp_vert.F
- scal_wind.F
- wind_scal.F
- writerestart.F
- writerestartphy.F
- startvar.F90 and grid_noro.F, which are used to read the Relief.nc file and compute the surface geopotential and the parameters needed for the orographic gravity wave drag.