GAME Handbook

GAME Development Team

1 Running the model

All physical quantities in this document are to be multiplied with their respective SI units.

Listing 1: Example input file.

```
#!/bin/bash
operator=MHB
overwrite_run_id=1
run_id=jw_perturbed_moist
run_span=21600
write_out_interval=900
grid_props_file=grids/B5L26T30000_O2_OL17_SCVT.nc
init_state_filename=test_5_B5L26T30000_O2_OL17_SCVT.nc
init_state_file=input/$init_state_filename
output_dir_base=output
cfl_margin=0.0
scalar_diffusion_on=1
momentum_diffusion_on=1
tracers_on=1
rad_on=0
radiation_delta_t=3600
write_out_mass_dry_integral=1
write_out_entropy_gas_integral=1
write_out_energy_integral=1
export OMP_NUM_THREADS=4
number_of_cpus=1
year=2000
month=1
day=1
hour=0
source core/run.sh
```

Listing 1 is an example of an input file. Table 1 explains the meanings of the variables.

2 Generating required files

2.1 Grid generation procedure

A grid is determined by the following five properties:

- the resolution, specified via the parameter `RES_ID`
- the orography, specified via the parameter `ORO_ID`
- the height of the top of the atmosphere, specified via the parameter `TOA`
- the number of layers, specified via the parameter `NUMBER_OF_LAYERS`
- the number of layers following the orography, specified via the parameter `NUMBER_OF_ORO_LAYERS`

The grid generator needs to be recompiled for every specific resolution, top height, number of layers as well as number of orography following layers. Therefore change the respective constants in the file `grid_generator.c` and execute the bash script `compile.sh`. Then run the grid generator using the bash script `run.sh` with the desired `oro_id`. Table 2 explains all the parameters to be set in `run.sh`. Otimized grids have the postfix `_SCVT`.

name	domain	meaning
operator	string	Operator of the model, for example `Company XYZ, Inc.`
overwrite_run_id	0, 1	if 0: use auto-generated run_id, if 1: use manually set run_id (see next line)
run_id	string (optional)	run_id to be used if overwrite_run_id is set to 1
run_span	integer	How long the model shall run into the future.
write_out_interval	integer ≥ 900	Every how many seconds autput shall be generated.
grid_props_file	string	File name of the grid properties file.
init_state_filename	string	File name of the initialization state file.
init_state_file	string	Full path of the initialization state file.
output_dir_base	string	The directory to which output shall be written.
cfl_margin	double	Manual reduction of the time step below the CFL criterion: $\Delta t = (1 - \text{cfl\_margin})\,\Delta t^{(\text{CFL})}$.
diffusion_on	0, 1	diffusion switch
dissipation_on	10, 1	dissipation switch
tracers_on	0, 1	tracers switch
rad_on	0, 1	radiation switch
radiation_delta_t	double ≥ Δt	Every how many seconds the radiation flux densities shall be updated.
write_out_mass_dry_integral	0, 1	Switch to decide wether a global integral of dry mass shall be written out at every time step.
write_out_entropy_gas_integral	0, 1	Switch to decide wether a global integral of the entropy shall be written out at every time step.
write_out_energy_integral	0, 1	Switch to decide wether a global integral of the energy shall be written out at every time step.

Table 1: Input file explanation.

name	domain	meaning
`oro_id`	all value for which an orography is defined	orography ID
`optimize`	0, 1	optimization switch (fails if `oro_id` is not 0)
`n_iterations`	integer ≥ 1	number of iterations (ignored if `optimize` = 0), 8000 seems to be a safe value
`use_scalar_h_coords_file`	0, 1	switch to determine wether horizontal coordinates of triangle vertices (generators of the grid) shall be used from another file
`scalar_h_coords_file`	string	input file for dual triangle vertices (only relevant if `use_scalar_h_coords_file` = 1)

Table 2: Grid generator run script explanation.

ORO_ID	**description**
0	no orography
1	orography of JW test
2	Gaussian mountain of 8 km height and 224 m standard deviation located ad 0 N / 0 E
3	real orography

Table 3: Definition of orography IDs.

TEST_ID	**description**
0	standard atmosphere
1	standard atmosphere with Gaussian mountain (ORO_ID = 2)
2	JW dry unperturbed
3	JW dry perturbed
4	JW moist unperturbed
5	JW moist perturbed

Table 4: Definition of test IDs.

2.2 Generating a new orography file

Orography files are generated with the code residing in the directory `orography_generator/src`. Firstly, change the parameter `RES_ID` in the file `orography_generator.c` to the desired value and compile. Then source the bash scribt `run.sh` with the desired `oro_id`. Tab. 3 shows the definition of the orography IDs. Real orography can be downloaded from

- `https://psl.noaa.gov/cgi-bin/db_search/DBSearch.pl?Dataset=NCEP+Reanalysis&Variable=Geopotential+height&group=0&submit=Search`

These files are stored in the directory `orography_generator/real`. An information file explains them.

2.3 Generating a new test state file

A new test state can be generated with the code in the directory `test_generator/src`. Therefore, firstly change the parameters `RES_ID`, `NUMBER_OF_LAYERS` and `NUMBER_OF_ORO_LAYERS` in the file `test_generator.c`. Then compile by sourcing the file `compile.sh` before executing the file `run.sh` with the specific `test_id`. Tab. 4 shows the definition of the test IDs.