Wikiprint Book

Title: 1. The sources of the components

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Table of Content

The LMDZORINCA configurations

The LMDZORINCA configurations (LMDZORINCA and LMDZORINCA_v5) allow you to couple the LMDz atmospheric circulation model, the ORCHIDEE land model, and the INCA atmospheric chemistry model close to the CMIP6 coupled model.

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1. The sources of the components

1.1. LMDZORINCA_v6.1.10

LMDZORINCA_v6.1.10 is the default configuration. It is compatible with the IPSLCM6.1.10_LR, LMDZOR_v6.1.10 models. It is constructed with the following models:

- LMDZ branches/IPSLCM6.0.15 rev 3483 for the gcm and the create_etat0_limit
- ORCHIDEE tag tags/ORCHIDEE_2_0/ORCHIDEE rev 5661
- INCA trunk/INCA6 rev 871

This configuration allows you to work with the INCA version tuned for 39 levels for NMHC, NMHC_AER, NMHC_AER_S, AER, GES and DUSS, and on 79 levels for AER.

The same version of INCA is used in IPSLCM5A2CHT.1 configuration.

It is not yet possible to use the new LMDZ physics scheme with this configuration.

1.2. LMDZORINCA

LMDZORINCA is the configuration used for CMIP5. It is constructed with the following models:

- LMDZ branch LMDZ4_AR5 rev 1567 for the gcm
- LMDZ trunk LMDZ5 rev 1531 for the create_etat0_limit
- ORCHIDEE tag orchidee_1_9_5 on the cvs file repository
- INCA trunk INCA3 rev 255

This configuration allows you to work with the INCA version tuned for 19 levels.

1.3. Flags managing the INCA and ORCHIDEE activation

When you compile a model configuration which includes the INCA and ORCHIDEE models, those two models can be activated or deactivated in your simulation. In LMDZORINCA_v5 these activations are managed by the submission directory you chose (in EXPERIMENTS).

1.3.1. Activating or deactivating INCA

Flag	Value	Meaning
config_inca	none	run without INCA
config_inca	aero	coupling with INCA AER/NMHC_AER
config_inca	chem	coupling with INCA NMHC/GES

1.3.2. Activating or deactivating ORCHIDEE

Flag	Value	Meaning
veget	y	run with Orchidee

veget	n	run without Orchidee

2. Available resolutions

When you compile the model you must choose the chemistry component and its resolution:

- AERxLMD9695-L39
- NMHC_AERxLMD9695-L39
- GESxLMD9695-L39
- AERxLMD144x142-L39
- AERxLMD9695-L19
- NMHC_AERxLMD9695-L19
- GESxLMD9695-L19
- AERxLMDZ144142-L19

With LDMZORINCA_v5 we recommend to use the 39 vertical level resolution. With LMDZORINCA we recommend to use the 19 vertical levels resolution.

2.1. Changing the resolution

You can add the compilation of another resolution by copying the syntax of an existing resolution. If you do so, you will need to regrid all input files for the chosen chemistry model. ■documentation To regrid the inca files

3. Initial states

With the LMDZ model you can create initial files (start.nc, startphy.nc and limit.nc) for each simulation (for this, use the experiments : EXPERIMENTS/LMDZORINCA/CREATE/). However, start.nc file only contain zero-values for tracers when the model is coupled to INCA. You must therefore work on those values or use output files from existing simulations. By default, we provide one initial state per configuration.

- ${R_INIT}/CHM/LMDZORINCA/INCA${RESOL_CHM}/start.nc --> start.nc
- ${R_INIT}/CHM/LMDZORINCA/INCA${RESOL_CHM}/startphy.nc --> startphy.nc

With

- ${R_INIT} = /ccc/work/cont003/p86ipsl/IGCM/INIT at TGCC
- ${RESOL_CHM} = 9695-L39 / 9695-L19 / 144142-L19 / 144142-L39

They are defined in the [InitialStateFiles] section of lmdz.card

```
[InitialStateFiles]
List=  (${R_INIT}/CHM/LMDZORINCA/INCA${RESOL_CHM}/start.nc     , start.nc     ) \
       (${R_INIT}/CHM/LMDZORINCA/INCA${RESOL_CHM}/startphy.nc  , startphy.nc  )
```

4. Experiments

In the EXPERIMENTS directory the available configurations are LMDZORINCA, LMDZOR, LMDZ. In LMDZORINCA you can choose among three kind of experiments:

- NMHC_AER
- AER
- GES

4.1. inca.card

4.1.1. UserChoices Parameters

You can manage some parameter since the inca.card file

- climatological=[n/y] --> set climatological to choose if the simulation will use online 10m wind (y) or offline (no)
- freq_write_chem=[time in second] --> set freq_write_chem to choose the write frequency in second for inca output (inca_avgr, forcate)
- feedb=[0/1] --> heat fluxes computed with feedback corresponding to 0 = no aerosol effects, 1 = aerosol effects selected by ok_ade, ok_aie

4.1.2. 10-m winds

- There is an experiment directory for each configuration of the chemistry component:
  - EXPERIMENT/LMDZORINCA/NMHC_AER/
  - EXPERIMENT/LMDZORINCA/AER/
  - EXPERIMENT/lMDZORINCA/GES/

Each of those directories contain a config.card

- If you work with an aerosol configuration (AER or NMHC_AER) you can chose to work with 10-m winds computed by the LMDZ model or read in forcing files. By default the second option is chosen. On the other hand, if you want to use the values computed by LMDZ, you must change the model by hand by setting the climatological variable to true in INCA/src/INCA_SRC/aerosol_meteo_calc.F90.

Files definition to read the 10-m winds

```
[BoundaryFiles]
List=           (/ccc/work/cont003/subipsl/subipsl/ECMWF320x160/AN${year}/165_${year}${month}.nc       , u10mec.nc)\
                (/ccc/work/cont003/subipsl/subipsl/ECMWF320x160/AN${year}/166_${year}${month}.nc       , v10mec.nc)\
                (${R_BC}/ATM/LMDZORINCA/${RESOL_ATM}/NUDGE_FILES/ERAI/AN${year}/u10m_ecmwf_${year}${month}.nc , u10m.nc  )\
                (${R_BC}/ATM/LMDZORINCA/${RESOL_ATM}/NUDGE_FILES/ERAI/AN${year}/v10m_ecmwf_${year}${month}.nc , v10m.nc  )
```

4.1.3. Text outputs

In the INCA4 model version, the text outputs are not in the standard output files. They are redirected to a text file per processor. These files are concatenated at the end of the simulation to create only one inca.out file. This file is saved in the DEBUG/ archive. If the simulation fails, the file is saved in the Debug/ directory which is available in the experiment directory.

4.2. lmdz.card

You will find all the information needed to understand the lmdz.card file here.

4.2.1. The nudged mode

You can work in nudged mode (by forcing the winds using files read by the LMDZ model) or in climatological mode (by using the wind values computed by LMDZ). If you work in nudged mode, several forcing files are available on the subipsl shared account at TGCC : /ccc/work/cont003/subipsl/subipsl (only on Curie)

- ECMWF96x95 : regridded winds in 96x95 from OPERA of ecmwf
- ECMWF144x142 : regridded winds in 144x142 from OPERA of ecmwf
- ECMWF320x160 : winds distributed by ecmwf (1979 to 2013)
- ERAI96x95 : regridded winds in 96x95 from ERAI of ecmwf
- ERAI : winds distributed by ecmwf (store on /ccc/store/cont003/subipsl/subipsl/dmf_import/ERAI/NETCDF/GLOBAL_075/4xdaily/AN_PL for year 1979 to 2011)

4.2.2. adjust

If you have a simulation which includes the INCA model, you must not use the adjust option which creates biases at the beginning of the simulation in particular for configurations with aerosols. If you didn't change the models you can use Bands files which are defined by default in the lmdz.card files.

```
AER
#LMDZ_Bands_file_name=/ccc/store/cont003/dsm/p86cozic/IGCM_OUT/LMDZORINCA/AER/L5OI4_Bands/ATM/Debug/L5OI4_Bands_Bands_96x9
```

```
NMHC_AER
#LMDZ_Bands_file_name=/ccc/store/cont003/dsm/p86cozic/IGCM_OUT/LMDZORINCA/NMHC_AER/L4OI3NA_39_Bands/ATM/Debug/L4OI3NA_39_B

GES
not provided
```

If you added computations in the model, we recommend to regenerate this file by performing a 3-month pre-simulation.

5. The aerosol coupling and the radiative effect in LMDZORINCA

LMDZORINCA allows you to activate the aerosol impact on climate. To this end, we have used Céline Déandreis' PhD results.
This coupling can be made in two different modes:

* offline (reading the aerosols in files)

* online (computing the aerosols using INCA)

Different flags were introduced to manage these new options: **aerosol_couple** and **flag_aerosol** (in physiq.def).
The aerosols you can use with offline or online coupling are : SO4, BC, POM, SS and DUST. If your coupling is offline, refer to the next chapter.

5.1. Flag definitions

Flag	Value	Meaning
aerosol_couple	n	offline coupling
aerosol_couple	y	online coupling

LMDZ offers two flags to activate the radiative forcings: **ok_ade**, **ok_aie**

Flag	Value	Meaning
ok_ade	y/n	computing (or not) the aerosol direct effect
ok_aie	y/n	computing (or not) the aerosol indirect effect

The ok_ade and ok_aie flags are managed from lmdz.card :

* AER --> aerosol_couple = y, ok_ade = y and ok_aie = n

* NMHC_AER --> aerosol_couple = y, ok_ade = y and ok_aie = n

* GES --> aerosol_couple = n, ok_ade = n and ok_aie = n

5.2. Variable definitions

You can also choose to compute the radiative forcing without their climatic impacts. In this case, you must use the **feedb** variable in the src/INCA_SRC/radlwsw_inca.F90 routine. If the variable equals 0 the climatic impact is not activated, if the variable equals 1 the climatic impact is activated.