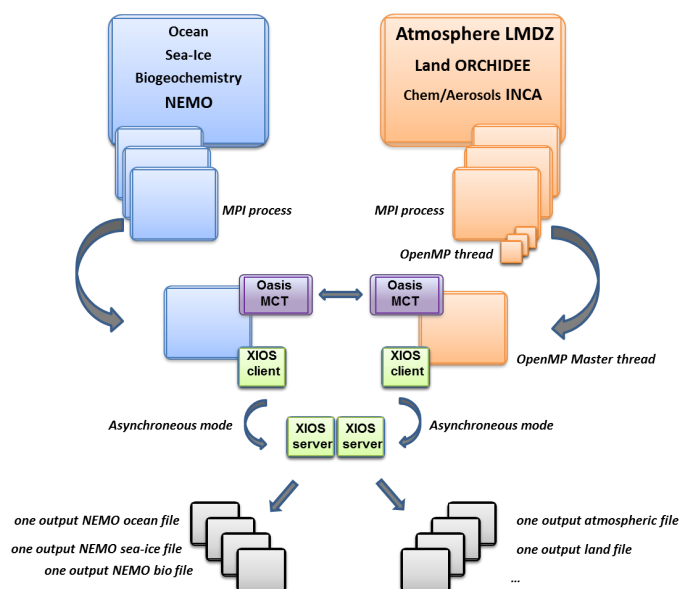# IPSL-CM5A2 configuration

Table of Content

Person in charge: Arnaud Caubel

1. IPSL-CM5A2 model

IPSL-CM5A2 is an **IPSL coupled climate model** including atmosphere, land, ocean, sea ice and carbon cycle. The goal of this model is to reproduce IPSLCM5A-LR version, with reduced computing times to allow to run long simulations (i.e thousands of years) within reasonnable time. Main caracteritics of this model are **ORCA2-LIM2-PISCES x LMD 96x95x39**, old LMDZ physics, ORCHIDEE with Choisnel hydrology (2 layers). This model uses both recent component versions and recent technical developments (hybrid parallelization MPI-OpenMP, XIOS 2.0 as input-output library, OASIS3-MCT parallel coupler) that allow to reach **56 simulated years per day** on about 300 Curie computing cores. This model is available on Ada (IDRIS) and Curie (TGCC) supercomputers and benefits from last developments of libIGCM runnning environment.

IPSL-CM5A2 model includes :

- model components :
    - **LMDZ** as atmospheric model ;
    - **NEMO** as ocean model including sea ice (LIM2) and marine biogeochemistry (PISCES) ;
    - **ORCHIDEE** as land model ;
- tools :
    - **OASIS3-MCT** as parallel coupler ;
    - **XIOS** as I/O library ;
    - **libIGCM** as running environment (scripts) to run the model and to perform post processing ;

2. Technical details

IPSL-CM5A2 model is available at following resolutions/configurations :

- **IPSL-CM5A2-LR** : LMDZ(Old Physics) 96x95x39-ORCHIDEE(Choisnel) - NEMO-LIM2-PISCES ORCA2

The resolution of LMDZ is 96x95 (3.75° in longitude and 1.875° in latitude) with 39 vertical levels. The ocean configuration is ORCA2 : global ocean with a tripolar grid with one South Pole, one North Pole above Siberia and one North Pole above northern America. The resolution is 2°. In the tropical region, the latitudinal resolution decreases to 1/2°. There are 31 vertical levels.

IPSL-CM5A2 is composed of following components and tools :

```
#-H- IPSLCM5A2  IPSLCM5A2 coupled configuration
#-H- IPSLCM5A2  1st frozen IPSLCM5A2 version
#-H- IPSLCM5A2  NEMOGCM branch nemo_v3_6_STABLE revision 6665
#-H- IPSLCM5A2  XIOS2 trunk revision 858
```

```
#-H- IPSLCM5A2   IOIPSL/src svn tags/v2_2_2
#-H- IPSLCM5A2   LMDZ5 trunk rev 2595
#-H- IPSLCM5A2   ORCHIDEE version trunk rev 3525
#-H- IPSLCM5A2   OASIS3-MCT 2.0_branch rev 1129
#-H- IPSLCM5A2   IPSLCM5A2 svn
#-H- IPSLCM5A2   libIGCM trunk rev 1330
#-M- IPSLCM5A2   arnaud.caubel@lsce.ipsl.fr
#-C- IPSLCM5A2   IOIPSL/tags/v2_2_2/src                         HEAD        8   IOIPSL/src    modeles
#-C- IPSLCM5A2   trunk/ORCHIDEE                                 3525       14   ORCHIDEE      modeles
#-C- IPSLCM5A2   branches/OASIS3-MCT_2.0_branch/oasis3-mct 1129           15   oasis3-mct    .
#-C- IPSLCM5A2   LMDZ5/branches/testing                        2595       11   LMDZ          modeles
#-C- IPSLCM5A2   CONFIG/UNIFORM/v6/IPSLCM5A2                    HEAD        8   IPSLCM5A2     config
#-C- IPSLCM5A2   trunk/libIGCM                                 1330       10   libIGCM       .
#-C- IPSLCM5A2   branches/2015/nemo_v3_6_STABLE/NEMOGCM         6665        7   .             modeles
#-C- IPSLCM5A2   XIOS/trunk                                     858       12   XIOS          modeles
```

2.0.1. How to use it

Here are the commands you need to know if you want to retrieve and compile the IPSL-CM5A2 model and if you want to setup and run a piControl experiment (pdControl is also available):

```
mkdir YOUR_DIRECTORY ; cd YOUR_DIRECTORY
svn_ano # svn co http://forge.ipsl.jussieu.fr/igcmg/svn/modipsl/trunk modipsl
cd modipsl/util
./model IPSLCMA2
cd ../config/IPSLCMA2
gmake # by default ORCA2xLMD9695-L39
cp EXPERIMENTS/IPSLCM5/EXP00/config.card .
vi config.card # modify JobName (at least) : MYJOBNAME, restarts
../../util/ins_job # Check and complete job's header
cd MYJOBNAME
vi Job_MYJOBNAME # modify PeriodNb, adjust the time, headers ...
llsubmit Job_MYJOBNAME # IDRIS
ccc_msub  Job_MYJOBNAME # TGCC
```

2.0.2. Restart files

Default IPSL-CM5A2 configuration starts from VLRtun01 simulation at the date of 3599-12-31. The monitoring of this simulation is available here :
■http://esgf.extra.cea.fr/thredds/fileServer/work/p25sepul/IPSLCM6/DEVT/piControl/VLRtun01/MONITORING/index.html

2.0.3. Output level

By default, only **monthly outputs** and **low output levels** are activated.

2.0.4. Lengths, frequencies

2.0.4.1. Period length

Default period length is 1Y, i.e in config.card :

```
PeriodLength=1Y
```

Note that clean_PeriodLenght.job will remove last period files, i.e last simulated year files.

2.0.4.2. Pack Frequency

Default pack frequency is 10Y, i.e in config.card :

```
PackFrequency=10Y
```

Note that since clean_latestPackperiod.job works on the latest pack period, clean_latestPackperiod.job will remove files from latest 10Y pack period. clean_latestPackperiod.job can also be used several time in a row to delete several 10Y pack periods.

2.0.4.3. Rebuild frequency

Since we run with XIOS (server mode) as output library, **the rebuild step is not needed anymore**.

2.0.5. Computing centres

2.0.5.1. TGCC Bull Curie thin nodes

The basic configuration (default configuration) runs on Curie TGCC machine and uses 302 computing cores : 1 process for XIOS, 45 processes for NEMO, and 32 MPI processes and 8 OpenMP thread for LMDZ. This configuration allows you to run 56 simulated years per day. In order to use less computing ressources, it is possible to run on 160 cores (38 simulated years per day) as follows : 1 process for XIOS, 31 processes for NEMO, and 32 MPI processes and 4 OpenMP thread for LMDZ. To do that, you have to :

- Modify config.card as follows :

```
#========================================================================
#D-- Executable -
[Executable]
#D- For each component, Real name of executable, Name of executable for oasis
ATM= (gcm.e, lmdz.x, 32MPI, 4OMP)
SRF= ("" ,"" )
SBG= ("" ,"" )
OCE= (opa, opa.xx, 31MPI)
ICE= ("" ,"" )
MBG= ("" ,"" )
CPL= ("", "" )
IOS= (xios_server.exe, xios.x, 1MPI)
```

- create the new job :

```
../../libIGCM/ins_job
```

- Modify PARAM/namelist_ORCA2_cfg

```
   jpni        =   1      !  jpni   number of processors following i (set automatically if < 1)
   jpnj        =  31      !  jpnj   number of processors following j (set automatically if < 1)
   jpnij       =  31      !  jpnij  number of local domains (set automatically if < 1)
```

- submit the job : ccc_msub (or llsubmit) Job_MYJOBNAME

Because of load-balancing (difference between ocean computing time and atmosphere computing time), not all configurations (in terms of number of process/threads) are efficient. If you want to run a configuration with less cores, ask Arnaud Caubel what would be the optimum configuration.

2.0.5.2. IDRIS IBM Ada

The basic configuration (default configuration) runs on Ada (IDRIS). In order to use efficiently computing ressources, you have to use Intel environment. To do that you have to :

- ask IDRIS assistance (mail to assist@…) to be authorized to use Ada full node and (# @ node = N) option.
- specify the environment you want to use when you do the ../../libIGCM/ins_job command as follows :

```
Hit Enter or give MPI Environement (default is IBM), possible MPI environments are IBM (MPI IBM) and Intel (MPI Intel)
Intel
MPIEnvironment is Intel
```

3. Tuning and evaluation of the model

Person in charge: Pierre Sepulchre