

## IPSL-CM5A2 configuration

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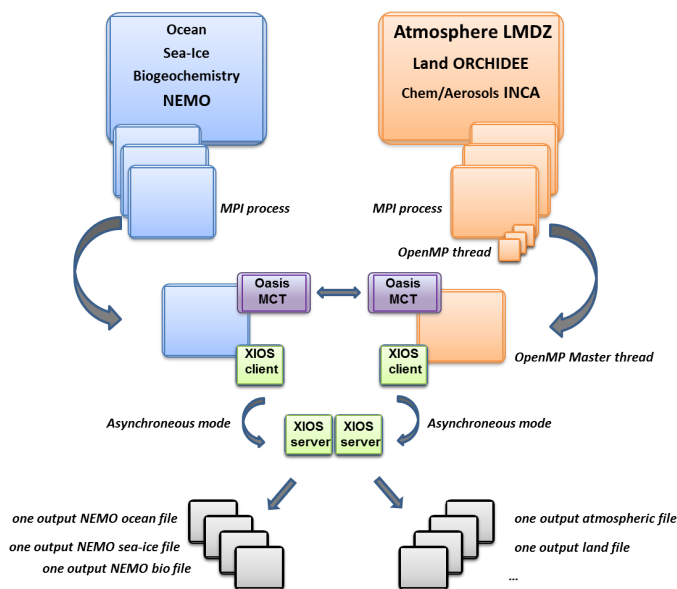
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## 1. IPSL-CM5A2 model

**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 IPSL-CM5A-LR version, with reduced computing times to allow to run long simulations (i.e thousands of years) within reasonable time. Main characteristics of this model are **ORCA2-LIM2-PISCES x LMD 96x95x39, old LMDZ physics, ORCHIDEE with Choisisel 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 computing cores. This model is available on Ada (IDRIS) and Curie (TGCC) supercomputers and benefits from last developments of libGCM running 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 2.0** 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** : 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 **VLRun01** simulation at the date of **3699-12-31**. The monitoring of this simulation is available here : <http://esgf.extra.cea.fr/thredds/fileServer/work/p25sepul/IPSLCM6/DEVT/piControl/VLRun01/MONITORING/index.html>

### 2.0.3. Output level

By default, **low output levels** are activated : monthly and daily outputs for atmospheric component, monthly and/or yearly outputs for other components. Remind that you have to think of the output you need before launching a long simulation.

### 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

The basic configuration (default configuration) runs on Curie TGCC and Ada IDRIS 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)
jpni_j    = 31     ! jpni_j number of local domains (set automatically if < 1)
```

- submit the job : `ccc_msub` (or `lsubmit`) `Job_MYJOBNAME`

Because of load-balancing (difference between ocean computing time and atmosphere computing time), not all of the 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.

##### 2.0.5.1. IDRIS Ada features

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