The IPSLCM5 configuration

Table of Content

The IPSLCM5 configuration **1**
1. The IPSLCM5_v5 configuration **2**
2. The components' origin **2**
3. Resolutions and configurations **3**
3.1. IPSLCM5A-LR 3
3.2. IPSLCM5A-MR 3
3.3. IPSLCM5B 3
4. The experiments **4**
4.1. EXP00 4
4.2. piControl 4
4.2.1. Main differences between piControl and EXP00 4
4.3. historical 4
4.3.1. Main differences between piControl and historical 4
4.4. Paléo. configurations 5
4.5. Chistorical 5
4.6. CpiControl 5
5. The initial states **5**
5.1. Which achieved simulations can you use as initial state? 5
6. The output levels **6**
6.1. Be careful: the configurations can produce a very large number of outputs 6
7. What is the amount of outputs produced by those 3 experiments? **6**
7.1. Outputs parameterizations 6
7.1.1. Table of the amount of outputs for 10 years (in Go) 6
7.2. Dimension and number of files for a historical simulation: 156 years, OutLevel=high, without ATLAS and MONITORING directories 7
7.3. Dimension and number of files for a historical simulation, for the ATLAS and MONITORING directories 7
8. Ressources on usual machines **7**
8.1. Information obtained in 2012 for the computing time requested for 2013 7
8.2. TGCC 7
8.2.1. Bull Curie 7
8.2.2. Bull Titane (this computing machine will be stopped in June 2013) 7
8.3. IDRIS 8
8.3.1. IBM : Ada 8
9. Command summary **8**
10. Evaluation **8**

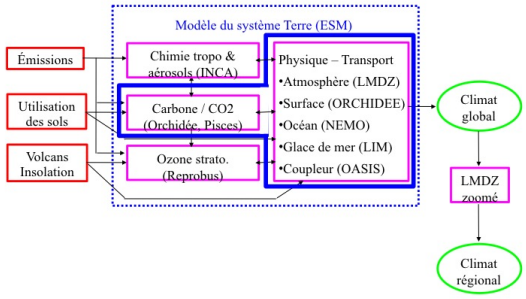
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1. The IPSLCM5_v5 configuration

IPSLCM5_v5 is **the reference configuration of the coupled IPSL model** for the CMIP5 simulations including atmosphere, land, ocean, sea ice and carbon cycle. This configuration includes :

- the model components:
  - LMDZ, the atmospheric model ;
  - NEMO, the ocean model including sea ice (LIM2) and marine biogeochemistry (PISCES) ;
  - ORCHIDEE, the land model ;
  - the OASIS coupler ;
- the tools :
  - IOIPSL, the library dealing with the IPSL model I/O ;
  - XMLIOSERVER, the I/O server ;
  - scripts to run the model and to perform post processing and the ksh functions library libIGCM

IPSLCM5_v5



2. The components' origin

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.

As a reminder, here are the versions of the components and tools.

```
vi modipsl/util/mod.def
#-H- IPSLCM5_v5  IPSLCM5_v5 coupled configuration
#-H- IPSLCM5_v5  CMIP5 version 08/12/2011
#-H- IPSLCM5_v5  with 5 NEMO sub-domains for vargas or titane by default
#-H- IPSLCM5_v5  NEMO svn branches/CMIP5_IPSL 3205
#-H- IPSLCM5_v5  XMLF90 svn trunk revision 297
#-H- IPSLCM5_v5  XMLIO_SERVER svn trunk revision 297
#-H- IPSLCM5_v5  IOIPSL/src svn tags/v2_2_1
#-H- IPSLCM5_v5  LMDZ5 trunk revision 1628
#-H- IPSLCM5_v5  ORCHIDEE version orchidee_1_9_5
#-H- IPSLCM5_v5  OASIS3 rev 1677 trunk
#-H- IPSLCM5_v5  IPSLCM5_v5 svn
#-H- IPSLCM5_v5  libIGCM trunk
#-M- IPSLCM5_v5  arnaud.caubel@lsce.ipsl.fr
#-C- IPSLCM5_v5  IOIPSL/tags/v2_2_1/src        HEAD         8  IOIPSL/src     modeles
#-C- IPSLCM5_v5  tags/ORCHIDEE_1_9_5/ORCHIDEE  HEAD        14  ORCHIDEE       modeles
#-C- IPSLCM5_v5  CPL/oasis3/trunk              1677         8  prism          .
#-C- IPSLCM5_v5  LMDZ5/trunk                   1628        11  LMDZ           modeles
#-C- IPSLCM5_v5  CONFIG/UNIFORM/v5/IPSLCM5_v5  HEAD         8  IPSLCM5_v5     config
#-C- IPSLCM5_v5  tags/libIGCM_v2.0_rc2               HEAD        10  libIGCM        .
```

```
#-C- IPSLCM5_v5  branches/CMIP5_IPSL/NEMO      3205         7  .              modeles
#-C- IPSLCM5_v5  branches/CMIP5_IPSL/UTIL      3405         7  .              modeles
#-C- IPSLCM5_v5  XMLF90                          297        12  .              modeles
#-C- IPSLCM5_v5  XMLIO_SERVER/trunk              297        12  XMLIO_SERVER   modeles
```

3. Resolutions and configurations

Three configurations are setup and used for CMIP5. They all have 39 vertical levels for the atmosphere component. The horizontal resolution of the atmosphere and the atmospheric physics differ:

- The IPSLCM5A configurations use the LMDZ4 physics (close to the one used for CMIP3). These configurations are setup and evaluated for 2 resolutions :
  - ORCA2xLMD9695-L39. The resolution of LMDZ is 96x95 (3,75° in longitude and 1,875° in latitude) with 39 vertical levels.
  - ORCA2xLMD144142-L39. The resolution of LMDZ is 144x142 (2,5° in longitude and 1,25° in latitude) with 39 vertical levels. Note that this resolution is numerically unstable.
- The IPSLCM5B configuration uses the LMDZ5 physics. It includes thermals and cold pools. This configuration is not entirely setup and it must not be used without the help of the LMD experts. Its usual resolution is ORCA2xLMD9695-L39.

Other resolutions exist as benchmarks but they are not setup.

3.1. IPSLCM5A-LR

By default the coupled version is IPSLCM5A-LR.

3.2. IPSLCM5A-MR

- You must choose the resolution when compiling. To choose MR resolutions: `gmake ORCA2xLMD144142-L39`
- change TagName : `TagName=IPSLCM5A-MR` in `config.card`
- specify pmagic=-0.01 to be setup like IPSLCM5A-MR in CMIP5. Change `PARAM/config.def_preind`, `PARAM/config.def_annuel`or `PARAM/config.def_actuel`
- use a larger number of processors. If you use 5 processors for NEMO, increase this number to 53 processors. Change `JobNumProcTot=53` in `config.card`
- reduce the length of the time series. Use a historical MR CMIP5 simulation as an example.
- Be careful, the MR configuration is not stable. It can stop due to a numerical instability leading to temperature values that are too small at certain gridpoints. In those cases, restart the last period by choosing a Matsuno-type timestep. Change `ByPass_hgardfou_mats=nin` `COMP/lmdz.card`.

Summary of the difference between IPSLCM5A-LR and IPSLCM5A-MR

File	IPSLCM5A-LR	IPSLCM5A-MR	Comments
PARAM/config.def_xxx	pmagic=0.0	pmagic	Choose the pmagic parameter
PARAM/gcm.def	gcm.def_96x95x39	gcm.def_144x142x39	PARAM file used
PARAM/namcouple	namcouple_ORCA2xLMD9695	namcouple_ORCA2xLMD144142	PARAM file used
COMP/*.card		ChunckJobxD	reduce the TS length

3.3. IPSLCM5B

- Change TagName : `TagName=IPSLCM5B`in `config.card`
- Change `LMDZ_Physics=NPv3.1`in `COMP/lmdz.card`
- The physics parameter are taken in the `PARAM/physiq.def_L39_NPv3.1` file

Summary of the differences between IPSLCM5A-LR and IPSLCM5B-LR

File	IPSLCM5A-LR	IPSLCM5A-MR	Comments
PARAM/physiq.def	PARAM/physiq.def_L39_AP	PARAM/physiq.def_L39_NPv3.1	PARAM file used

4. The experiments

The EXPERIMENTS directory contains the benchmark experiments. They are stored in 3 subdirectories: LMDZ, LMDZOR and IPSLCM5.

Reminder: it is possible to perform LMDZ-type (atmosphere only) or LMDZOR-like (atmosphere and land) experiments with executables of this configuration. See LMDZOR

The experiments associated to IPSLCM5A are the following:

- EXP00 : a present-day control experiment (pdControl).
- piControl : a preindustrial control experiment (piControl). The outputs correspond to the CMIP5 requirements.
- historical : a historical experiment (1850-2005) with all necessary forcings.
- Chistorical : a historical experiment (1850-2005) with interactive CO2. It is in its final stage but not yet ready.
- CpiControl : a preindustrial control experiment with interactive CO2. It is in its final stage but not yet ready.

4.1. EXP00

4.2. piControl

4.2.1. Main differences between piControl and EXP00

File	EXP00	piControl	Comments
`COMP/lim2.card`	NONE	Post_1D_icemod	No post processing for the 1D_icemod file (no mask, no TS)
`COMP/lmdz.card`	ConfType=actuel	ConfType=preind	Present-day or preindustrial forcings
PARAM/config.def	config.def_actuel	config.def_preind	PARAM file used
	OutLevel=low	OutLevel=medium	Low or medium output level
PARAM/output.def	output.def_low	output.def_medium	PARAM file used
	LMDZ_NMC_daily=n	LMDZ_NMC_daily=y	daily NMC outputs
	LMDZ_NMC_hf=n	LMDZ_NMC_hf=y	6-h NMC outputs
		aerosols_11YearsClim_1995.nc	
	climoz_LMDZ_1855_v2.nc	climoz_LMDZ_1995_v2.nc	
`COMP/orchidee.card`	PFTmap_IPCC_2000.nc	PFTmap_IPCC_1850.nc	Vegetation map used
`COMP/pisces.card`	DBIO_ENABLE=n	DBIO_ENABLE=y	
`COMP/*`	ChunckJobxD=OFF		deactivation of TS
`config.card`	WriteFrequency="1M 1D"	WriteFrequency="1M 1D HF"	No HF for ATM
	WriteFrequency="1M"	WriteFrequency="1M HF"	No HF for SRF

4.3. historical

4.3.1. Main differences between piControl and historical

File	piControl	historical	Comments
`COMP/lim2.card`	NONE	Post_1D_icemod	No post processing for the 1D_icemod file (no mask, no TS)
`COMP/lmdz.card`	ConfType=preind	ConfType=annuel	Preindustrial or annual forcings
	OutLevel=medium	OutLevel=high	Low or medium output level
	LMDZ_COSP_OK=n	LMDZ_COSP_OK=y	COSP activated

		LMDZ_COSP_daily1979=y	activated COSP daily outputs starting from 1979
	aerosols_11YearsClim_1995.nc	aerosols_11YearsClim_${year}.nc, aerosols${year}.nc, 1:12:	annual aerosols: starting from the 1st period and every 12 period (month) [min]:[modulo:][max]
		climoz_LMDZ_${year}.nc, climoz_LMDZ.nc, 1:12:	Annual climoz
		CO2_1765_2005.txt	list of annual CO2 values
		CH4_1765_2005.txt	list of annual CH4 values
		N2O_1765_2005.txt	list of annual N2O values
		CFC11_1765_2005.txt	list of annual CFC11 values
		CFC12_1765_2005.txt	list of annual CFC12 values
`COMP/opa9.card`	OUTPUT_LEVEL=2	OUTPUT_LEVEL=3	larger number of ocean outputs
`COMP/orchidee.card`	PFTmap_IPCC_1850.nc	PFTmap_1850to2005_AR5_LUHa.rc2/PFTmap_IPCC_${year_p1}.nc, PFTmap.nc, 12:12:	Vegetation map used
		VEGET_UPDATE=1Y	update frequency of the vegetation map
		LAND_COVER_CHANGE=y	update of the vegetation map
`COMP/*`		ChunckJobxD	activation of TS (OFF/xxY)
		TimeSeriesVarsxD	Larger number of variables
`config.card`	WriteFrequency="1M 1D HF"	WriteFrequency="1M 1D HF HF3h HF3hm"	HF3h and HF3hm for ATM

4.4. Paléo. configurations

IPSLCM5A-LR has been used at LSCE for glacial climates (21 ka BP, contact Masa Kageyama or Olivier Marti), mid-Holocene (4kaBP, 6ka BP and 9ka BP, contact Olivier Marti or Pascale Braconnot) and for other ancient climates configurations.

4.5. Chistorical

Equivalent to historical with interactive CO2 (contact Patricia Cadule or Laurent Bopp). The model is forced with estimations of fossil emissions during the historical period. The CO2 atmospheric concentration results from the equilibrium between prescribed emissions (fossil), carbon absorption by the ocean (PISCES) and the terrestrial biosphere (ORCHIDEE).

4.6. CpiControl

Equivalent to piControl with interactive CO2 (contact Patricia Cadule or Laurent Bopp). Control simulation.

5. The initial states

You must take the time to identify the initial states used by the model.

- By default, the EXP00 and pdControl simulations have climatological initial states.
- By default, the historical simulation is not performed because the initial states are not provided.
- The carbon reservoirs equilibrium is a necessary and essential step to create the initial state for the biogeochemical cycles of the terrestrial biosphere (ORCHIDEE) and of the ocean (PISCES). This initial state of the cycles must be performed with an IPSLCM5 equilibrated climate corresponding to the period for which you wish to start the simulation.

5.1. Which achieved simulations can you use as initial state?

A few files allowing you to start your own simulations have been copied at TGCC and at IDRIS :

- they are stored in the shared directories, at TGCC : /ccc/store/cont003/dsm/p86ipsl/IGCM_RESTART/IPSLCM5A/... and at IDRIS : /u/rech/psl/rpsl035/IGCM_RESTART/... and with the same names as in each IGCM_OUT directories
- they are synchronized between TGCC and IDRIS. You can ask to have more restart files copied by writing to the platform-users _@… list
- For IPSLCM5A, a restart date is 9 files and 700 MO.

Table of simulations and dates stored (extract) :

Simulations	Date	Original machine
piControl2	1849-12-31	SX9
piControl2	1859-12-31	SX9
piControl2	1869-12-31	SX9
piControl2	1985-12-31	SX9
!CpiControl01	1849-12-31	SX9
v3.historical1	2005-12-31	SX9
v3.historical2	2005-12-31	SX9
v3.historical3	2005-12-31	SX9
v3.historical4	2005-12-31	SX9

6. The output levels

6.1. Be careful: the configurations can produce a very large number of outputs

We recommend you to adjust the output levels based on your scientific goal. An estimate of the volume and number of files produced is given below.

7. What is the amount of outputs produced by those 3 experiments?

7.1. Outputs parameterizations

	EXP00	**piControl**	**historical**
`COMP/lmdz.card`	OutLevel=low	OutLevel=medium	!Outlevel=high

7.1.1. Table of the amount of outputs for 10 years (in Go)

	low				**medium**				**high**	Restart			
	MO	DA	HF	TS	MO	DA	HF	TS	MO	DA	HF	TS	
ATM	15	11		13	10	20	38	50	23	108 (+210 COSP)	150 (+840 COSP)	213	6
CPL	1	27			1	26			1	26			0,4
OCE	8	1			9	1		10	9	51		61	16
ICE	0,4				0,4			0,4	0,4	2		2	1
MBG	15				20			0,7	20			24	40
SRF	1				2		10	4	2			0,6	5
SBG	5				5			1,2	5			2	15
Total					47,4	47	48	66,2	61,4	187	150	302	84

Grand Total								**210**				**400** (610 with COSPDA, 1450 with COSPHF)	

7.2. Dimension and number of files for a historical simulation: 156 years, OutLevel=high, without ATLAS and MONITORING directories

The pack period is configured in `config.card`. A larger pack period allows you to reduce the number of files but in case your simulation stops, you must restart the whole period.

Resolution		Pack for 120 months (10 years)	Pack for 60 months (5 years)
96x95x39	file number	3852	4339
	Restart file number	1404	1404
	Restart file space	88 Go	88 Go
	the largest	65 Go	32 Go
	medium	3,5 Go	3 Go
	Total space	13 To	13 To
144x142x39	file number	3852	4339
	Restart file number	1404	1404
	the largest	148 Go	73 Go
	medium	7 Go	6 Go
	Total space	25 To	25 To
	Restart file space	100 Go	100 Go

7.3. Dimension and number of files for a historical simulation, for the ATLAS and MONITORING directories

Directory	File number	Size in GO
MONITORING	399	0,01
ATLAS	19395	4,60

8. Ressources on usual machines

8.1. Information obtained in 2012 for the computing time requested for 2013

Reminder: The ressources needed for IPSL configurations including the IPSLCM5 coupled model configuration on the usual computing centers.?

8.2. TGCC

8.2.1. Bull Curie

The basic configuration uses 32 computing cores: 1 for the OASIS coupler, 5 for NEMO, and 26 for LMDZ. The configuration is regularly used and evaluated on this machine: ■http://webservices.ipsl.jussieu.fr/trusting/

8.2.2. Bull Titane (this computing machine will be stopped in June 2013)

8.3. IDRIS

8.3.1. IBM : Ada

9. Command summary

Here are the commands you need to know if you want to retrieve and compile the IPSLCM5_v5 model and if you want to setup and run an EXP00/pdControl experiment:

```
mkdir MONREPERTOIRE ; cd MONREPERTOIRE
svn_ano # svn co http://forge.ipsl.jussieu.fr/igcmg/svn/modipsl/trunk modipsl
cd modipsl/util
./model IPSLCM5_v5
cd ../config/IPSLCM5_v5
gmake # par défaut ORCA2xLMD9695-L39
cp EXPERIMENTS/IPSLCM5/EXP00/config.card .
vi config.card # modify JobName (at least) : MYJOBNAME
../../util/ins_job
cd MYJOBNAME
vi Job_MYJOBNAME # modify PeriodNb, adjust the time, ...
llsubmit Job_MYJOBNAME # IDRIS
ccc_msub  Job_MYJOBNAME # TGCC
```

10. Evaluation

Remember to evaluate the files produced by this simulation.