ORCHIDEE Training course

Code management, installation, simulation, documentation

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Wiki and web site

Official web site

http://labex.ipsl.fr/orchidee

ORCHIDEE wiki

On the wiki you find useful information about on-going developments and help to use the model. Lots of information is found in HowTo section

http://forge.ipsl.jussieu.fr/orchidee/wiki

You need a **“login forge” to be used on the wiki**. This login is needed to see the full content of the wiki, to edit the texte and also to see the SVN repository on the web interface. Write to orchidee-help to get a login.

Finding information
Email lists @ipsl.jussieu.fr

All ORCHIDEE user's are invited to subscribe to:

orchidee-dev	Discussion and information about ORCHIDEE
platform-users	Ask and answer questions about libIGCM Information about IPSL tools

2 email addresses for contact:

orchidee-help	For technical questions
orchidee-project	To contact the ORCHIDEE project team

See how to subscribe :
http://forge.ipsl.jussieu.fr/orchidee/wiki/GroupActivities/Contact

Finding information
“Developer's meeting”

All users and developers of ORCHIDEE are welcome to ORCHIDEE developer's meetings organized about every 2 months. These meetings consist in a presentation of a specific topic followed by discussions and questions. Meeting place in Jussieu but often a videoconference is set up.

See reports and presentations here :

http://forge.ipsl.jussieu.fr/orchidee/wiki/GroupActivities/Meetings/Developer

Information about these meetings are done at orchidee-dev email list.

Finding information
Scientific documentation

- A scientific documentation is integrated in the code.

- It is generated using Doxygen, the documentation is generated in both pdf and html format.

- see here latest compiled version of the documentation :

https://forge.ipsl.jussieu.fr/orchidee/wiki/Documentation

Code management through SVN
What is SVN ?

- All different versions of ORCHIDEE are managed through SVN.

- SVN, also called subversion, is **a versioning system** that helps to keep track of different versions. With subversion it is always possible to extract all previous versions of a specific directory.

- Main repository : svn://forge.ipsl.jussieu.fr/orchidee

Code management through SVN
Different versions of ORCHIDEE

Trunk : The main version of ORCHIDEE. Each modification on the trunk has a specific revision number.

- ***Each revision is not fully validated***
- ***Some revision numbers are more tested, see wiki:***

https://forge.ipsl.jussieu.fr/orchidee/wiki/ReferenceSimulations

Branch : a version under development by a group of people. Different branches exist. A branch is a copy of the trunk that is modified. The goal is to integrate developements on the branch in the trunk.

Perso : each user can have one or several personal versions on svn. A personal version is a copy from the trunk, tag or branch at a specific moment. The user is responsible of his own version. ***Updates, bug corrections and re-integration in the trunk is not automatic and might be difficult.***

Code management through SVN
How to know which version I use ?

- When you communicate with other people, it is necessary to know exactly which version you use.

- Both <u>version</u> and <u>revision number</u> are needed.

```
> cd modipsl/modeles/ORCHIDEE
> svn info

Path: .
URL: svn://forge.ipsl.jussieu.fr/orchidee/trunk/ORCHIDEE
Repository Root: svn://forge.ipsl.jussieu.fr/orchidee
Repository UUID: f489ceea-5127-0410-b15c-c4a6149ed9a7
Revision: 3917
Node Kind: directory
Schedule: normal
Last Changed Author: fabienne.maignan
Last Changed Rev: 3917
Last Changed Date: 2016-11-18 14:34:53 +0100 (Fri, 18 Nov 2016)
```

Version : trunk/ORCHIDEE

Revision number : 1172

Code management through SVN
Login SVN

- trunk and tags are public versions. No personal login is needed. Login public : sechiba

- **personal login : firstname.lastname**

All user/developer can ask for a personal login and a personal folder SVN. This login is used for accessing branches and personal folders. **A personal folder is only read and writeable for the owner.**

A personal folder is useful when starting a long development, for example for a phd or when a modified version of ORCHIDEE is used for an article. A personal folder helps for the

    - traceability of code
    - back up

Install and compile
How to install using modipsl

see also hands-on exercises this afternoon

- modipsl is a tool used to install and compile predefined configurations, for example ORCHIDEE offline or ORCHIDEE coupled to LMDZ

- modipsl contains scripts for extraction of predefined configurations, creation of makefiles, creation of job and some more. modipsl is also a empty file tree that will receive the models and tools.

- use **./model *config*** to download a specific configuration

```
> svn co http://forge.ipsl.jussieu.fr/igcmg/svn/modipsl/trunk modipsl
> cd modipsl/util
> ./model -h                    # list predefined configurations
> ./model config                # extract a predefined configuration
```

Install and compile
Predefined configurations with ORCHIDEE

ORCHIDEE_trunk : the latest version on ORCHIDEE/trunk for offline use. For new developments this is often the version to use. Note :

- You get the latest version of the trunk of ORCHIDEE : not always fully tested
- The trunk changes often : if you extract today and again next week there might be differences in the source code due to evolution of the trunk
- You can use this target to extract a branch, see further slides

ORCHIDEE_AR5 : off-line version used for reference CMIP5 simulations. Contains only source code without scripts for running.

Install and compile
Predefined configurations with ORCHIDEE

LMDZOR_v6 : configuration under development. To be use for coupling the latest version of the trunk ORCHIDEE with LMDZ(atmospheric model). Currently corrsponding to IPSLCM6.0.5. Follow changes here:
http://forge.ipsl.jussieu.fr/igcmg_doc/wiki/DocHconfigBlmdzorv6

LMDZOR_v5 : old stable version with ORCHIDEE and LMDZ version corresponding to AR5 simulations (CMIP5).

IPSLCM6.0.5-LR : coupled configuration containing NEMO(ocean model), LMDZ and ORCHIDEE. Latest official version.

IPSLCM6.0.6-LR : Under construction. To be announced next week hopefully..

Install and compile
Install a branch or personal version

You can modify the version of the ORCHIDEE source before extraction of a configuration. In **modipsl/util/mod.def**, modify line:

```
#-C- ORCHIDEE_trunk  trunk/ORCHIDEE        HEAD  14  ORCHIDEE  modeles
```

into

```
#-C- ORCHIDEE_trunk  trunk/ORCHIDEE        2724   14  ORCHIDEE  modeles
```

or

```
#-C- ORCHIDEE_trunk  branches/xxx/yyy      HEAD  14  ORCHIDEE  modeles
```

For exemple:

```
#-C- ORCHIDEE_trunk     branches/ORCHIDEE-MICT/ORCHIDEE    HEAD   14 ORCHIDEE modeles
```

Install and compile
Different platforms

- Compiling options of ORCHIDEE is preconfigured at following platforms :

obelix at LSCE
curie at TGCC
ada at IDRIS
ciclad and climserv at IPSL

- Compiling at other machines need more time for installing pre-request (compiler, netcdf,..)

- The script modipsl/util/ins_make creates makefiles for the target machine.

Install and compile
TGCC and IDRIS

To work on the TGCC or IDRIS computing centres you need:

- **a login connected to an existing group/project**, discuss with your supervisor/colleagues

- **CPU resources** in this group, yearly demand, discuss with your supervisor/colleagues

- **knowledge about the environment** at these centres : different machines, file systems, etc..

- **knowledge about how to calculate CPU consumption**

Install and compile
obelix

ORCHIDEE_trunk and LMDZOR_v6 can be used at obelix.

- **Note 1.** The Job PBS directive for the core distribution needs to be changed if using more than 8 MPI. For example if using 32MPI, the headers will be

  #PBS -l nodes=1:ppn=32

  but needs to be changed to

  #PBS -l nodes=4:ppn=8

- **Note 2.** When running LMDZ at obelix, change in run.def to:

  use_filtre_fft=n

- **Note 3.** Hybrid MPI-OpenMP mode has not been tested

Install and compile
ciclad and climserv

ORCHIDEE_trunk and LMDZOR_v6 can be used in standard configuration with modipsl and libIGCM on ciclad and climserv. See specific information here :
http://forge.ipsl.jussieu.fr/igcmg_doc/wiki/DocBenvDipslAciclad

- **Note 1.** Modification in default compilation of XIOS needed to using netcdf sequential, add **--netcdf_lib netcdf4_seq** in modipsl/config/AA_make on the line make_xios as follow:

```
(cd  ../../modeles/XIOS ; ./make_xios --netcdf_lib netcdf4_seq
--prod --arch ${FCM_ARCH} --job 8 ; cp bin/xios_server.exe ../../bin/. ; )
```

- **Note 2.** Change PBS directive as for obelix, for 32 MPI set

```
#PBS -l nodes=4:ppn=8
```

Install and compile
Compiling ORCHIDEE

- **Compiling is done with a main Makefile in modipsl/config/ORCHIDEE_OL** directory (or LMDZOR_vx)
- The main Makefile launch compilation of XIOS, IOIPSL and finally ORCHIDEE
- Inside the main Makefile, the script **makeorchidee_fcm is launched to compile ORCHIDEE**. This compile script is based on the tool FCM.
- Dependencies between modules are determined automatically. No modifications are needed if you add a module in one of the existing src_ directories.
- **Specific platform dependent compile options are set in modipsl/modeles/ORCHIDEE/arch/** directory. 2 files per platform: arch-ifort_LSCE.fcm and arch-ifort_LSC.path

Install and compile
makeorchidee_fcm

makeorchidee_fcm: a script launched by the main Makefile in config/ORCHIDE_OL

Example 1 : compile at curie(TGCC) for MPI parallel run mode

```
./makeorchidee_fcm -parallel mpi -arch X64_CURIE -driver
```

Example 2 : compile at ada(IDRIS) for MPI-OpenMP parallel run mode

```
./makeorchidee_fcm -parallel mpi_omp -arch X64_ADA -driver
```

Example 3 : compile at obelix(LSCE)

```
./makeorchidee_fcm -arch ifort_LSCE -driver
```

Example 4 : compile using gfortran compiler for sequential run mode
First make sure that the files arch/gfortran.fcm and arch/gfortran.path are suitable for your environement especially the path to netcdf library.

```
./makeorchidee_fcm -parallel seq -arch gfortran -driver
```

Example 5 : clean files created during previous compilation

```
./makeorchidee_fcm -clean
```

Install and compile
How to compile ?

Compiling off-line driver for the trunk version

```
> cd modipsl/config/ORCHIDEE_OL
> gmake
```

or to compile without XIOS (only IOIPSL)

```
> gmake without_xios
```

After successful compiling,
executables are found in :

modipsl/bin/

Install and compile
Steps to follow for installion at a new platform

- 1. Install modipsl and the configuration ORCHIDEE_trunk

- 2. Modify compile options in following files:
  - modipsl/util/**AA_make.gdef** (used for compilation of IOIPSL)
  - modipsl/modeles/**XIOS/arch/arch-*yourtarget*.[fcm/path/env]**
  - modipsl/modeles/**ORCHIDEE/arch/arch-*yourtarget*.[fcm/path]**

Note: the variable FCM_ARCH in AA_make.gdef is the name of the arch files in ORCHIDEE/arch and XIOS/arch.

- 3. Recreate makefiles with target chosen above and compile as usual

```
cd modipsl/util; ./ins_make -t yourtarget
```

=> Requirements are MPI and netCDF4 library.
Additional requirements: parallel library NetCDF4/HDF5

=> It is possible to compile and use without XIOS and without MPI.

Simulation
Input files to run in off-line mode

Executables : orchidee_ol + xios_server.exe (optional)

Parameter files : run.def : text file with run options
iodef.xml, context_orchidee.xml, field_def_orchidee.xml, file_def_orchidee.xml (optionals)

Boundary conditions

forcing_file.nc : climate forcing variables
PFTmap.nc : vegetation map (optional)

Initial state files - <u>if no restart files</u>

soils_param.nc, soils_param_usdatop.nc(optional)
PFTmap.nc : vegetation map
routing.nc : river routing (optional)
floodplains.nc and cartepente2d_15min.nc (optional)
reftemp.nc : temperature (optional)
alb_bg.nc : background albedo (optional)

Restart files (input/output)

driver_rest_in.nc, sechiba_rest_in.nc, stomate_rest_in.nc

Simulation
Output files produced by ORCHIDEE

Restart files

By default, the model produces 3 restart files : for the driver, sechiba and stomate components. Theses files are used to restart the model for next period.

1St execution, no restart file to start the model Files produced are :
driver_rest_out.nc, sechiba_rest_out.nc, stomate_rest_out.nc

2Nd execution, before rename restart files produced in 1st run into :
driver_rest_in.nc, sechiba_rest_in.nc, stomate_rest_in.nc
and add following in run.def :

```
SECHIBA_restart_in =     sechiba_rest_in.nc
STOMATE_RESTART_FILEIN = stomate_rest_in.nc
RESTART_FILEIN =         driver_rest_in.nc
```

3rd execution, rename restart files produced in 2nd run

etc...

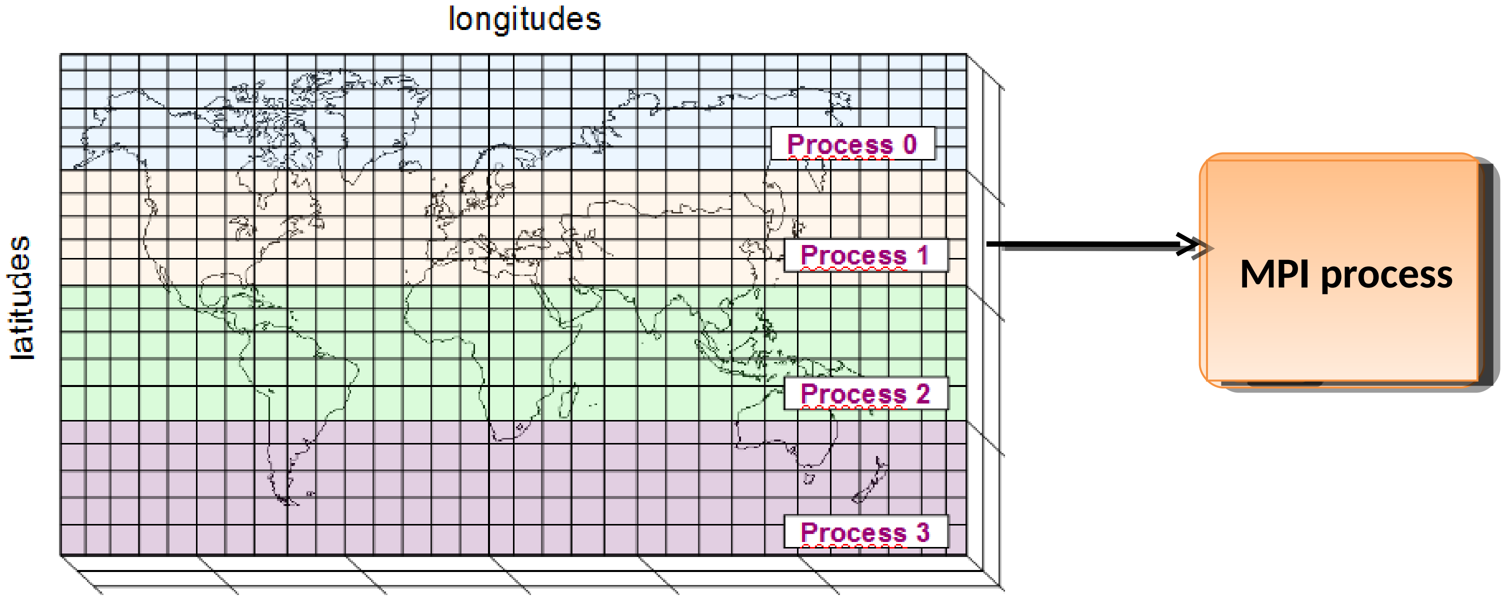
Simulation
Output files produced by ORCHIDEE

Diagnostics **"history files"**
The diagnostics/output are written by XIOS in netCDF format.
Different files, with different levels of output can be configured :

sechiba_history.nc
sechiba_out_2.nc
stomate_history.nc
stomate_ipcc_history.nc

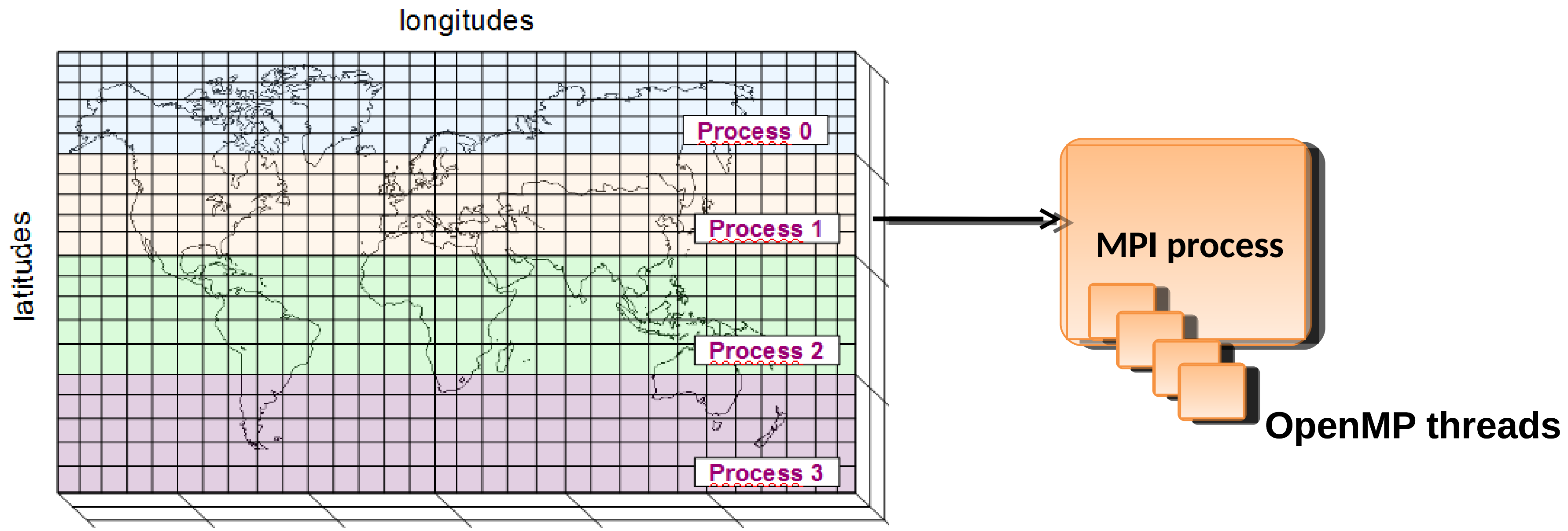
See hands on exercises how to change level and frequency.

Simulation
Parallel mode



- **MPI parallelisation (distributed memory)** : the global domain is divided into sub-domains, each MPI process treats one sub-domain on one computing core.

Simulation
Parallel mode



- **MPI parallelisation (distributed memory)** : the global domain is divided into sub-domains, each MPI process treats one sub-domain on one computing core.

- **Hybbrid MPI + OpenMP (distributed + shared memory)** : each MPI process treats one sub-domain, each MPI process run OMP threads, each OMP threads treats a new subdivision of the sub-domain. *Only possible in coupled mode with LMDZ.*

Simulation
Configurations using libIGCM

libIGCM is a script library developed at IPSL
S. Denvil in charge

Training courses are frequently given to use libIGCM

See documentation here:
http://forge.ipsl.jussieu.fr/igcmg_doc/Doc

Simulation
ORCHIDEE_OL configuration using libIGCM

Content in **modipsl/config/ORCHIDEE_OL**, in the trunk:

OOL_SEC_STO
OOL_SEC
SPINUP_ANLAYTIC
FORCESOIL
TESTSTOMATE

Classic submit directories for different experiments using libIGCM

Obsolete : Not longer maintained in the trunk

ENSEMBLE
SPINUP

More complex configurations used for FLUXNET simulations

AA_make
AA_make.ldef
Makefile

Files for compilation

Simulation
ORCHIDEE_OL configuration using libIGCM

OOL_SEC_STO
Experiment set up with sechiba and stomate

OOL_SEC
Experiment set up with sechiba only

SPINUP_ANLAYTIC
Experiment set up with sechiba, stomate and spinup_analytic activate. In this experiment, the forcing is set to loop over 10 years.

FORCESOIL and TESTSTOMATE
Obsolete experiments, replaced by spinup_analytic. To use these experiments you need first to produce specific forcing files.

Simulation
Differences in ORCHIDEE_OL

The configuration ORCHIDEE_OL have some differences compared to the coupled v6 configurations such as LMDZOR_v6.

No need to create the submission directory: They already exist. Choose one of the existing directories and copy it to a new name, modify and create the main job using ../../../libIGCM/ins_job.

No DRIVER directory: The comp.driver files are found in COMP directory.

Simulation
Modify parameters

In PARAM/run.def some parameters are modified by orchidee_ol.driver, sechiba.driver and stomate.driver. These parameters are always marked equal AUTO or AUTOBLOCKER

AUTO : These parameters can be changed using options in *comp.card* or *config.card.* You can also change them directly in the run.def file, for this case the drivers will not change them again.

AUTOBLOCKER : The job will stop if you modify these parameters. They are set by the *comp.driver* mainly using the information from config.card.

For example, in PARAM/run.def:

```
STOMATE_RESTART_FILEIN = _AUTOBLOCKER_
XIOS_ORCHIDEE_OK = _AUTO_
```

=> You can add or modify parameters directly in PARAM/run.def

Coding Guidelines

All new developements in the ORCHIDEE trunk must follow the Coding Guidelines.

See https://forge.ipsl.jussieu.fr/orchidee/wiki/Documentation

- **Comments in english**
- **Indentation**
- **Key words in capital letters**
- **Module and subroutine description part**
- **...**