Wikiprint Book

Title: 1. Compiling environment

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Compile

The compiling steps are described in this chapter.

1. Compiling environment

First of all, make sure that your working environment contains all the necessary compiling tools. To this end, see the chapter Computing environments

1.1. FCM

Most of IPSL models and components use the **fcm** tool for compiling. Recent versions of the models have fcm in their source directory. Therefore no specific installation is needed anymore.

If no fcm is available in the source directory, fcm must then be installed and added to your environment variable PATH. At following machines, fcm is already installed

```
# At TGCC:
PATH=~p86ipsl/fcm/bin:$PATH

# At IDRIS:
PATH=/smphome/rech/psl/rpsl035/FCM/bin:$PATH

# At LSCE(obelix):
PATH=/home/orchideeshare/igcmg/fcm/FCM_V1.2/bin:$PATH
```

For other machines, extract fcm from svn and add the path to your environment variable PATH. Extract as follow:

```
svn co  http://forge.ipsl.jussieu.fr/fcm/svn/PATCHED/FCM_V1.2 fcm
```

For each machine supported by the IPSL tools, two kinds of files ***.fcm** and ***.path** exist. They provide all the information needed by fcm to create a makefile. These files are stored in the directory arch/ (LMDZ/arch/, INCA/arch/).

- *.fcm : contains the compiler information
  - compiler name
  - compiling options
  - options and settings
- *.path : contains the library path names.

These files have the name of the machine as a prefix : arch-X64_CURIE.fcm, arch-X64_CURIE.path

Note : for configurations IPSLCM5 and IPSLCM6, arch files for OASIS and NEMO are taken in `modipsl/config/IPSLCM6/SOURCE/OASIS` and `modipsl/config/IPSLCM6/SOURCE/NEMO`

2. Creating the main makefile

Note : The compilation of NEMO forced configuration requires a few special steps. Read more for NEMO.

Each model configuration XXX *has a main makefile which provides information about each model component's makefiles. The main Makefile is stored in the modipsl/config/XXXX directory. The main Makefile is created when a model configuration is downloaded and installed.*

Example :

```
cd modipsl/util
./model LMDZOR_v5
(...)
Makefiles setup, scripts and data for ada
```

```
Installation in ../config/LMDZOR_v5
Path from Makefile to modipsl/util : ../../util
Installation in ../modeles/IOIPSL/src
Path from Makefile to modipsl/util : ../../../util
Installation in ../modeles/ORCHIDEE/src_global
Path from Makefile to modipsl/util : ../../../util
Installation in ../modeles/ORCHIDEE/src_parameters
Path from Makefile to modipsl/util : ../../../util
Installation in ../modeles/ORCHIDEE/src_parallel
Path from Makefile to modipsl/util : ../../../util
Installation in ../modeles/ORCHIDEE/src_stomate
Path from Makefile to modipsl/util : ../../../util
Installation in ../modeles/ORCHIDEE/src_sechiba
Path from Makefile to modipsl/util : ../../../util
Installation in ../modeles/ORCHIDEE
Path from Makefile to modipsl/util : ../../util
```

You can recreate those Makefiles by running the **`ins_make`** script. You have to do this if, for example, you changed the path of modipsl.

```
cd modipsl/util/
./ins_make
```

The main Makefile is created by concatenating the following 3 items: *AA_make.ldef* and *AA_make* located in the directory where the main Makefile will be created, and the lines corresponding explicitly to the target machine of the *util/AA_make.gdef* file. For each predefined machine the util/AA_make.gdef file contains the compiler settings. If your machine is not included, you can choose a target among the predefined machines in AA_make.gdef or you can add a new one.

```
vi AA_make.gdef

(...)
#-Q- ada
(...)
#-Q- curie
(...)
#-Q- aix6
(...)
#-Q- gfortran
(...)
```

In this case, the script becomes

```
./ins_make -t target
```

3. The main makefile

The Makefile is available for different resolutions. Example with LMDZOR_v5 :

```
LMD4443 : libioipsl liborchidee lmdz44x43x19 verif
       echo "noORCAxLMD4443" >.resol
       echo "RESOL_ATM_3D=44x43x19" >>.resol

LMD5655 : libioipsl liborchidee lmdz56x55x19 verif
       echo "noORCAxLMD5655" >.resol
       echo "RESOL_ATM_3D=56x55x19" >>.resol

LMD9671 : libioipsl liborchidee lmdz96x71x19 verif
       echo "noORCAxLMD9671" >.resol
       echo "RESOL_ATM_3D=96x71x19" >>.resol
```

```
LMD9695 : libioipsl liborchidee lmdz96x95x19 verif
       echo "noORCAxLMD9695" >.resol
       echo "RESOL_ATM_3D=96x95x19" >>.resol

LMD9695-L39 : libioipsl liborchidee lmdz96x95x39 verif
       echo "noORCAxLMD9695-L39" >.resol
       echo "RESOL_ATM_3D=96x95x39" >>.resol

LMD144142 : libioipsl liborchidee lmdz144x142x19 verif
       echo "noORCAxLMD144142" >.resol
       echo "RESOL_ATM_3D=144x142x19" >>.resol

LMD144142-L39 : libioipsl liborchidee lmdz144x142x39 verif
       echo "noORCAxLMD144142-L39" >.resol
       echo "RESOL_ATM_3D=144x142x39" >>.resol
```

Available resolutions are :

- LMD4443
- LMD5655
- LMD9671
- LMD9695
- LMD9695-L39
- LMD144142
- LMD144142-L39

Another feature of the Makefile is ability to compile any model with the chosen resolution.

For _***v5*** configurations, the default resolution is 96x95x39.

4. How to compile?

Once you chose a resolution you can start compiling:

```
gmake my_resolution
```

For the default resolution gmake is fine. Example for LMDZOR_v5:

```
cd modipsl/config/LMDZOR_v5
gmake LMD144142-L39
```

The hidden file **.resol** is created when compiling was successful. This file contains information about the resolution you have just compiled. This file will be used later when setting up the simulation, in particular to locate the input files.
Going back to the previous example, the .resol file looks as follows :

```
ORCAxLMD144142-L39
RESOL_ATM_3D=144x142x39
```

Once the file **.resol** is created, you can recompile your configuration using the gmake script without specifying the resolution.

5. How to change compile options for debugging or optimization of the model?

- You can change your optimization options for IOIPSL models in the AA_make.gdef file. To this end you must find your target machine and change the associated lines. You will have to recreate the Makefile.
- Three levels of optimization for the INCA and LMDZ models are predefined in the arch/ files.You can select them in the modipsl/config/.../Makefile file. The three options are: **-debug**, **-dev**, **-prod**. XIOS offers the same three levels of compilations, accessible through the flags `--debug`, `--dev` and `prod`.

Example: to compile LMDZ you can add the keyword "-debug" :

```
(cd ../../modeles/LMDZ; ./makelmdz_fcm (...) -debug (...) -arch $(FCM_ARCH) gcm ; cp bin/gcm_$(RESOL_LMDZ)_phylmd_para_orc
```

The default option is `-prod`

- For ORCHIDEE in all _v5 configurations, the compile options are also set in AA_make.gdef file, change as for IOIPSL. For LMDZOR_v5.2 configuration which is using the trunk of ORCHIDEE, the compile options are set in models/ORCHIDEE/arch. Switch between -prod, -dev or -debug as for LMDZ in the main makefile.

6. How to compile for hybrid MPI-OpenMP run mode?

This is possible only for configuration LMDZOR_v5.2 at curie or ada. In that case you must change the main makefile and recompile:

```
cd modipsl/config/LMDZOR_v5.2
# Change in AA_make all 3 occurrences for "-parallel mpi" into "-parallel mpi_omp"
../../util/ins_make
gmake clean
gmake
```