Tutorial 07 :
Create my croco interanual configuration

- The idea here is to do an interanual run from 201301 to 201303 forced by interanual global data on your personal grid.

- Just keep in mind that there are some steps to do to convert interanual forcing files (Ocean / Atmospheric for instance), majority of those are done just using matlab/python scripts present in the crocotools directory , they are located for instance in :
  * Ocean forcing : ***Oforc_OGCM/***
  * Atmospheric forcing : ***Aforc_NCEP*** / ***Aforc_CFSR*** / ***Aforc_ECMWF*** …

There are some scripts to download the forcing files directly from Opendap web sites. Then, if it is done, the scripts put these native data in a dedicated directory, then the scripts convert the data to the right format to be read by Croco, in order to have in your Run directory, in **DATA**/:

1) Upload data (request script) ⇒ ***DATA_native_yourconfig/***

2) Convert data (change name file name variable,netcdf format and attributes, apply variable factor, flip latitudes / vertical grid) ⇒ ***DATA_yourconfig/***

For some of data, like data from Mercator and ERA5, user have to register and retrieve key access to download with python scripts, to the Copernicus data service (CMEMS) website and the climate data store (CDS) respectively.

- In this tutorial, we will use atmospheric reanalysis global data from ECMWF, called ERA5. We can directly compute online interpolation on the grid croco, by activating a key in the code, so in this case, there is no need to create these inputs for Croco. It prevent us to create huge preprocessed files ..

  * Atmospheric reanalysis : Hourly data from ERA5 (ECMWF) 0,25° (ONLINE : interpolation) / information in directory **Aforc_ERA5/**

  * Ocean monthly data from glorys reanalysis (Mercator) 1/12° , 2013/01 to 2013/03 (Also already uploaded) but to be interpolated on your grid / information in directory **Oforc_OGCM/**

- The code croco will run on a **SCRATCH** directory (you already know) created by a job script **run_croco_inter.pbs**. It will process a plurimonth run by simulating croco month by month, initializing the next month by the last restart file created in the previous month and so on...

- Prerequisites :
  * no more than 100*100 point grid Please !!
  * try to not have Open Boundary Condition of one or 5 point grid
  * Global data are not truly « global », we have a domain limited by -170< lon <170 -60 <lat < 60

Recap on your environment

As you already know, to connect to the CHPC :

* Just type with your « login » :

```
ssh -X login@lengau.chpc.ac.za
```

```
[login@login2 ~]$ qsubi1
```

```
[login@cnode0220 croco]$
```

NODES

* Check if Run_inter directory exist :

1) Go into your Run_inter directory, then you can forget step 2

```
[login@cnode0220 ]$ cd Run_inter
[login@cnode0220 Run_inter]$
[login@cnode0220 Run_inter]$
```

2) If the Run_inter does not exist (or if you want to recreate your grid, repeat the step2 from #tutorial02 and then Edit your create_config.bash file)

```
[login@cnode0220 ]$ nedit create_config.bash
```

→

From Text Editor (nedit, vi ..)

MY_CONFIG_NAME=Run_inter

```
[login@cnode0220 ]$ ./create_config.bash
[login@cnode0220 ]$ cd Run_inter
[login@cnode0220 Run_inter]$
```

NODES

Create Your inputs

Now, we will create from reanalysis mercator GLORYS12° the initial/boundary files (*bry.nc) because is cheaper than creating climatological files (*clm.nc).

First we will edit the crocotools_param.m file, and change some parameters below. If you have mask at northern boundary on your grid, so you have to be consistent and put for instance *obc=[1101] % [SENW]*, meaning that you won't generate northern boundary variable in the croco boundary files. Just edit the variable below in crocotools_param.m, and also add a new path variable DATADIR2, to point to global data location in CHPC :

```
[login@cnode0220 Run_inter]$ nedit crocotools_param.m
```

From Text Editor (gedit, vi ..)

```
Ymin          = 2013;
Ymax          = 2013;
obc = [1 1 1 1]; %depending of your open boundaries
(1=open , [S E N W])
makeini       = 1;
makeclim      = 0;
makebry       = 1;

DATADIR2 =
'/home/gmorvan/lustre/DATASETS_GLOB_INTER/';

%% ATMO data
Download_data = 0;   % Get data from OPENDAP sites
%ERA5_dir    = [FORC_DATA_DIR,'ERA5_',CROCO_config,'/'];
ERA5_dir    = [DATADIR2,'/DATA_ERA5_GLO/'];

%% OGCM data
OGCM        = 'mercator';
OGCM_dir    = [DATADIR2,'/DATA_GLORYS_GLO/'];
```

We will use a matlab script from ***Oforc_OGCM*** directory in croco_tools **make_OGCM_mercator.m** : (make_ini/make_bry command are wrapped into)

```
[login@cnode0220 Run_inter]$ matlab -nodesktop
```

```
>> start
>> make_OGCM_mercator
```

```
[login@cnode0220 Run_inter]$ ls CROCO_FILES/
[login@cnode0220 Run_inter]$
croco_ini_mercator_Y2013M01.nc
croco_bry_mercator_Y2013M(01/02/03).nc
```

Prepare croco sources / Compilation

1) We will prepare now code sources, changing cppkey variables in cppdefs.h file
   * activating BULK_FLUX/
   * activating ONLINE/ERA_ECMWF for online interpolation
   * activating FRC_BRY / desactivating CLIMATOLOGY

```
[login@cnode0220 Run_inter]$ nedit cppdefs.h
```

From Text Editor (nedit, vi ..)

```
# define YOUR_REGION

# (undef/define) OBC_EAST
# (undef/define) OBC_WEST
# (undef/define) OBC_NORTH
# (undef/define) OBC_SOUTH

# define MPI
# define BULK_FLUX
#  define  ONLINE
#   define  ERA_ECMWF

# undef CLIMATOLOGY
# define FRC_BRY
```

2) Now in param.h file , we will need to:
   * Fix grid variables such as N sigma level (has to be consistent with N sigma written you already have in your crocotools_param .
   * Retrieve Physical grid LLm0/MMm0 on CROCO_FILES/croco_grd.nc, many ways :
      ⇒ it was written in the log of make_grid command
      ⇒ ncdump -h CROCO_FILES/croco_grd.nc and then computes size(x_rho) -2 ghost points for instance (idem for eta_rho)
   * Fix MPI repartition you want, in this example 4 processors in Xi direction (NP_XI=4) / 1 in eta direction (NP_ETA=1) for instance

```
[login@cnode0220 Run_inter]$ nedit param.h
```

From Text Editor (nedit, vi ..)

```
      parameter (LLm0= ??, MMm0= ??,
N= ??)  ! YOUR REGIONAL CONFIG
      parameter (NP_XI= 4,  NP_ETA=1,
NNODES=NP_XI*NP_ETA)
```

3) Compilation

```
[login@cnode0220 Run_inter]$ ./jobcomp_lengau
```

Then just check you ‘ve generated your croco binary file **croco**

Launch run

1) We will adapt the job script file called **run_croco_inter.pbs**, used for interanual processing (to be run in a cluster). Firstly, it had the same information than the native one **run_croco_inter.bash** script but with an header at the top of the script . It have a user section where you give some informations for instance about the period in time you want to process but also the data name.... Basically this script will copy / or create link for input files on the **SCRATCH** directory , then it run the code, updating a template namelist at the beginning, for one month and then store the outputs at the end of the month, then it the restart file created become the new initial condition for the second run and so on …
Firstly you have to copy this jobfile in your environment :

```
[login@cnode0220 Run_inter]$ cp /home/gmorvan/lustre/run_croco_inter.pbs .
```

```
[login@cnode0220 Run_inter]$ nedit run_croco_inter.pbs
```

From Text Editor (nedit, vi ..)

```
#PBS -l select=1:ncpus=24:mpiprocs=4
#PBS -M XXX@XXX
# number of processors for MPI run
NBPROCS=4

# command for running the mode : ./ for sequential job, mpirun -np NBPROCS for mpi run
#RUNCMD='./'
RUNCMD="mpirun -np $NBPROCS "

ATMOS_BULK=ERA5

#
# Oceanic boundary and initial dataset (SODA, ECCO,...)
#
OGCM=mercator

NY_START=2013
NY_END=2013

ND_HIS= ???
```

Frequency of the outputs to be changed ND_HIS=1 to have one value per day

2) Here we adapt the namelist file croco_inter.in to do Online interpolation, we will change the path and date of ERA5 file to be read by croco during runtime

```
[login@cnode0220 Run_inter]$ nedit croco_inter.in
```

From Text Editor (nedit, vi ..)

```
online:    byear  bmonth recordsperday byearend bmonthend / data path
          NYONLINE   NMONLINE      24
     2013     4

/home/gmorvan/lustre/DATASETS_GLOB_INTER/DATA_ERA5_GLO/
```

3) Process the run for 3 months 2013 january to march

```
[login@cnode0220 Run_inter]$qsub run_croco_inter.pbs
```

Postprocessing

If everything works well , you should have 3 avg / his files on your **SCRATCH** directory

```
[login@cnode0220 Run_inter]$ cd SCRATCH/
[login@cnode0220 Run_inter]$ ls
[login@cnode0220 Run_inter]$ croco_(avg/his)_Y2013M1.nc
croco_(avg/his)_Y2013M2.nc croco_(avg/his)_Y2013M3.nc
```

To visualize it, just concatenate files and use **croco_gui** tools, to see the variablity :

```
[login@cnode0220 Run_inter]$ ncrcat -h croco_avg_Y2013M*.nc croco_avg_Y2013.nc
```

```
[login@cnode0220 Run_inter]$ croco_gui
```