Activity 5 – Set up and run a realistic configuration

1. Download the croco tools and datasets

- get the CROCO_TOOLS package from:

https://gitlab.inria.fr/croco-ocean/croco_tools/-/releases/v2.0.0

- We are going to use the Matlab version. Copy the files croco_tools-v2.0.0/start.m and croco_tools-v1.3.1/ crocotools_param.m in your working folder (e.g. *~/ModNum/case_regional*)

- edit the start.m and modify the path to the croco_tools routines if needed (tools_path needs to point to the croco_tools-v2.0.0 folder)

- Edit the crocotools_param.m to and modify the path to the data files (variable DATADIR). It should point to:

if you are logged in a LOPS computer:

DATADIR='/net/krypton/data0/project/vortex/gula/ModNum/Data/'

if you are in a IUEM computing rooms:

DATADIR='/forums/public/pub/Data/'

Otherwise you need to download datasets (COADS + WOA + Topo) from

https://www.croco-ocean.org/download/datasets/

2. Create files for the Benguela test-case

See* https://croco-ocean.gitlabpages.inria.fr/croco_doc/ *for a detailed tutorial

In brief you need to :

- start matlab:

    On IUEM computers: ***module load matlab/R2022b; matlab***
    On LOPS computers: ***module load matlab/2014a***; ***matlab -nodesktop***

and run start.m to load all path *(just type "start" in the matlab window/terminal)*

- run the following scripts (just type their name in matlab)
  - make_grid to create your grid file [CROCO_FILES/croco_grd.nc]
  - make_bulk to generate surface forcings used to compute wind stress, surface heat flux, surface freshwater flux [CROCO_FILES/croco_blk.nc]
  - make_clim to generate initial conditions T, S, currents , SSH [CROCO_FILES/croco_ini.nc]
  - make_bry to generate oceanic boundary conditions : T, S, currents , SSH [CROCO_FILES/croco_bry.nc]

3. Compile and run the BENGUELA_LR case

Download and untar the croco code if you don't have it. See (https://github.com/quentinjamet/Tuto/blob/main/ModNum/Activity1.md)

- Copy the following files in your working folder (e.g. *~/ModNum/case_regional*)

    croco/OCEAN/jobcomp
    croco/OCEAN/croco.in
    croco/OCEAN/param.h
    croco/OCEAN/cppdefs.h

On LOPS/IUEM computers:

- Load the fortran/netcdf modules:

```
module purge
module load intel/12.1 netcdf/c-4.4.1.1-intel12 netcdf/fortran-4.4.4-intel12
```

- eventually change the SOURCE location in the jobcomp to point to the croco routines:

```
SOURCE=../croco/OCEAN
```

Add OPEN_MP parallelization (see Activity1.pdf)

Then Compile and run :

./jobcomp
./croco croco.in

You can check the output of the simulation in CROCO_FILES

4. Create files for your own configuration

- edit the crocotools_param.m to choose all parameters for your configuration (name, grid location and size, time and duration, path to forcing files, etc.)

5. Compile and run your simulation

- Edit the param.h to define the size of your grid (and parameters for your parallelization) according to the ones you have chosen in crocotools_param.m
- Edit the cppdefs.h to choose your numerical options
- Edit the croco.in to choose the run time parameters. Choose the parameters to have at least 2 years of simulation with monthly averages (every 30 days).

6. Check your simulation

- Check the circulation:

  - *you can use a python gui in python, see https://croco-ocean.gitlabpages.inria.fr/croco_doc/tutos/tutos.14.visu.python.html*

  - *you can use the croco_gui.m in with matlab, see https://croco-ocean.gitlabpages.inria.fr/croco_doc/tutos/tutos.14.visu.matlab.html*

  - *or various examples in python (see example_croco_xarray.ipynb, or example_croco.ipynb on http://jgula.fr/ModNum)*

- Try to find a paper documenting the circulation in this region and check if it is (at least qualitatively) well reproduced in the simulation.

- Average the simulation over the last year only (*you will consider only the last year of your simulation to minimize the effects of the spin-up.*)

- Plot the mean currents (surface and barotropic) and vertical sections of stratification for your simulation and for observations *(you can use WOA2009 data – or directly use the croco_clm.nc file which contains monthly climatology from WOA2009 data interpolated on the model grid).*