TUTORIAL 02:
CREATE MY CROCO GRIDS

In this tutorial, we do the steps to prepare our first model grid. We will connect to the super-computer LENGAU, and run Matlab to do the first CROCO pre-processing step. We will then analyse the CROCO sigma vertical coordinate system.

STEP 1: Logging onto the Lengau HPC cluster

→ From a terminal/konsole, execute the following instruction:

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

Replace **login** with your corresponding account number.

→ Reserve one interactive processor (Step 4 from **#TUTORIAL01**):

```
[login@login2 ~]$ qsubi1
[login@cnode0220 ~]$
```

→ Go directly into your **lustre/CROCO** directory:

```
[login@cnode0220 ~]$ cd lustre/CROCO
[login@cnode0220 CROCO]$ ls
croco-v2.0.1 croco_tools-v2.0.0
[login@cnode0220 CROCO]$
```

NODES

STEP 2: Creating CROCO input files for Run_Clim

The simplest example of CROCO configuration is the configuration called **BENGUELA_LR** which corresponds to a domain in the Benguela upwelling zone of the coasts of Namibia and South-Africa with a relatively Low Resolution (LR). This configuration is the one that comes by default in the CROCO code and it is similar to the one described in *Penven et al.* (2001). Before creating your own configuration, let's begin by recreating the BENGUELA_LR Grid.

→ Go into the **croco** source code directory **croco-v2.0.1**:

```
[login@cnode0220 ~]$ cd croco-v2.0.1
[login@cnode0220 croco-v2.0.1]$ ls
AGRIF                MPI_NOLAND    OCEAN       SCRIPTS      create_config.bash
CHANGELOG.md         MUSTANG       PISCES      TEST_CASES
CVTK                 OBSTRUCTION   README.md   XIOS
[login@cnode0220 croco-v2.0.1]$
```

NODES

→ Edit the file **create_config.bash** using the Linux command **vi** or the **nedit** software:

```
[login@cnode0220 croco-v2.0.1]$ vi create_config.bash
[login@cnode0220 croco-v2.0.1]$
                                        :
# Configuration name
# ------------------
MY_CONFIG_NAME=Run

# Home and Work configuration directories
# ---------------------------------------
                                        :
```

NODES

→ Using the up ⮝ and down ⮟ arrows, locate the line **68**, where the MY_CONFIG_NAME is. This name will be the name of your first configuration and the associated configuration directory. Go into the **vi** insert mode by typing **i**. Use the horizontal arrows ⮜ ⮞ and the delete keys to replace the string "Run" by "Run_BENGUELA_LR". Quit the insert mode by pressing the Esc key.

→ Save and exit **vi** by tying the following keys: **:wq**. Then, execute the script:

```
[login@cnode0220 croco-v2.0.1]$ ./create_config.bash
[login@cnode0220 croco-v2.0.1]$
```

→ Here is what you will see in your terminal:

```
oce-dev is defined. all-in architecture and no external codes considered

Your choices :
 - CROCO_DIR         : /home/login/lustre/CROCO/croco-v2.0.1
 - TOOLS_DIR         : /home/login/lustre/CROCO/croco-v2.0.1/../croco_tools-v2.0.0
 - CONFIG_HOME_DIR   : /home/login/lustre/CROCO/croco-v2.0.1/
 - CONFIG_WORK_DIR   : /home/login/lustre/CROCO/croco-v2.0.1/
 - CONFIG_NAME       : BENGUELA_LR
 - OPTIONS           : prero oce-dev agrif inter
 Do you want to proceed ? [Y/n]
```

→ Press the key **Y** to accept. Then you will see:

```
Creating configuration ...

Copy CROCO useful scripts and input files
-----------------------------------------
[login@cnode0220 croco-v2.0.1]
```

→ This script creates a directory within **croco-v2.0.1** with the name that you defined in MY_CONFIG_NAME. This directory contains all the necessary codes to create your input files and launch your simulation. This will be **your working directory**. The contents of this folder should be similar to the following:

```
[login@cnode0220 croco-v2.0.1]$ cd Run_BENGUELA_LR
[login@cnode0220 Run_BENGUELA_LR]$ ls
AGRIF_FixedGrids.in     croco_inter.in           oct_start.m
cppdefs_dev.h           croco_inter.in.1         param.h
cppdefs.h               croco_stations.in        run_croco.bash
create_config.bash.bck  crocotools_param.m       run_croco_forecast.bash
CROCO_FILES             DATA                     run_croco_inter.bash
croco.in                download_glorys_data.sh  start.m
croco.in.1              jobcomp                  town.dat
[login@cnode0220 Run_BENGUELA_LR]$
```

→ In **SETPS 3 and 4**, you will need one of my Matlab script called **draw_zonal_section.m**. You can copy it into you CROCO working directory Run_BENGUELA_LR:

```
cp /home/apps/chpc/earth/CROCCO_Workshop/CROCO_TRAINING_Basic/3_Some_files/
                        draw_zonal_section.m .
```

STEP 3: Recreating the BENGUELA_LR Grid

→ It is done with **MATLAB**

→ Go into your new CROCO working directory (**cd croco-v2.0.1/Run_BENGUELA_LR**)

→ Launch **matlab -nodesktop** (or the alias **mat**):

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

NODES

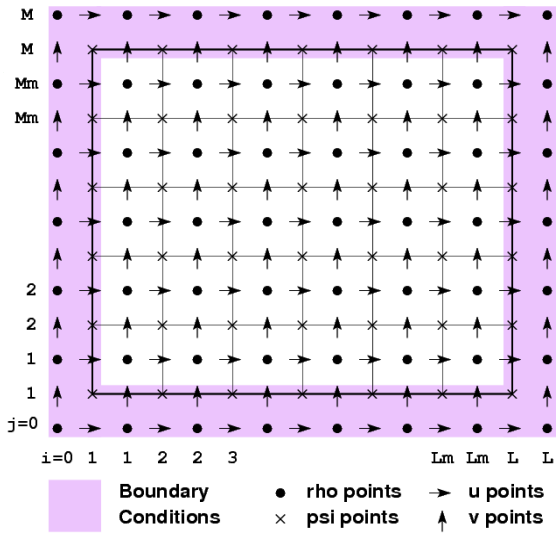
→ Inside MATLAB, execute the command **start** that will add some paths to Matlab (= tell Matlab where are the CROCO_TOOLS useful programs), and then open the **crocotools_param.m** file using the Matlab command edit:

```
                            < M A T L A B (R) >
                  Copyright 1984-2020 The MathWorks, Inc.
                R2020a Update 8 (9.8.0.1873465) 64-bit (glnxa64)
                               February 3, 2022

To get started, type doc.
For product information, visit www.mathworks.com.
>> start
>> edit crocotools_param
```

→ Analyse the parameters of the section "1- Configuration parameters used by make_grid.m"

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
%
% 1  - Configuration parameters
%      used by make_grid.m (and others..)
%
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
isoctave=exist('octave_config_info');
%
%  CROCO title names and directories
%
CROCO_title  = 'Benguela Model';
CROCO_config = 'Benguela_LR';
%
% Grid dimensions:
%
lonmin =   8;    % Minimum longitude [degree east]
lonmax =  22;    % Maximum longitude [degree east]
latmin = -38;    % Minimum latitude  [degree north]
latmax = -26;    % Maximum latitude  [degree north]
%
% Grid resolution [degree]
%
dl = 1/3;
%
% Number of vertical Levels (! should be the same in param.h !)
%
N = 32;
%
%  Vertical grid parameters (! should be the same in croco.in !)
%
theta_s     =  7.;
theta_b     =  2.;
hc          = 200.;
vtransform =  2.; % s-coordinate type (1: old- ; 2: new- coordinates)
                  % ! take care to define NEW_S_COORD cpp-key in cppdefs.h
```



➥ Activate the creation of graphics with **makeplot=1** at line 130.

→ (Off Matlab) You can look at the global topographic input data, i.e. the etopo2 data set:

```
[login@cnode0220 Run_BENGUELA_LR]$ cd ../../croco_tools-v2.0.0/
DATASETS_CROCOTOOLS/Topo
[login@cnode0220 Topo]$ ncdump -h etopo2.nc
[login@cnode0220 Topo]$ ncview etopo2.nc
```

NODES

GRID & MASK

→ (Back in Matlab) Launch the Matlab command make_grid: this will create your horizontal/vertical grid (position of the grid points, size of the grid cells, bottom topography, land mask, etc…) using information from the global etopo2 data base.

```
>> make_grid
 Making the grid: Run_BENGUELA_LR/CROCO_FILES/croco_grd.nc
 Title: Benguela Model
 Resolution: 1/3 deg
 Do you want to use interactive grid maker ?
 (e.g., for grid rotation or parameter adjustments) : y,[n] n
 :
 Do you want to use editmask ? y,[n] n
 :
 Write it down...
>>
```

→ For now, type "**no**" when asked to use interactive grid maker or to use editmask.

↳ The grid will be stored in the NetCDF file: **CROCO_FILES/croco_grd.nc**

→ (Off Matlab) You can look at the CROCO grid file:

```
[login@cnode0220 Topo]$ cd ../../../croco-v2.0.1/Run_BENGUELA_LR/CROCO_FILES
[login@cnode0220 CROCO_FILES]$ ncdump -h croco_grd.nc
[login@cnode0220 CROCO_FILES]$ ncview croco_grd.nc
```

NODES

→ (Back in Matlab) Inspect your vertical grid, using the Matlab script that has been copied in your **Run** directory in **STEP 2**:

draw_zonal_section(N,theta_s,theta_b,hc,vtransform,lat_index)

```
>> help draw_zonal_section
>> draw_zonal_section(32,7,2,200,2,12)
>>
```

↳ Try different values for N, theta_s, theta_b, hc, and vtransform

STEP 4: Creating your CROCO Grid

→ Redo **steps 2 & 3** choosing the region of the world you would like to simulate. Call your configuration **Run_Clim**. You can play with the grid rotation and the editmask.

↳ Remember the size of your grid (LLm, MMm)

Do not exceed a 100x100 grid
Do not overlap the equatorial zone by less than 2°
Do not create boundaries of less than 5 points
[Choose a place where there is a river]

STEP 5: Exiting

→ When you are satisfied with your grid, exit Matlab:

```
>> exit
```

→ Give back the compute node and logout from Lengau:

```
[login@cnode0220 Run_Clim]$ exit
logout
qsub: job 4416950.sched01 completed
[login@login2 ~]$ exit
```

NODES

STEP 6: Check List

→ Here is the list of the essential commands that you must execute during this hands-on session. The following table can help you confirm that you have executed all of them:

		Commands	✌
STEP 1	1	ssh -X login@lengau.chpc.ac.za	
	2	qsubi1	
	3	cd lustre/CROCO	
	4	ls	
STEP 2	1	cd croco-v2.0.1	
	2	nedit create_config.bash &	
	3	./create_config.bash	
	4	cd Run_BENGUELA_LR	
	5	cp /home/apps/chpc/earth/CROCCO_Workshop/CROCO_TRAINING_Basic/3_Some_files/draw_zonal_section.m .	
STEP 3	1	matlab -nodesktop	
	2	start	
	3	edit crocotools_param	
	4	make_grid	
	5	help draw_zonal_section	
	6	draw_zonal_section(32,7,2,200,2,12)	
STEP 4	N	Redo **STEP 2** and **STEP 3**	
STEP 5	1	exit	
	2	exit	
	3	exit	