CROCO

Victor Trappler

November 20, 2019

Introduction

CROCO is a new oceanic modeling system built upon ROMS_AGRIF and the non-hydrostatic kernel of SNH (under testing), gradually including algorithms from MARS3D (sediments) and HYCOM (vertical coordinates). An important objective for CROCO is to resolve very fine scales (especially in the coastal area), and their interactions with larger scales. It is the oceanic component of a complex coupled system including various components, e.g., atmosphere, surface waves, marine sediments, biogeochemistry and ecosystems[1].

In this document, I will try to provide a summary of my understanding of this model and its use, especially in the light of my PhD work.

1 Numerics

1.1 Parametrization of the bottom friction

Linear friction

$$(\tau_b^x, \tau_b^y) = -r(u_b, v_b) \tag{1}$$

Quadratic (constant)

$$(\tau_b^x, \tau_b^y) = C_d \sqrt{u_b^2 + v_b^2}(u_b, v_b) \tag{2}$$

Quadratic with Von Karman log-layer

$$(\tau_b^x, \tau_b^y) = C_d \sqrt{u_b^2 + v_b^2}(u_b, v_b) \tag{3}$$

$$C_d = \begin{cases} \left(\frac{\kappa}{\log(\Delta z_b / r_z)}\right)^2 & \text{for } C_d \in [C_d^{\min}, C_d^{\max}] \\ C_d^{\min} \\ C_d^{\max} \end{cases} \tag{4}$$

$$\kappa = 0.41 \tag{5}$$

$$\tag{6}$$

[1] taken from `http://www.croco-ocean.org/`

1.2 Numerical methods used

2 Utilisation

CROCO is written mainly in FORTRAN, so it needs to be first compiled, then executed

2.1 Compilation

2.1.1 param.h

Initialize parameters of the simulation, especially the number of tides to take into account:

- Physical grid

```
      #elif defined FRICTION_TIDES
        parameter (LLm0=139, MMm0=164,    N=1)
```

- NTIDES

```
!-----------------------------------------------------------
! Tides, Wetting-Drying, Point sources, Floast, Stations
!-----------------------------------------------------------

#if defined SSH_TIDES || defined UV_TIDES
      integer Ntides              ! Number of tides
                                  ! ====== == =====
# if defined IGW || defined S2DV
      parameter (Ntides=1)
# elif defined(FRICTION_TIDES)
      parameter (Ntides=10) ! HERE to change number
# else
      parameter (Ntides=8)
# endif
```

2.1.2 cppdefs.h

```
#define REGIONAL        /* REGIONAL Applications */
```

2.1.3 Compile

```
#!/bin/sh
../OCEAN/jobcomp
```

2.2 Execution

2.2.1 The .in file

```
time_stepping: NTIMES   dt[sec]  NDTFAST  NINFO
               25920      10      1       1
```

`NTIMES` is the number of time steps for the simulation

`dt` is the time-step for the simulation

Time simulated	`NTIMES`
1 hour	360
1 day	8640
3 days	25920
1 week (7 days)	60480
1 month (30 days)	259200
1 year (360 days)	3110400
1 year (365 days)	3153600

Table 1: Table of some values for NTIMES, with `dt` of 10s

```
restart:          NRST, NRPFRST / filename
                   720    -1
                   CROCO_FILES/croco_rst.nc
history: LDEFHIS, NWRT, NRPFHIS / filename
            T      180     0
            CROCO_FILES/croco_rst_obs_1mo.nc
```

`NRST` : Number of time-steps between saving a rst file

`NWRT` : Number of time-steps between saving to the history file

```
forcing: filename
                           CROCO_FILES/croco_frc_M2S2K1.nc
climatology: filename
                           CROCO_FILES/croco_clm.nc
```

Here, the forcing filename is generated using MATLAB/OCTAVE and the `croco_tools`, that includes the tide

```
  bottom_drag:     RDRG [m/s],  RDRG2,  Zob [m],  Cdb_min, Cdb_max
                1.00d-04    0.00d+00    5.00d-06    1.00d-04
1.00d-01
```

2.3 Toward a black-box utilisation using `crocopy`