M2 Marine Physics Year 2019–2020

Numerical Modeling

Final Project

due date: March 2nd, 2020

Instructions You will be evaluated on your computer work (50%) and your report (50%).

1. The computer work consists in: a zip file containing
   - the scripts (`cppdefs.h`, `param.h` etc.) to build the executable
   - the script(s) to build the input files
   - the `croco.in` file(s)
   - the scripts to produce your figures
   - the list of your history files (not the history files themselves!). This can be done with the following instruction: `ls -lrt croco_*nc > filelist`
2. The report will be a 10 to 15 pages technical report presenting all the steps of your work and a presentation of the results.

The project consists in setting up a realistic configuration of the region of your choice, run a spinup experiment and perform some analysis.

The configuration can be chosen anywhere in the globe (Gulf Stream, Kuroshio, ACC, etc.). The choice of the resolution and size of the domain is up to you, but you must be able to run at least a full year of simulation.

Outputs must include snapshots every 5 days and monthly (30 days) averages.

Question :

What is the largest model time step you can use? Is this consistent with your horizontal resolution and domain?

Analysis of the spin-up. Plot the following figures:

1. time evolution of surface kinetic energy (KE) integrated over the domain.
2. map of SSH variance estimated on the last 6 months using the snapshots.
3. map of EKE (eddy kinetic energy) estimated on the last 6 months using the snapshots.
4. snapshots of ζ/f (relative vorticity normalized by the local Coriolis parameter) at the surface at $t = 9$, 30, 90, 360 day (and latter if possible).
5. same plot at $z = -400$ m.
6. snapshots of temperature at $z = -400$ m at $t = 9$, 30, 90, 360 day (and latter if possible).
7. zonal or meridional sections of density and velocity in an interesting part of your domain at $t = 9$ day and $t = 360$ day.

Discussion Use those figures to discuss the model spin-up. Comment on the existence or not of mesoscale turbulence in the simulation.

Realism of the simulation. Try to find papers documenting the circulation in this region and check if it is (at least qualitatively) well reproduced in the simulation by producing relevant comparisons.

Comment on the realism of the simulation