M2 Marine Physics Year 2024–2025

Numerical Modeling

Final Project

due date: Feb 28, 2025

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

The configuration can be chosen anywhere in the globe (Bay of Biscay, 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 year and a half of simulation.

The report should be 10 to 15 pages, briefly present the technical steps of your work, the required plots described below, and a critical analysis of the results.

Question:

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

Analysis of the simulation: Plot and comment the following figures:

2. time evolution of surface kinetic energy (KE) integrated over the domain.
3. snapshots of ζ/f (relative vorticity normalized by the local Coriolis parameter) at the surface at $t = 10$, 30, 90, 360 day (and latter if possible).
4. same plot at $z = -400$ m (or you can choose a different depth depending on your local topography).
5. snapshots of temperature at $z = -400$ m at $t = 10$, 30, 90, 360 day (and latter if possible).
6. zonal or meridional sections of density and velocity in an interesting part of your domain at $t = 10$ day and $t = 360$ day.

7. Mean surface velocities over the last year of the simulation.

8. map of SSH variance over the last year of the simulation using the snapshots.

9. map of surface EKE (eddy kinetic energy) estimated over the last year of 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. You can also produce your own comparisons using observations/reanalysis (*e.g.*, WOA data). Comment on the realism of the simulation.