

3D nested model for the Galician Shelf: Ecological response and interannual variation in the carbon export.

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SINTEF

Task I.7 has the following objectives (short version):

Duration: Months 1-36

Objectives:

- Implement the existing SINTEF nested 3D model in order to establish a coupled hydro-biological model, and investigate, together with IST, the optimal way of coupling these type of models.
- Simulate the response of the ecosystem to wind events,
- Calculate the possible variations of carbon export due to annual variation of wind forcing,
- Establish a mathematical model for meso-zooplankton in the Galician shelf to be used in the ecosystem model.

Activity year 1

The SINTEF model has been implemented for the coast Iberian region with a bathymetry provided by IST. The SINTEF model comprises of a large-scale model having a grid point distance of 10 km and a nested model having a grid point distance of 2 km (Fig. 1). A relative large area has been chosen for the model set-ups. These areas will however be reduced in order to save computer time and thus be able to make more test runs. Both models have 23 horizontal levels of thickness (from surface to bottom): 8 x 5 m, 10 m, 4 x 25 m, 3 x 50 m, 100 m, 200 m, 400 m, 2x50 m, 1000 m, 2500 m.

The models have been run with the Levitus density fields and the sensitivity of the currents to the Galician shelf to change in the specified flow through the open boundaries has been investigated. It was found that the flow field on the Galician shelf was insensitive to the open boundary conditions for the large-scale model. The flow field appears to be driven by the density field. This means that the present model domain can be reduced. An example of simulated flow field (without any wind input) is shown in Fig. 2. Simulation with wind does of course change the current pattern in near the surface. Thus, a constant wind from north (10 m s^{-1}) creates a southward coastal jet.

The nested model has also been tested and an example of simulated flow field is shown in Fig. 3. The present model version uses bottom topography interpolated from an original 10 km model grid. The detailed bottom topography is not resolved. These data has to be digitised from analogue maps.

The nested model concept has been tested and found to work well. Further development within the framework of WP1 will use this concept.

Plans for the second year

- Implement a detailed bottom topography for the Galician shelf
- Compare simulation runs with results from the IST model and available data. This process will start in early July in Trondheim.

- Establish the first ecological model to be used within WP1 and make some test runs with various wind scenarios
- Discuss the ecological model structure and model results with other members of WP1.

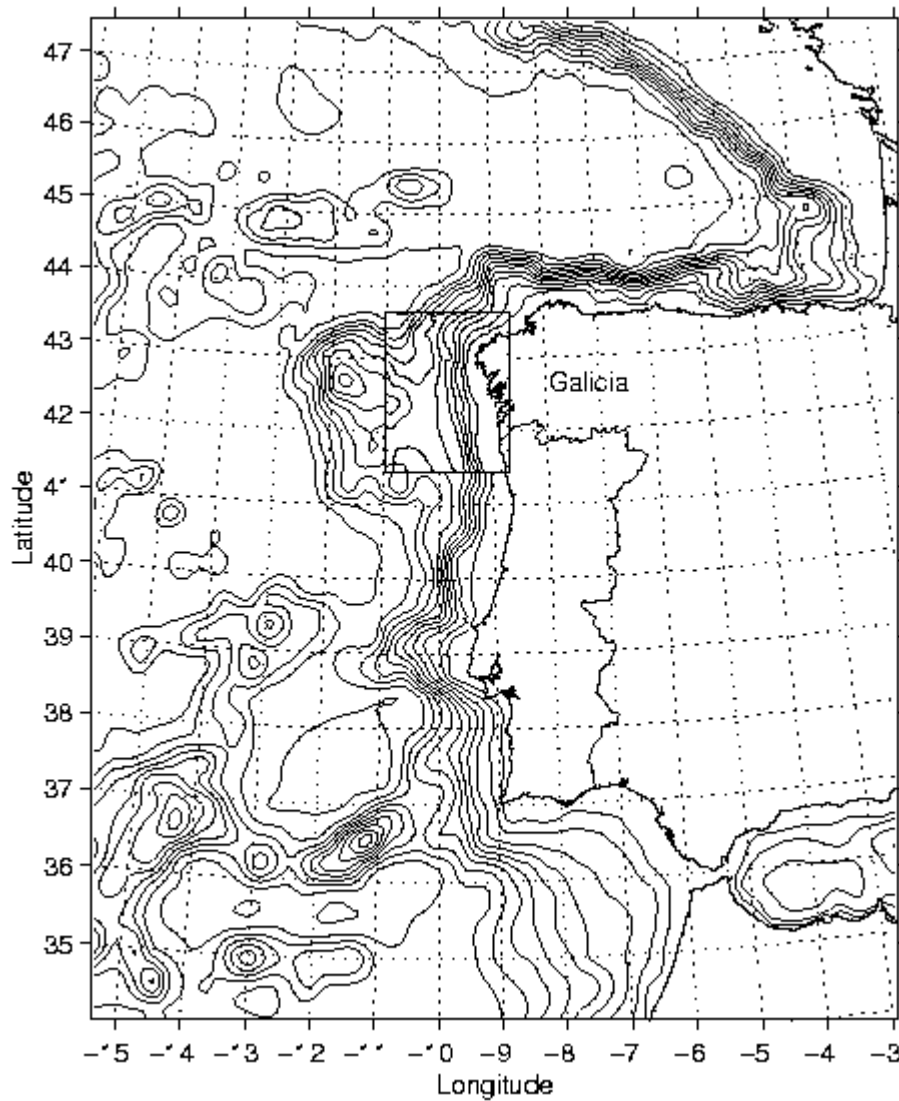


Figure 1 Model domains for the large scale and the nested models. The rectangle off the Galician coast shows the present domain for the nested (2 km) model. The isobaths are shown for every 500 m in addition the 200 m isobath.

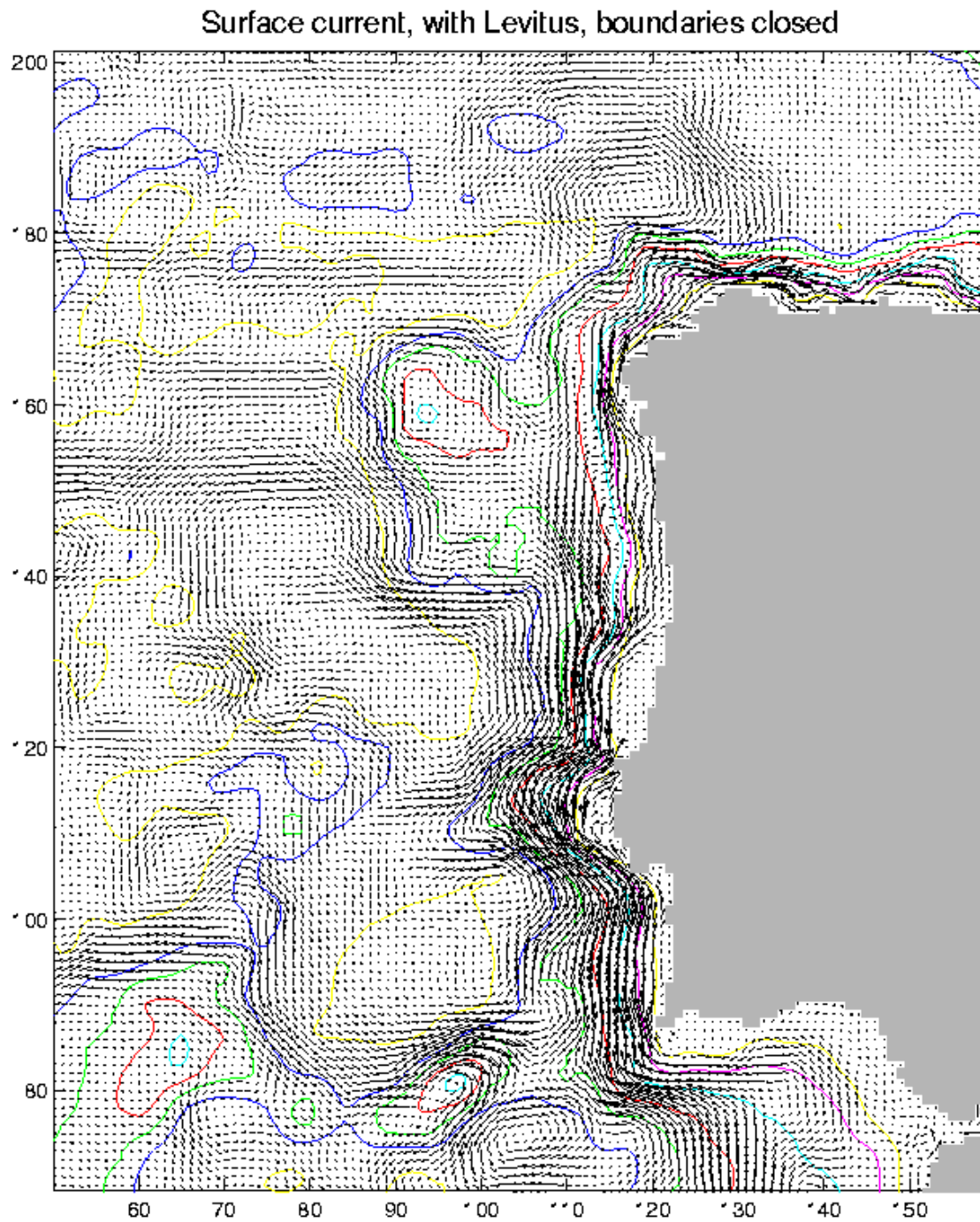


Figure 2 Simulated surface currents with all boundaries closed. The axis units are distance from the lower left model boundary in units of 10 km and the isobaths are shown for every 500 m and an additional one at 200 m. No wind input were used in this simulation experiment.

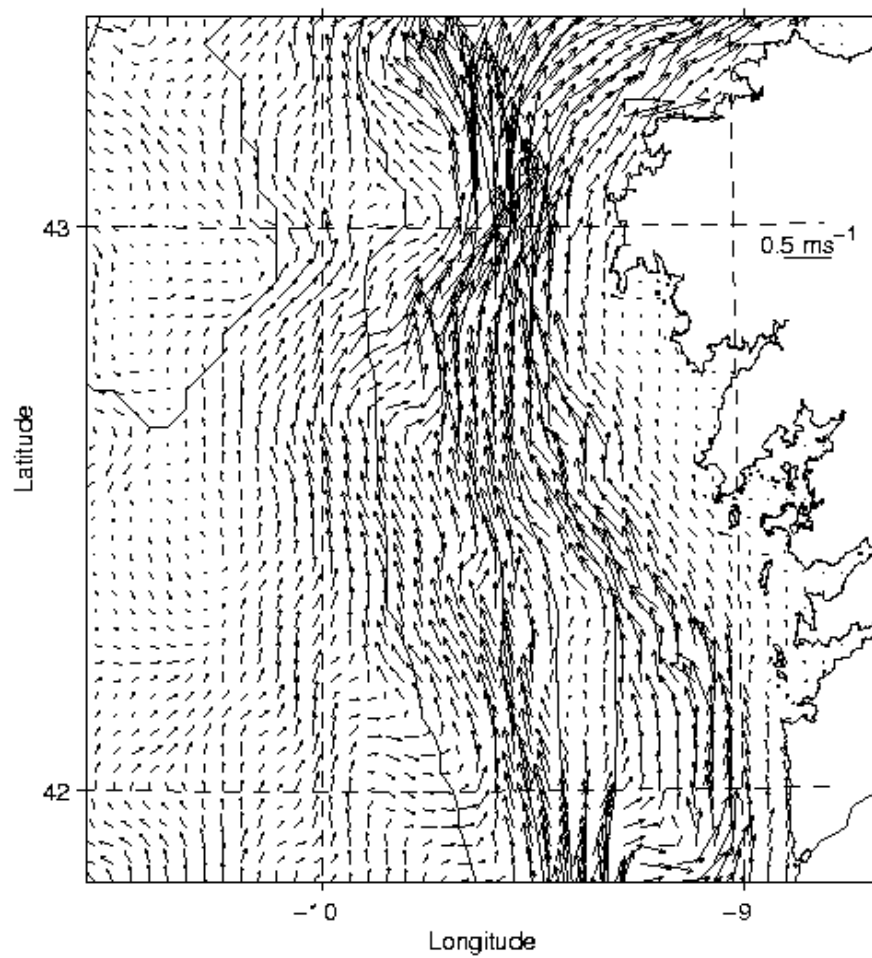


Figure 3 Simulate surface current from the nested model (no wind). Every second grid point is shown.