Assessing the performance of one-way and two-way nesting techniques for the shelf circulation modelling system of the eastern Canadian shelf

Jorge Urrego-Blanco¹, Jinyu Sheng¹, Frederic Dupont²

¹Department of Oceanography, Dalhousie University, Halifax, NS, Canada, B3H 4R2
²Environment Canada, Dorval, QC, Canada, H9P 1J3

Speaker may be reached at jorge.urrego.blanco@dal.ca

In this study the performance of one-way and two-way nesting techniques is assessed using model results produced by a regional ocean circulation modelling system for the eastern Canadian shelf. The assessment is made to determine the dynamical consistency between parent (PM) and child model (CM), the representation of circulation features in the region and the generation of numerical noise during the interaction of PM and CM components. It is demonstrated that different from one-way nesting, the feedback from the child model (CM) to the parent model (PM) in two-way nesting experiments ensures that the circulation produced by the PM and CM are dynamically consistent over the region where the models overlap. In comparison with one-way nesting, the use of the two-way nesting technique also leads to a better representation of coastal currents over the Gulf of St. Lawrence and the Scotian Shelf, and also improves significantly the large-scale circulation in the results produced by the PM. It is demonstrated that regardless of the feedback frequency, numerical noise is generated in the PM in two-way nesting experiments during the feedback from CM results. We propose the two-way nesting using the semi-prognostic method as an alternative to conventional nesting techniques to eliminate numerical noise during the feedback from CM to PM while ensuring dynamical consistency between the model components.