McGill Computational Science and Engineering Seminar

Friday March 9th at 14:00 in Burnside Hall room 1205

A Finite Element Semi-Lagrangian Barotropic Ocean Model

Daniel LeRoux,

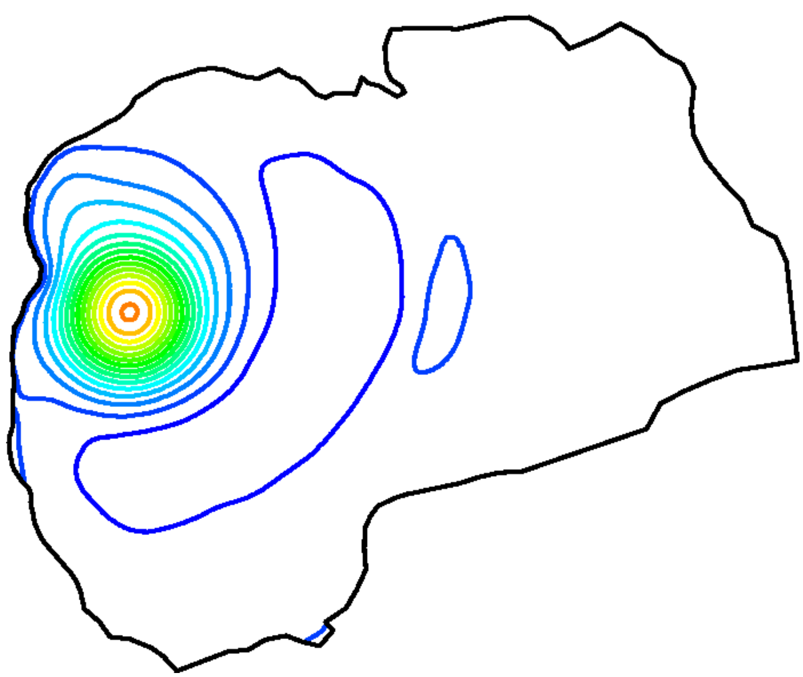
Departement de Mathematiques et de Statistiques, Universite Laval Quebec Canada

The finite-element, semi-implicit, and semi-Lagrangian methods are combined together to solve the shallow-water equations using unstructured triangular meshes. The aim of the presentation is to illustrate the promise of such an approach for ocean modeling.

Triangular finite elements are attractive for ocean modeling because of their flexibility for representing irregular boundaries and for local mesh refinement. However, most (if not all) popular finite elements pairs perform poorly in simulating geostrophic balance and gravity-inertia waves, leading to noisy solutions. A new triangular finite-element pair is proposed which improves on results obtained with existing pairs.

The semi-Lagrangian scheme discretizes substantive time derivatives along the particle trajectories that arrive at meshpoints at the end of a timestep, and gives very good phase speeds with little numerical dispersion compared to Eulerian schemes. Here, a "kriging" interpolator is used for the semi-Lagrangian advection, leading to an accurate representation of the slow Rossby modes.

Results of test problems to simulate the propagation of fast gravity and slow Rossby waves are presented.



Simulation of an eddy in the idealized Gulf of Mexico after 11 weeks of propagation. The sea level or pressure is shown.

Coffee and desserts are served after the seminar at 15:00 in the lounge, Burnside Hall 1024