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Modelling the separation of western boundary currents with a finite element model

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There has been a recent resurgence of interest in the use of the finite element method in formulating models of the ocean circulation. This has led to several new models entering development. The roster of such models includes the Imperial College Ocean Model (ICOM), which uses an unstructured, dynamically adapting mesh.

ICOM is used to model the separation of western boundary currents in an idealised northward channel, with separation induced by placing an obstacle on the western boundary. Results are shown to compare favourably with those obtained from a simple Barotropic Vorticity Equation Model (BVEM) in an equivalent configuration. Mesh adaptivity is beneficial in allowing extremely high resolution in close proximity to the western boundary, with low resolution in the eastern half of the channel. This significantly improves the computation time for ICOM and allows for much higher Reynolds numbers to be simulated. Furthermore, the unstructured mesh of ICOM offers a much smoother representation of the western boundary's shape than the piecewise-constant boundary of BVEM.