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Finite-element model of the Great Barrier Reef circulation

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An unstructured-mesh, finite element, depth-integrated model of the hydrodynamics of the whole Great Barrier Barrier Reef (GBR), Australia, has been developed and implemented on a parallel computer. Far away from reefs, islands and important bathymetric features, the mesh size may be as large as a few kilometres,whereas, in the vicinity of reefs and islands, the grid is drastically refined, leading to meshes that can be 100 metres in size. This enables our model to simulate motions characterized by a wide range of space and time scales. Large scale currents, i.e. the tides, the wind-induced circulation and the bifurcation of the East Australian Current, are reproduced with an accuracy that is comparable to that achieved by today's large-scale models of the GBR. The model is also successful at representing small-scale processes, such as tidal jets, their instabilities, as well as the eddies developing in the wake of islands and headlands. Both large and small scales have been validated. A study of multi-scale reef connectivity has been undertaken.