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Towards a high-resolution, unstructured-mesh model of the Great Barrier Reef

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The Great Barrier Reef (GBR) comprises more than 2800 individual reefs spread over 2600 km length of the Australia's north-eastern continental shelf, at the western margin of the Coral Sea. The topography is highly complex, with individual reefs ranging in area from 0.01 to 100 km^2. The interaction of this complex topography, the wind, the tides, and the circulation in the adjoining Coral Sea all serve to strongly influence the circulation on the GBR shelf. This circulation plays a crucial role in a number of important biological processes, including the flushing of Great Barrier Reef waters by Coral Sea waters, the connectivity of reef populations as a result of the transport of water-borne larvae between reefs, the transport of nutrients and pollutants by water currents,... These processes occur over a wide range of scales in both space and time, ranging from meters to hundreds of kilometers, and from minutes to years. A numerical model of the GBR should therefore be able to address the broadest range of time and space scales.

We have developed an unstructured-mesh model of the GBR. Such a model permits to locally increase the resolution in order to capture small-scale phenomena. The model solves the non-linear shallow water equations with the finite element method on a mesh whose refinement depends on the distance to the reefs and on the bathymetry. Due to the large amount of elements required to accurately represent all the processes, the numerical code is implemented on a parallel computer. The model and refinement strategies are presented. Preliminary results are discussed.