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An Unstructured Mesh Finite Volume C-grid Coastal Ocean Model

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The staggered C-grid has been adopted by many structured grid models. It is considered to be the grid best suited to resolve coastal physics. However, it suffers from one main drawback; that is a Coriolis mode can be excited when the Rossby Radius is not well resolved. Since coastal flows are dominated by cross-shore flows in approximate geostrophic balance it is important to ensure that the cross-shore region, within a Rossby radius of the coast, is well resolved. Coastal and estuarine models based on unstructured meshes have distinct advantages over traditional Cartesian based models and the last few years have seen the development of a large number of unstructured mesh models. Here we present a new model based on an unstructured C-grid and show how the correct choice of spatial and temporal discretisation can lead to a stable, accurate and efficient unstructured mesh model. We demonstrate the advantages of such an approach using a circular basin test case dominated by flooding and drying and geostrophy. We also demonstrate the advantages of the unstructured mesh method which allows us to place higher resolution near the coast.