On the Representation of Bathymetry by Unstructured Grids

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Abstract

A two-step methodology to improve the representation of bathymetry by unstructured grids is introduced. First, nodal depths are evaluated from a set of scattered data points using a new algorithm. Denoted equal volume method, this algorithm improves the representation of cross-sections relative to traditional methods, by imposing the conservation of the volume associated with each element, rather then minimizing depth errors at the nodes. In the second step, a new filter is applied to smooth the bathymetry and eliminate local extrema. The filter reduces the small-scale oscillations of the bathymetry, associated with measurement errors, unresolved bathymetric features and the interpolation algorithms, while preserving the overall domain volume. A first set of tests demonstrates the usefulness of the filter by itself. Error reductions of the order of 50% at some locations are obtained in tidal simulations in a large estuary. The full methodology is then tested in a synthetic estuary. Relative to traditional interpolation techniques, the equal volume method leads to more accurate numerical simulations of flow and transport, in particular when grid resolution is poor.

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