Geophysical Research Abstracts
Vol. 17, EGU2015-3448, 2015
EGU General Assembly 2015

Cell-vertex discretization of shallow water equations on mixed unstructured meshes

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Finite-volume discretizations can be formulated on unstructured meshes composed of different polygons. A staggered cell-vertex finite-volume discretization, keeping the velocity degrees of freedom on cell centroids and scalar degrees of freedom on vertices, presents one possible choice. Its performance is analyzed on mixed meshes composed of triangles and quads. Although triangular meshes are most flexible geometrically, quads are more efficient numerically and do not support spurious inertial modes of the triangular cell-vertex discretization. Mixed meshes composed of triangles and quads combine benefits of both. In particular, triangular transitional zones can be used to join quadrilateral meshes of differing resolution, i. e., to provide smooth nesting of a fine mesh into a coarse one. Based on a set of examples involving shallow water equations it is shown that mixed meshes offer a viable approach provided some background biharmonic viscosity (or the biharmonic filter) is used to stabilize the triangular part of the mesh.