Korn, Peter

Formulation of an unstructured grid model for global Ocean dynamics. (English)

Zbl 1380.65275
J. Comput. Phys. 339, 525-552 (2017).

Summary: A conservative discretization of the ocean primitive equations for global ocean dynamics is formulated on an unstructured grid. The grid consists of triangular cells with a C-type staggering of variables, where scalar variables are located at centers of grid cells and normal components of velocity are placed at cell boundaries. Reconstructions, necessitated by the staggering of variables, are chosen from a set of admissible reconstructions such that the discrete equations obey a weighted weak form, which guarantees discrete conservation properties. At the same time, a spurious mode, specific to the triangular C-grid, is controlled in a way that is compatible with conservation properties. The conservation properties of the discrete model are verified. Numerical simulations are presented, ranging from idealized geophysical flows to an ocean simulation at eddy-permitting resolution in order to substantiate the statement that global ocean dynamics can be formulated on triangular C-grids.

MSC:

65M60 Finite element, Rayleigh-Ritz and Galerkin methods for initial value and initial-boundary value problems involving PDEs

86A05 Hydrology, hydrography, oceanography

35Q86 PDEs in connection with geophysics

Keywords:

unstructured grid model; triangular C-grid; conservative discretization; ocean primitive equations; checkerboard pattern

Software:

ICON; MPAS-Ocean

Full Text: DOI

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