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Discrete conservation properties for shallow water flows using mixed mimetic spectral elements

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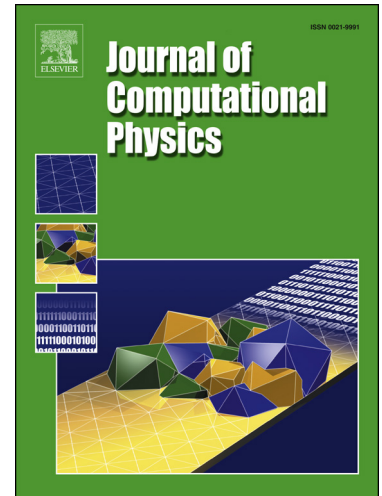
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Highlights

As confirmed through both formal proofs and numerical experiments the mixed mimetic spectral element method is shown to exhibit the following appealing properties for geophysical modelling over long time integrations:

- Conservation of mass, point wise in the strong form.
- Conservation of vorticity, in the weak form.
- Conservation of energy, subject to truncation error in the time stepping scheme.
- Conservation of potential enstrophy, subject to truncation error in the time stepping scheme and exact spatial integration.
- Geostrophic balance between pressure gradients and Coriolis terms for steady state solutions of the linearized system in the weak form.
- Strong form solution of the continuity equation.
- A discontinuous (local) solve for other moments in Q_h .
- Diagonal mass matrix for the nonlinear potential vorticity equation for the case of inexact spatial integration.
- Arbitrarily high order spatial accuracy.

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