Central-Upwind Schemes for the Ripa System of Shallow Water Equations

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Abstract

We introduce a central-upwind scheme for one- and two-dimensional systems of shallow-water equations with horizontal temperature gradients (the Ripa system). The scheme is well-balanced, positivity preserving and does not develop spurious pressure oscillations in the neighborhood of temperature jumps, that is, near the contact waves. Such oscillations would typically appear when a conventional Godunov-type finite volume method is applied to the Ripa system, and the nature of the oscillation is similar to the ones appearing at material interfaces in compressible multifluid computations. The idea behind the proposed approach is to utilize the interface tracking method, originally developed in [A. Chertock, S. Karni, A. Kurganov, *M2AN Math. Model. Numer. Anal.,* 42(2008), pp. 991-1019] for compressible multifluids. The resulting scheme is highly accurate, preserves two types of "lake at rest" steady states, and is oscillation free across the temperature jumps, as it is illustrated in a number of numerical experiments.

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