

# A HIGH-ORDER EXPLICIT RUNGE-KUTTA APPROXIMATION TECHNIQUE FOR THE SHALLOW WATER EQUATIONS

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ABSTRACT. We introduce a higher-order in time approximation of the Shallow Water Equations that is invariant-domain preserving and well-balanced. The employed time-stepping technique is a novel explicit Runge-Kutta (ERK) approach which is an extension of the class of ERK-IDP methods introduced in [?] for systems of non-linear conservation equations. Moreover, we show that any explicit Runge-Kutta method applied to the Shallow Water Equations, supplemented with a higher-order in space discretization, can be made mass conservative, invariant-domain preserving and well-balanced with respect to rest states. The resulting method is then numerically illustrated through verification and validation

**Keywords:** shallow water equations, well-balanced, higher-order accuracy, convex limiting, explicit Runge-Kutta, time discretization

**Mathematics Subject Classifications (2010):** 65M60, 65M12, 35L50, 35L65, 76M10

## REFERENCES

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