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A Fully Implicit Domain Decomposition Algorithm for Shallow Water Equations on the Cubed-Sphere

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Popular approaches for solving the shallow water equations for climate modeling are explicit and semi-implicit methods. In this talk, we discuss a fully implicit method for solving the shallow water equations on the cubed sphere. In the fully implicit method, a large sparse nonlinear system of equations needs to be solved at each time step, and the focus of the talk is a parallel, fully coupled, Newton-Krylov-Schwarz algorithm with a Jacobian matrix approximately calculated on a weakly non-matching mesh on the cubed sphere. We show numerically that with such a preconditioned nonlinearly implicit method the time step size is no longer constrained by the CFL number and the parallel scalability of the algorithm on machines with a large number of processors will be reported.