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**Multilevel Schwarz Preconditioner for a Fully Implicit
Global Shallow Water Solver**

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A multilevel Schwarz preconditioner is proposed as part of a fully implicit solver for the shallow water equations discretized with a second-order well-balanced finite volume scheme on the cubed-sphere. Fully implicit methods have the advantage that the time step size is no longer constrained by the CFL condition. But a large sparse nonlinear system of equations has to be solved at every time step. To solve these nonlinear systems, we use a Newton-Krylov-Schwarz method, in which the multilevel Schwarz preconditioner plays a key role for the effectiveness and efficiency. We show by numerical experiments that with the multilevel method, the numbers of nonlinear and linear iterations per time step are almost independent on the number of processors and much less sensitive to the implicit time step size compared to the one-level method. Numerical results obtained on machines with thousands of processors are provided to show the parallel scalability of the solver.