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Towards local stochastic subgid-scale parameterization for the barotropic vorticity equation

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In atmosphere and ocean modeling often stochastic subgrid-scale parameterizations based on first principles are required. Stochastic mode reduction offers a strategy for constructing such parameterizations under a small number of basic assumptions. We consider the validity of these assumptions in an energy and enstrophy conserving finite difference discretization of the barotropic vorticity equation. For that purpose resolved and unresolved modes are introduced in the model. The resolved modes are defined as averages of the "true" solution over some predefined number of grid cells and the unresolved modes describe the deviations of the "true" solution from the averaged values. We consider the time scale separation between the resolved and unresolved modes under different model configurations. We test the stochastic mode reduction assumption, that particular
nonlinear self-interactions between the unresolved modes can be modeled using an Ornstein-Uhlenbeck process.