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Potential Vorticity Mixing in Shallow-Water Vortices

Potential vorticity (PV) is conserved in adiabatic inviscid flow. Nevertheless, in a vortex such as a hurricane, nonlinear mixing continually redistributes PV, and the resulting filamentation cannot be followed exactly by deterministic models with limited resolution. Consequently, various statistical approaches (such as minimum enstrophy and maximum entropy) have been proposed to compute equilibrium solutions. Most studies of this process to date have applied these methods in the simplest dynamical context, namely, two-dimensional nondivergent incompressible flow. This talk will concentrate on the extension of these ideas to the next level of dynamical complexity, namely, the shallow-water equations. We will review the analytical formulation of the maximum entropy method by Chavanis and Sommeria and its numerical solution by an extension of the Turkington-Whitaker algorithm. Results and their implications for hurricane dynamics will be presented.