Stability analyses of divergence and vorticity damping on cubed-sphere grids

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Abstract

Selecting the level of explicit numerical diffusion requires a fine balance: while it needs to be sufficiently large to ensure numerical stability, too much diffusion can itself create instability. This talk discusses linear stability for the diffusion mechanisms of divergence and vorticity damping on cubed-sphere grids. Three different grids are investigated, including the popular equiangular grid and the equi-edge grid used by the FV3 dynamical core. Von Neumann analysis is used to derive stability limits for C and D grid staggerings. The linear theory is then examined in simple test cases with the D-grid CAM-FV3 model. These contrast the scale selectivity of Laplacian and higher-order damping and show numerical instability for diffusion coefficients above the stability limit.

Keywords: Divergence damping, vorticity damping, cubed, sphere grids, diffusion, stability

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