Geophysical Research Abstracts
Vol. 15, EGU2013-2032-1, 2013
EGU General Assembly 2013

Towards a parameterization of slow modes in a shallow water model on the sphere

Christian Böinghoff (1), Ulrich Achatz (2), and Stamen Dolaptchiev (2)

(1) Institute for Mathematics, Goethe-University, Frankfurt am Main, Germany (boeinghoff@math.uni-frankfurt.de), (2) Institute for Atmosphere and Environment, Goethe-University, Frankfurt am Main, Germany

The dynamics of the shallow water equations on the rotating sphere contain geostrophically balanced Rossby-waves and unbalanced external gravity waves. In the atmosphere, the large-scale dynamics is dominated by the balanced flow. However, the ageostrophic components of the flow act as an important forcing mechanism of the geostrophic large-scale flow.
In a global shallow water model on the rotating sphere, we aim on parameterizing fast, presumably mostly unbalanced, modes. For this purpose, we decompose the flow into geostrophic and ageostrophic modes. The geostrophic modes are solely represented by the potential vorticity, whereas ageostrophic modes are described by *ageostrophic vorticity* and *divergence* of the horizontal wind. For details of this decomposition see [2].
For our investigation, we use a spectral shallow water model described in [1]. As initial conditions, we use a (balanced) Rossby-Haurwitz-wave. The model is forced by a zonally-symmetric relaxation of geopotential height towards a characteristic mid-tropospheric distribution. As it turns out, there is no clear scale separation (neither in space nor in time) between geostrophic and ageostrophic modes. In the ageostrophic vorticity both long-time fluctuations with periods of the order of days and fast fluctuation with periods of the order of hours are visible. In contrast to this, the horizontal divergence is extremely variable both in space and time. The presentation will discuss progress in the development of a corresponding stochastic fast-mode parameterization.

REFERENCES

[1] J. Hack and R. Jakob, 1992: *Description of a global shallow water model based on the spectral transform method*, technical note, National Center for Atmospheric Research, Boulder, Colorado.

[2] W.T.M. Verkley, 2009: *A balanced approximation of the one-layer shallow-water equations on a sphere*, J. Atmospheric Sci. 66, 1735-1748.