
Nonlinear wave interactions in shallow water equations on the sphere

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Abstract

The shallow water (SW) equations constitute an important model to study the interactions between waves in the atmosphere, especially gravity waves, which can affect the slow dynamics through energy exchanges, causing errors in weather forecasts. The eigenfunctions of the linearized SW equations on the sphere, corresponding to Rossby-Haurwitz and gravity waves, are given in terms of Hough harmonics.

In the present work, the nonlinear interactions in different types of triads involving Rossby-Haurwitz and gravity waves are considered. The equations and constraints for a resonant triad are derived, and supported on existing methods, the Hough coefficients are calculated. For some examples of resonant triads, an analysis of the total energy is made, considering energy transfers and the precession resonance mechanism.

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