# Nonlinear simulation of Trapped, and Harmonic, Rossby waves in a zonal β-plane channel

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## Abstract

Harmonic Rossby waves are the traditional solutions of the Shallow Water Equations (SWE). A new type of solutions of the SWE was developed in recent years that represent Trapped Rossby waves that do not spread over the entire meridional domain. The two types of waves are obtained as analytic solution of a Schrödinger eigenvalue with constant potential in the case of Harmonic waves and linear potential in the case of Trapped waves. Here we report on 100-days numerical simulation by a finite difference Shallow Water solver that is initialized with the two types of waves. As anticipated by the theory in the linear simulation (i.e. when the advection terms of the time variation are omitted from the model equations) Harmonic waves are accurately simulated in narrow channels and Trapped waves are destroyed while in wide channels Trapped waves are accurately simulated and Harmonic waves are destroyed. Surprisingly, in the nonlinear simulations, when the advective terms are added to the model's equations, Harmonic waves are destroyed within 2-3 weeks of the simulation in a narrow channel while Trapped waves with the same small amplitude are accurately simulated throughout the entire 100 days. The reason for this superiority of Trapped waves over Trapped waves in the nonlinear simulation is not understood and is currently under investigation.