Resonant excitation and nonlinear evolution of waves in the equatorial waveguide in the presence of the mean current

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We study the interactions of planetary waves propagating across the equator with trapped Rossby or Yanai modes, and a mean zonal flow. The equatorial waveguide with a mean current acts as a resonator and responds to planetary waves with certain wavenumbers by making the trapped modes grow. Thus excited waves reach amplitudes greatly exceeding the amplitude of the incoming wave. Nonlinear saturation of the excited waves is described by the amplitude equation with one or two attracting equilibrium solutions. In the latter case the spatial modulation leads to formation of characteristic defects in the wave field. The evolution of the envelopes of long trapped Rossby waves is governed by the driven complex Ginzburg - Landau (GL) equation, and by the damped driven nonlinear Schr\"odinger (NLS) equation for short waves. The envelopes of the Yanai waves obey the nonlinear simple wave equation with cubic nonlinearity.