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*Rossby wave interaction between the tropics and midlatitudes: a novel asymptotic theory and solitary waves*

Simplified asymptotic equations are developed for the non-linear interaction of long wavelength equatorial Rossby waves and barotropic Rossby waves with a significant midlatitude projection in the presence of suitable horizontally and vertically sheared zonal mean flows. The simplified equations allow for non-linear energy exchange between the barotropic Rossby waves and the baroclinic equatorial waves for non-zero zonal mean vertical shear through wave-wave interactions. Idealized examples in the model demonstrate that midlatitude Rossby wave trains in a baroclinic mean shear can transfer their energy to localized equatorially trapped baroclinic Rossby waves through a non-linear "westerly wind burst" mechanism. Conversely, equatorially trapped baroclinic Rossby wave trains in the idealized model can transfer substantial energy to the midlatitude barotropic Rossby waves. From the viewpoint of applied mathematics, the asymptotic equations derived here have several novel features. In particular, they admit analytic solitary wave solutions which correspond to interesting localized waves in the equatorial troposphere.