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The extra-tropical effects on the equatorially trapped waves

The equatorial atmosphere harbours a large spectrum of waves that are trapped near and travel along the equator. These equatorially trapped waves interact nonlinearly with each other and with the planetary-barotropic waves.

We consider the fully non-linear hydrostatic primitive equations on a beta-plane projected onto the two first modes of vertical structure, leading to two coupled shallow water systems. Here, we discuss the effect of a meridional barotropic shear on the equatorially trapped Kelvin waves by using three different numerical methods. We compare the performance of the f-wave method, the central scheme and a relaxation type scheme that permits to preserve exactly the meridional balance of the Kelvin wave and its zero meridional velocity, for the non-forced case. We demonstrate that, due to the meridional dependence of the numerical phase speed, the central scheme yields strong artificial deformations in the structure and dynamics of waves and thus it is inadequate for equatorially trapped waves. Moreover, the effect of meridional shear on an equatorial Kelvin wave is accurately captured by our relaxation scheme for equatorially trapped waves since the shear actually induces a weak but non-trivial meridional velocity.