Abstract View

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Forcing and Friction Effects on Vertically Propagating Waves in the Equatorial Oceans

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ABSTRACT

In this paper the linear equatorial ocean response to stress forcing is analyzed in terms of vertically propagating waves. A new projection onto the meridional eigenfunctions of the pressure equation is derived for a single Fourier wave component. The projection demonstrates that the solution is regular and not singular at the inertial latitudes, and is more convenient to use than the corresponding projection onto the meridional velocity equation. The wavenumber spectrum from the resulting forced vertical structure equation is found for four different choices of the vertical profile for the body force. The spectrum is shown to be insensitive to the particular profile chosen. The projection is then used to study the effects of forcing and linear damping on the vertical propagation of space-time transformed energy in three wave modes: the Kelvin, first Rossby and mixed Rossby-gravity waves. When the buoyancy frequency is constant, the energy decay is exponential in depth with the coefficient proportional to the damping magnitude. Finally it is shown that linear damping effects are very different on each vertically propagating or vertically standing wave. Thus, it is fallacious to make deductions about meridional phase changes in the total solution to a general forced problem from the phase changes of each wave component.

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