Abstract View

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Second Harmonic Resonance for Equatorial Waves

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ABSTRACT

Simple, exact analytical conditions for second harmonic resonance between equatorial waves are derived. Such resonance can occur only between two Rossby waves or two westward travelling gravity waves. It is shown that regardless of whether the waves, are plane waves or localized wave packets, the physical consequence of the resonance is *instability* of the fundamental with a corresponding transfer of its energy to its second harmonic. The time scale of the instability is $O(1/I\epsilon)$ where ϵ is the amplitude of the fundamental and I the interaction coefficient, which is tabulated for various resonances. For reasonable parameter values, it appears that second harmonic resonance can be important in the tropical ocean. The $n = 1$ Rossby wave and all gravity waves propagating towards the east are immune to this instability, however, because they cannot satisfy the analytical conditions for second harmonic resonance. Besides these results for equatorial waves, a new approximate solution to the "resonant dyad" equations for an arbitrary initial wave packet is derived which is applicable to *any* second harmonic resonance, whether the waves are equatorial or not.