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[Volume 13, Issue 3 \(March 1983\)](#)

Journal of Physical Oceanography

Article: pp. 450–458 | [Abstract](#) | [PDF \(677K\)](#)

Long Wave/Short Wave Resonance in Equatorial Waves

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(Manuscript received December 23, 1981, in final form September 17, 1982)

DOI: 10.1175/1520-0485(1983)013<0450:LWWRIE>2.0.CO;2

ABSTRACT

It is shown that resonant coupling between ultra long equatorial Rossby waves and packets of either short Rossby or short westward-traveling gravity waves is possible. Simple analytic formulas give the discrete value of the packet wave number k , for which the group velocity of the packet of meridional mode number n matches the group velocity of a nondispersive long Rossby wave of odd mode number m . The equations that describe the coupling are derived via the method of multiple scale and tables of the interaction coefficients are numerically calculated. For realistic parameter values, it appears this coupling could be important in the tropical ocean.

The principal physics of the coupled equations is threefold: 1) modulational or “side band” instability of plane waves, 2) instability of a short wave packet with respect to growing long waves if no long waves are initially present, and 3) solitary waves which consist of an envelope soliton of short waves of Nonlinear Schrödinger type traveling in conjunction with a unimontane soliton of Korteweg-deVries type as a single entity.

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