Geophysical Research Abstracts
Vol. 17, EGU2015-125-1, 2015
EGU General Assembly 2015

An empirical investigation of nonlinear energy transfer from the M2 internal tide to diurnal wave motions in the Kauai Channel, Hawaii

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Current profiles are examined for evidence of nonlinear energy transfers from the M2 internal tide to diurnal waves. The 6 month records, unlike shorter records, produce well-resolved velocity and shear spectra that consistently exhibit maxima at the diurnal tides O1 and K1, with a minimum at the intermediate M2 subharmonic, M2/2. The ratio of velocity spectral energy at M2/2 and M2 is quantified, providing a needed modeling benchmark.

Bispectra and bicoherences imply a negligible [M2/2, M2/2, M2] triad interaction, but possibly a significant interaction for the [O1, K1, M2] triad. Numerical simulations, however, indicate that O1 and K1 signals are from internal tides. Tests with synthetic data, linear tides plus random noise, reveal that bispectrum and bicoherence estimators can yield significant values, thus misleading results. Therefore, resolving the diurnal tides from M2/2 is essential to meaningfully assess nonlinear transfer of energy from M2 to diurnal waves.