Abstract View

Volume 17, Issue 5 (May 1987)

Journal of Physical Oceanography
Article: pp. 644–663 | Abstract | PDF (1.43M)

Infragravity Edge Wave Observations on Two California Beaches

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(Manuscript received December 23, 1985, in final form November 10, 1986)

DOI: 10.1175/1520-0485(1987)017<0644:IEWOOT>2.0.CO;2

ABSTRACT

Wavenumber-frequency spectra of the infragravity (periods 20-200 sec) wave velocity field in the surf zone of two California beaches are estimated. Because the longshore arrays of biaxial electromagnetic current meters are relatively short (comparable to the wavelengths of interest), high resolution spectrum estimators are required. Model testing provides insight into the limits, capabilities and reliability of the estimators used in this paper. On all 15 days analyzed, between 42% and 88% of the longshore current variance at the array is contributed by low mode ($n \leq 2$) edge waves. (Percentage estimates are not made at a few frequencies because the array is positioned near nodes.) The low mode signal in the cross-shore velocity at the arrays is usually masked by unresolvable high mode and/or leaky waves. The percentage of cross-shore current variance at the array estimated unresolvable high mode is less than 35%, with one exception for which approximately 50% of the variance is mode 0 across a substantial portion of the infragravity band. On average, low mode ($n \leq 2$) edge waves constitute 69% (17%) of the variance of the longshore (cross-shore) infragravity velocities at both arrays. There are days at both beaches that show factors of 3 asymmetry in the energy of up and downcoast progressive edge waves of a particular mode number, but the ratio of up and downcoast energy of up and downcoast progressive edge waves of a particular mode number, but the ratio of up and downcoast energy is usually within 1±0.1 On 8 of the 15 days, the spectrum of swash motions on the beach face is measured with a run-up meter. The swash spectrum, an estimate of the one-dimensional (summed over all wavenumbers) infragravity shoreline elevation spectrum, is compared to the edge wave shoreline elevation variances inferred from the velocity measurements at the array. As much as 50% of the variance in the present dataset, low mode edge waves contribute significantly to both the longshore velocity and run-up components of the nearshore infragravity wave field. Daily fluctuations in the shoreline elevation variance of individual low mode edge waves are regressed against the total wind and swell wave variance (periods 3–20 sec) measured outside the surf zone. The correlations are statistically significant at one beach, but not the other. Distortions of the observed edge wave dispersion curved (from a plane beach solution) because of beach concavity and mean longshore currents are small but detectable.

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