Abstract View

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Observations of Internal and Near-Inertial Oscillations at Drake Passage

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ABSTRACT

The kinetic energy levels Of horizontal oscillations near and above the inertial frequency are described based on 84 current records made during 5 years at Drake Passage. Instrument depths ranged from 280 to 3600 m. Moorings spanned the passage, though the best depth and time coverage is for a central location. For each variance spectrum of horizontal current, the frequency band above the local inertial and semidiurnal tidal peaks was fitted to the Garrett and Munk internal wave spectrum in the form of

The fit is determined by the log-log decay (p) of energy density (NE_0) with frequency (ω), where E_0 is the energy density at 1 cph (ω_0) normalized by stability frequency N. Although these parameters were generally near the "universal" values, there was considerable spatial variability—more than the year-to-year variability. Values of p were found to increase with depth; values of E_0 were larger in the northern passage and at the continental slopes suggesting source regions for wave energy. The fitted relation was integrated between local inertial and the appropriate stability frequency to examine the total kinetic energy of horizontal motions in the internal wave field. This internal wave energy was normalized by stability frequency and plotted versus depth for three distinct bathymetric regimes. Both energy levels and vertical distributions differ, with greater energy and more depth variation over the rugged bathymetry of the northern passage.

The prominent inertial peak was examined on the basis of its frequency, peak height and peak width at 50% of peak values. Values of these parameters fell within the range of values obtained by Fu for the North Atlantic. The time and space variations of inertial oscillations was described based mainly on band-passed records centered at local inertial frequencies. The phase coherence for inertial oscillations decreases with increasing vertical instrument separation with a vertical coherence scale somewhere in the order of 700–1500 m. For horizontal separations of less than 20 km

the phase coherence is significant in all cases, and for separations greater than 60 km the inertial waves are not coherent.

The partitioning of kinetic energy of horizontal oscillations between 2 hours and 2 days is examined. We earlier estimated that 49% of this energy is found in narrow pass-bands containing the dominant short period tides. Here we find that additionally 10 and 27% of that fluctuation kinetic energy is accounted for by inertial oscillations and internal waves, respectively.

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