Toward Regional Characterizations of the Oceanic Internal Wavefield

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Many major oceanographic internal wave observational programs of the last four decades are reanalyzed in order to characterize variability of the deep ocean internal wavefield. The observations are discussed in the context of the universal spectral model proposed by Garrett and Munk. The Garrett and Munk model is a good description of wintertime conditions at Site-D on the continental slope north of the Gulf Stream. Elsewhere and at other times, significant deviations in terms of amplitude, separability of the 2-D vertical wavenumber - frequency spectrum, and departure from specified power law behaviors are noted.

Specifically, the Garrett and Munk model overestimates annual average frequency domain spectral levels both at Site-D and in general. The bias at Site-D is associated with the Garrett and Munk model being a fit to wintertime data from Site-D and the presence of an annual cycle in high-frequency energy in the western subtropical North Atlantic having a maximum in winter. Variability of vertical wavenumber domain spectral levels is not as pronounced as in the frequency domain. Increased levels of kinetic energy spectra at high wavenumber tend to occur in combination with proportionately larger increases of energy at low wavenumber. Potential energy spectra are better fit by a simple power law over the entire vertical wavenumber domain, with the consequence that the wave spectrum is intrinsically non-separable. Separability is a more tenable approximation for more energetic states, such as wintertime conditions at Site-D. Subtle geographic patterns are apparent in deviations from the high-frequency and high vertical wavenumber power laws of the Garrett and Munk spectrum. Moreover, such deviations tend to co-vary: whiter frequency spectra are partnered with redder vertical wavenumber spectra.

Attempts will be made to rationalize the regional variability in terms of variability in generation processes, propagation characteristics and nonlinearity.