عنوان مقاله:

Internal Gravity Waves Spectrum Generated by a Cylindrical Body Moving in a Stratified Fluid

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خلاصه مقاله:

Internal waves are abundant in stratified environments such as the atmosphere and the ocean. In this paper, the internal waves and turbulent wake effect of a cylindrical body in a linear stratified environment is investigated. In a glass tank with dimensions ۳×۱×۰.۵ (m), a linear stratification with buoyancy frequency (N) equal to ۰.۵۱ per second, was set up. Then a cylindrical body with ۶ cm in diameter and ۴۵ cm at length was towed in the fluid, using a computer controlled system. While changing the Froude (from ۰.۱۶ to ۱.۵) and Reynolds numbers of the flow, the effects of these changes were examined on the formation of the internal waves and wake of the cylinder. The internal waves generated were studied using shadowgraph technique and signal fluctuations were recorded. The results show that the presence of internal waves depend on changes of buoyancy frequency (N), Froude numbers, and Reynolds numbers of the flow. It was also found that with an increase up to the critical Froude number, the activity of internal waves and their wavelengths enhanced. Also, irregular long and short waves as well as turbulence of the environment were observed in the range of supercritical Froude numbers. In this study, the signals are recorded in domains of frequency and statistics. Using an ultra-fast salinity meter (densitometer) for recording signal frequencies it was found that increasing Froude number results in more combination of frequencies occurred in the environment. Based on the results of current experiments and previous studies, an equation was extracted to calculate the wavelength by parameters like velocity of body, maximum frequency value and propagation angle. The energy of wave spectrum increased up to a critical Froude number, and then decreased due to turbulence. The statistical distribution of signals recorded in most of the scenarios was normal.

کلمات کلیدی:

Density stratification, Internal waves, Shadowgraph imaging technique, Salinity signal fluctuations, Froude number, spectral analysis