

Evolution of Nonlinear Internal Waves Northeast of Taiwan

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ABSTRACT

Synthetic Aperture Radar (SAR) images from ERS-1 have been used to study the characteristics of internal waves northeast of Taiwan. Rank-ordered packets of internal solitons propagating shoreward from the edge of the continental shelf were observed in the SAR images. The generation mechanism includes the influences of the tide and the Kuroshio intrusion across the continental shelf. The Kortweg-deVries (KdV) type equation can be used to explain the evolution of internal wave packets and linked to satellite image observations. Based on the assumption of a semidiurnal tidal origin, the wave speed can be estimated and is consistent with the internal wave theory. The torque acting on the offshore structures induced by the internal wave in coastal area is also discussed.

KEY WORDS: Internal Waves, Upwelling, Taiwan, Torque

INTRODUCTION

The tidal flow over topographic features such as a sill or continental shelf in a stratified ocean can produce nonlinear internal waves of tidal frequency and has been studied by many investigators (Sandstrom and Elliott, 1984; Apel et al., 1985; Apel, 1995). Their observations provide insight into the internal wave generation process and explain the role they play in the transfer of energy from tides to ocean mixing. These nonlinear internal waves were apparently generated by internal turbulent mixing or baroclinic shear instability over bottom features.

The East China Sea is rich in natural resources, which has been exploited extensively. Figure 1 shows the bottom topography northeast of Taiwan. The Kuroshio, the major western boundary current of the Pacific, pass through the east coast of Taiwan, forms the eastern boundary of the East China Sea as it skirts along the shelf edge in the Okinawa Trough. The Kuroshio Edge Exchange Process (KEEP) is a large oceanic project in Taiwan to study the exchange of material between the East China Sea and the Kuroshio at a permanent upwelling region northeast of Taiwan (Liu et al., 1992). The upwelling is induced by the intrusion of the Kuroshio across the continental shelf (Hsueh et al., 1993). The Kuroshio fronts and cold

eddies in the upwelling region have been observed by AVHRR images (Liu et al., 1992) and SAR images (Hsu et al., 1995). Followed the KEEP project, there is the KEEP-II project, a three-year

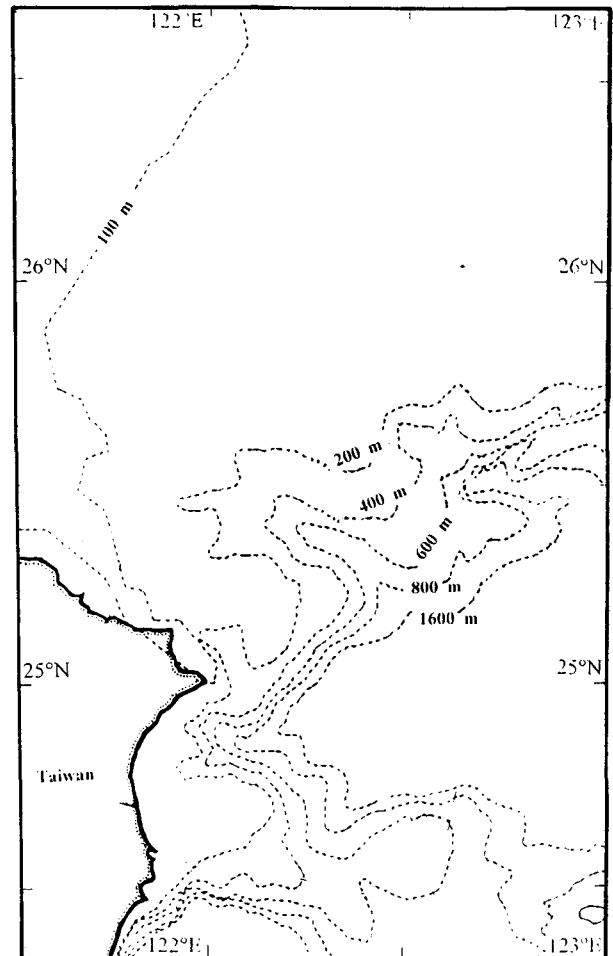


Fig. 1 The bathymetry of northeast of Taiwan in East China Sea.