Oceanic internal wave spectrum inferred from continuous measurements of temperature and pressure in seawater

Shingo Sugimoto[1]; Keiichi Tadokoro[1]; Ryoya Ikuta[2]; Takashi OKUDA[3]; Tsuyoshi Watanabe[1]; Daisuke Muto[4]; Akinori Kimoto[4]; Koji Miyata[4]; Koya SHIMAMURA[5]; Keizo Sayanagi[6]

[1] RCSVDM, Nagoya Univ.; [2] Faculty. Sci. Shizuoka Univ.; [3] RCSVDM Center.Nagoya Univ; [4] Grad. Sch. Env. Studies, Nagoya Univ.; [5] Geosciences, Shizuoka Univ.; [6] IORD, Tokai Univ

Observations of seafloor crustal deformation are very important to understand dynamics of plate boundary that include strain accumulation processes, great interplate earthquakes mechanisms. We have been developing an observation system with the GPS/Acoustic combination technique for monitoring of seafloor crustal deformation at the Suruga bay and the Kumano basin from 2002 and 2003, respectively. Repeated measurements of seafloor transponder can reveal directly the seafloor crustal deformation in the focal area of the subduction zone in the both observation areas. By using our observation system, we could detect coseismic deformation associated with M7 class offshore earthquakes [Tadokoro et al., 2006]. In addition, repeated observation within one year could detect the velocity of crustal deformation associated with subduction at the both observation areas where huge earthquakes repeatedly occur [Tadokoro et al., 2008].

Present analysis method simultaneously estimates temporal variation of acoustic velocity and positions of seafloor transponders assuming the layered structure of acoustic velocity. However, actual structure of acoustic velocity (or temperature) might have spatial variation due to oceanic current and internal wave. In this presentation, for modeling of the effect of the spatial variation on the seafloor positioning, we estimated spectrum of oceanic internal wave using by continuous measurements of temperature and pressure in seawater. In addition, we will discuss the scales of spatio-temporal variation of the temperature structure in the Suruga bay.

Generally speaking in physical oceanography, frequencies of internal waves are limited in between inertial frequency and buoyancy frequency. Some amplitude spectra of travel-time residual obtained by the analysis method are predominant around the range of frequencies. This means that some seafloor geodetic observations were affected by internal waves. We tried to estimate oceanic internal wave spectrum using the continuous measurements of temperature and pressure in seawater.

The continuous measurements in parallel with acoustic ranging were conducted by mooring or towing temperature and pressure sensors attached rope with interval of 50 m. These sensors whose name is SBE39 were produced by SBE Electronics. The recording interval was 3 seconds. For reduction of the measurement noise on the data, fitting of timeseries of temperature (or depth) to smooth surface with ABIC minimization [Murata, 1993] was carried out. By the fitting, we can carry out spectral analysis for timeseries of temperature (or depth) at arbitrary depth (or temperature).

First, we applied the sequence of above processing for the measured data by mooring in August and October 2008. As the result, some obtained spectra consistent with Garrett-Munk Spectrum [Garrett and Munk, 1972; 1975] which were constructed by synthesis of several standing waves, and integrated several observed data. In this presentation, we will discuss spatial variation of temperature structure through the spectral analysis of the measurement data obtained by towing.