Model of Temporal Variations in Sound Speed Structure at Suruga Bay During the Observations of Seafloor Crustal Deformation

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1.Introduction

Observations of seafloor crustal deformation is very important to understand the dynamics of plate boundary that include the strain accumulation processes, great interplate earthquakes mechanisms, and submarine volcanoes activities. We have been developing an observation system for monitoring of seafloor crustal deformation at the Suruga Bay [Tadokoro et al., 2003] and the Kumano basin [Tadokoro et al., 2004] from 2002 and 2003, respectively. Repeated measurements of seafloor benchmark can monitor and reveal the seafloor crustal deformation in focal area of the subduction zone directly.

2.Analysis and modeling

Temporal and spatial variations of sound speed structure in seawater are the error sources for seafloor positioning [Yada et al., 2004]. In order to monitor and the seafloor positioning including the temporal variations, we repeatedly measured sound speed profiles with the CTD (conductivity, temperature and depth) profiler during each acoustic ranging observation-line at Suruga bay. Based on the actual undersea velocity profiles measured with CTD profile, we made three models of the temporal variations below:

1st model:Homogenous model

2nd model:Averaged sound speed model

3rd model:Averaged sound speed and adjusted variation model

Using these models, we estimate the position of the seafloor benchmark and evaluate the temporal variation of sound speed.

3.Results and discussion

In the 2nd model (no adjusted) showed a typical pattern of travel-time residual that indicate a gross estimate of vertical position for seafloor benchmark. In the 3rd model, the effect of the temporal variation of sound speed was canceled out as the standard deviation of residual became half compared to the1st model. According to this analysis, we should correct the temporal variation with 0.1-0.2%. Thus, CTD measurement proves very useful to estimate the seafloor benchmark.