

Positioning error in seafloor benchmark caused by sound velocity structure

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There are three major factors in the location error of seafloor benchmark: 1) the positioning errors of the observation vessel with the kinematic GPS positioning, 2) errors in travel time reading of the acoustic signal, and 3) uncertainty and time-space variation of the sound velocity structure. Among these errors, Sato et al. [2001] has given detailed discussion on the kinematic GPS positioning. In this study, we discuss effects on seafloor positioning of velocity structure.

We measured sound velocity at Suruga Bay, Japan, on August 30-31, 2001 and February 12-13, 2002 as well as acoustic ranging and kinematic GPS positioning, using CTD profiler. The sound velocity has daily, seasonal, and spatial variations. In August 2001, we measured twice at the same position to investigate daily changes. In February 2002, we measured at the same position as August 2001 to investigate seasonal changes, in addition, we measured at four positions to investigate spatial variations.

Firstly, we quantify daily, seasonal, and spatial variations of the sound velocity structure. Next, we discussed the error in seafloor positioning taking no account of the above variations. The results of this study provide important information on the observations of ocean bottom crustal deformation, that is, how detailed consideration to the sound velocity is necessary for the seafloor positioning.