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Simultaneous inversion of 1-D sound velocity and positions of benchmarks to develop ocean-floor geodetic observation

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To clarify the behavior on plate boundary zones, especially related with mega-thrust earthquakes, we have needed high-resoluted crustal observation both in space and time. Around Japan, those plate boundaries are located beneath ocean, so our group has tried to develop an observation system for sea-floor crustal deformation.

As a part of these sea-floor crustal deformation measurements, we use an accurate acoustic ranging technique. However, due to variations of acoustic velocity structure, sometimes, estimated position error of seafloor benchmark units becomes larger than ~ 1 cm, which is not useful to identify relative plate motions. For our objectives, we try to invert variations of acoustic velocity structure in ocean to make stable estimation of bench marker positions. Although ray paths of our acoustic ranging are not good to invert full 3-dimesional acoustic velocity structure with temporal variation, we can invert 1-dimension velocity variation with depth for a given short time through some prior information, like a snapshot in some time. We apply the simple Joint Hypocenter Determination method in seismology [Kissling et al., 1994] to acoustic ranging data observed by Nagoya University group both in Suruga Bay and Kumano Basin. This paper focused on results and related remarks on Kumano Basin. Another is presented by Eto et al. [This meeting].

We report our strategy for observation systems and some results from observation data and synthetic data test.

Keywords: sea-bottom crustal deformation measurement, acoustic ranging, sound speed structure in ocean, joint hypocenter determination