Introduction of a newly designed GPS buoy deployed offshore of the Muroto Promontory

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We describe a newly designed GPS buoy for detecting tsunami. We have developed a GPS buoy for nearly ten years for detecting tsunami before its arrival to the coast, which may be beneficial for mitigating disaster due to tsunami. During a three years of operational experiment offshore Ofunato, we have detected tsunamis due to 2001 Peru earthquake (M7.9) and 2003 Tokachi earthquake (M8.0) with sufficiently high accuracy.

Although the success of using a GPS buoy for detecting tsunami, a few problems are yet to be solved. The experiment in Ofunato was made only about two kilometers offshore from the nearest coast. This is too close to the coast to mitigate initial damage due to tsunami. The tsunami buoy has to be placed much farther away from the coast, such as 10 km or more. To this end, we are now developing a new GPS buoy for deploying offshore of the Muroto Promontory, Kochi, Japan, of more than 10km. A couple of techniques are need to be innovated to make it feasible; first, reliable radio telecommunication system may have to be used, and second, accurate and real-time positioning of GPS is necessary for long distance baseline. The buoy itself has to be strongly built. Tri-directional anchoring that was used in Ofunato experiment cannot be used in Muroto because of deep ocean of about 100m; thus we employed single anchoring in the new system.

Since we basically use RTK analysis strategy as was the case in Ofunato, we need a base station onshore of the tip of the peninsula. We set the site in the field of Muroto Meteorological Observatory, for this purpose. The GPS antenna will be placed at the top of a wind measuring tower of 40m high, together with a radio receiving antenna. In addition to the regular RTK system, we try to use two newly introduced software called KVD and PVD (Isshiki et al., 2000). Since PVD is a single point positioning system using carrier phase of GPS signal, it reduces the burden of transmitting data from buoy to the base if data processing is made in the buoy.

This newly designed system is planning to be deployed in April 2004, so that the initial data will be reported at the time of presentation of this paper.