

## Improvement of the Japanese NOWPHAS Network by Introducing Advanced GPS Buoys

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### ABSTRACT

This paper presents observation results and numerical analysis of offshore wave, tsunami and tide based on the data obtained during Apr-Sept 2007, by two sets of GPS buoy system installed off the Northern Pacific Coast of Japan. These two sets of the GPS buoy successfully observed wave climate, abnormal high waves, and offshore astronomical tides with such little loss of information as only about 2% of the total observation data. Results of this paper show that offshore GPS buoys can observe much bigger significant wave heights in both normal and abnormal sea states than shallower seabed wave gauges, accentuating the importance of deep-sea wave observation to estimate offshore wave characteristics.

**KEY WORDS:** GPS buoy; NOWPHAS; wave observation; offshore information

### INTRODUCTION

Two sets of the GPS buoy system were installed off the Northern Pacific Coast of Japan, one in March and the other in April 2007 by the Ports and Airports Department of the Tohoku Regional Development Bureau of the Ministry of Land, Infrastructure and Transport, Japan in order to observe offshore deep-sea waves and tsunamis. It was an important step for improving Japan's NOWPHAS (Nationwide Ocean Wave information network for Ports and HArbourS) (Nagai, et.al., 1994; Nagai, 2002), thus starting continuous sea-state sampling without interruption for deep-water condition (Nagai, et. al., 1997). This paper describes characteristics of the observed offshore wave data for 6 months from April to September 2007, comparing with those obtained at seabed installed shallow wave gauges and coastal tide stations.

### GPS BUOY SYSTEM

Newly developed GPS buoy system, which applies RTK-GPS techniques to exact measurement of offshore floating buoys, is to be the future of offshore wave and tsunami monitoring system for Japanese coastal line (Nagai, et.al.,2006: Nagai, et.al.,2007). The GPS buoys can be installed in deeper and more offshore area than the existing seabed-installed wave gauges, making earlier tsunami detection possible with appropriate filtering techniques of observed data. In addition, they can observe deep-sea conditional waves and swells.

Fig. 1 shows a concept diagram of the GPS Buoy system (Kato, et. al., 2001). In setting an on-land reference GPS base station within 20km from the buoy, Real-Time Kinematical method is applied. Field pre-experiments conducted at 100m deep and 13km off the Muroto-Misaki cape in 2004, have proved its applicability to offshore wave, tide and tsunami observation (Nagai, et.al.,2004: Nagai, et.al.,2005).

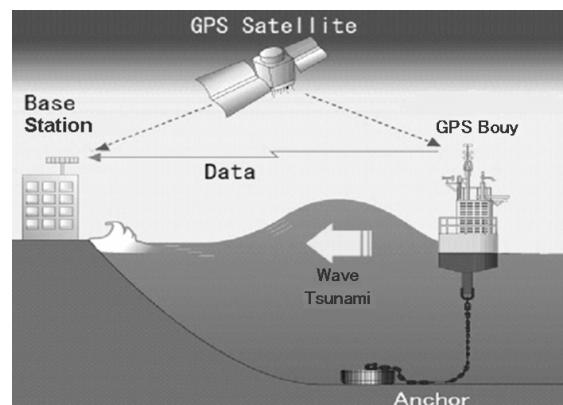


Fig.1 Concept Diagram of the GPS Buoy System