GPS Comprehensive Oceanographic Monitoring System (GCOMS)

Shigeki Okubo, Yasuhiro Matsushita
Maritime Disaster Prevention Systems Division, Hitachi Zosen, Ltd
Osaka, Japan

ABSTRACT

GPS Comprehensive Oceanographic Monitoring System (GCOMS) using buoy platform has been developed since 1997. GCOMS technology has already been applied to the nationwide GPS Wave Gauges to monitor 15 locations around the Japanese coast. On the basis of the GCOMS technology, new types of monitoring methods, Small-sized GPS Buoy for coastal area and PVD (Point precise Variance Detection) Wave Monitoring Unit, have been developed. The Small-sized GPS Buoy is characterized by its cost-efficiency and simplicity. The PVD Wave Monitoring Unit based on PVD method can be attached on floating fish-breeding reefs or floating beacons.

KEY WORDS: GPS; buoy; GPS Wave Gauge; Small-sized GPS Buoy; PVD Wave Monitoring Unit; RTK-GPS; PVD.

INTRODUCTION

Japan, an island nation lying off the east coast of Asia, is surrounded by the sea. Under this geographic feature, the Japanese people have made efforts to take full advantage of ocean resources. On the other hand, due to a number of natural disasters such as tsunami, storm surge, high waves, etc., oceanic observation technology has been studied for many years. In recent years, especially, the demand for monitoring the environment change due to the global warming is growing.

GCOMS combining high-accuracy GPS positioning technique with buoy has already been put to practical use in the oceanographic observation domain. The Japan’s Ports and Harbours Bureau, Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has actually applied GCOMS technology to nationwide GPS Wave Gauges since 2006 and 15 GPS wave gauges have already been installed around the Japanese coast. In addition, new types of GCOMS improved in cost-efficiency, simplicity, usability, etc. have been developed on the social demands.

In this paper, the overview and achievements of the GPS Wave Gauges using GCOMS technology are described. Moreover, the Small-sized GPS Buoy for coastal area, featured by its economical advantages and simplicity, as well as the compact Wave Monitoring Unit based on the PVD method, are also introduced.

OVERVIEW AND ACHIEVEMENT OF GCOMS

Basic principle of GCOMS

As shown in Fig. 1, GCOMS consists of a GPS buoy and a ground base station. The position of the GPS antenna set on the top part of the buoy is measured by GPS positioning method. The wave data are obtained by the vertical motion of the buoy. Also, to detect tide-level variations and tsunamis, band-pass filter technique is applied to GCOMS for eliminating short period waves after finding periodic sea waves.

Real-Time Kinematic GPS (RTK-GPS) method is used as a positioning system for the GPS observation equipment. RTK method requires the ground base station to correct the GPS positioning data and the buoy must be deployed within approximately 20-kilometer from the ground base station in order to sustain centimeter-order positioning accuracy.

The system configuration of GCOMS is shown in Fig. 2. The observed 1Hz phase data at the buoy are transmitted to the ground base station through the radio system. The data transmitted from the buoy are corrected by using RTK-GPS reference information obtained at the base station.

Fig. 1 Concept of GCOMS