ABSTRACT

Gageocho marine observation tower, placed on a fairly steep underwater shoal, was severely damaged by two typhoons, Kompas in 2010 and Muifa in 2011. After the accidents, a study was undertaken with respect to the deck clearance and structural response for breaking wave occurrences at the structural position. First, a wave propagation model based on nonlinear Boussinesq equations was applied to find the shallow water design wave condition and deck clearance. Next, a dynamic structural analysis was done incorporating slamming force impact by violent breaking waves. The structure was redesigned based on the results of the study and was rebuilt at the same place in 2014.

KEY WORDS: Slamming force, breaking waves, deck clearance, jacket structures, dynamic analysis, lumped mass.

INTRODUCTION

Four offshore structures have been constructed in Korean seas; three marine observation towers and one gas production platform (Fig. 1). The marine observation towers act as a sort of integrated research stations acquiring and analyzing various oceanographic and meteorological data around Korean peninsula. Starting from Ieodo station built in 2003 (Shim et al., 2004), Korea Institute of Ocean Science and Technology has installed two more stations, Gageocho station in 2009 and Socheongcho station in 2014.

The marine observation towers were mostly constructed in shallow water zones mainly due to their construction costs. Especially, Gageocho station was placed on a fairly steep underwater shoal which is about 10 m deep and can be reached within 500 m from the ambient 70 m deep flat bottoms (Fig. 2). Hence, incoming waves are easily amplified on the slope and deformed to violent breaking waves. The structure was damaged by two typhoons, Kompas in 2010 and Muifa in 2011 (Fig. 3). The cellar deck and stairways were severely deformed (Fig. 4). Several devices in the main deck including personal computers were also dislocated possibly by some violent oscillations of whole structure due to the strong attacks of high waves.

Fig. 1. Offshore Structures in Korea.

After the accidents, a study was undertaken to investigate the main reasons for the structural damages with respect to two aspects; deck clearance and structural rigidity. In stormy wave conditions, the