A STUDY ON OPTIMAL DEPLOYMENT OF TSUNAMI OBSERVATION INSTRUMENTS IN KOREA

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INTRODUCTION

Tsunamis are one of the most destructive natural phenomena (Pugh and Woodworth, 2014). For past decades, the risk of potential earthquake zones has been issued by Japanese researchers, which could occur tsunami, in Niigata and Tottori area located in the west coast of Japan and the Ryukyu trench located in Okinawa as well (Disaster Prevention Research Institute, Japan). Also, there is a Yamamoto Rise on the East Sea, where it strongly affects tsunami propagation. This topography causes high tsunami energy to concentrate on the east coast of Korea (Cho and Lee, 2013). For example, the 1983 Akita and 1993 Hokkaido earthquake induced-tsunamis, Japan, respectively cause the property and life damages to the certain cities on the east coast of Korea (Figure 1). Therefore, it is important to propose the optimal deployment location of offshore tsunami observation instruments to contribute to the tsunami early warning system by increasing probability of tsunami detection with the minimal number of instruments considering a large number of potential tsunami scenarios. In this study, by considering various factors, the optimal location of instruments is suggested based on the numerical model results of possible tsunami scenarios.

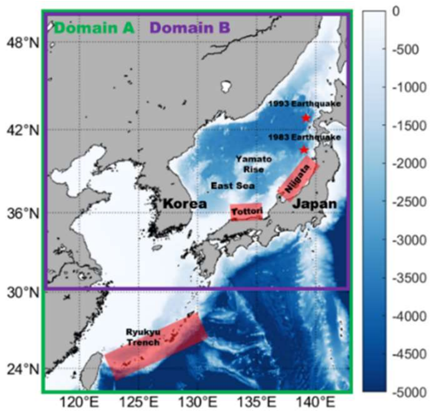

Figure 1 – Study area (green and purple box) and locations of potential earthquake zone(red box), and the epicenters of the 1983 and 1993 earthquakes (red stars).

METHODOLOGY

The present study suggests the optimal position of tsunami detection instruments based on the numerical computation of deep ocean tsunami dynamics and GIS technologies (Omira et al.,2009). This study used COMCOT (Cornell Multi-grid Coupled Tsunami model) for numerical modeling with potential earthquake scenarios. For efficient calculation, the 59 scenarios on the west side of Japan was carried out in domain B, and the 56 scenarios of the Ryukyu Trench was carried out in domain A using real bathymetry data, GEBCO resampled to 30 arc seconds grid size (Figure 1). After superimposing the spatial distribution of tsunami's main energy beam from the model results, the optimal location of the instrument can be found by GIS technologies suggested by Omira et al. (2009). In addition, not only the dynamics of the tsunami but also the efficiency of the early tsunami warning, and Korea's technological, financial, and legal factors were taken into consideration.

Based on the tsunami's main energy beam, we simultaneously considered tsunami travel time, the maximization of evacuation time, delay of transmission and delay of detection with a statistical tool (Mulia et al., 2017, Omira et al., 2009).

DISCUSSION

This study will propose the 2 to 4 observation stations located on the tsunami main energy beam in the East Sea of Korea and the South Sea of Korea, respectively, which is effective for estimating tsunami source suggested by Percival et al. (2011).

In addition, the Korea Meteorological Administration considers Ulleung Island and Dokdo are the best positions for the tsunami early detection and warning system in terms of security and cost-effectiveness. Therefore, we also propose another optimal location of instrument focusing on Ulleung Island and Dokdo to meet the needs of the government agency.

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