ABSTRAK

Pesisir Selatan Pulau Jawa, khususnya wilayah Widarapayung di Kabupaten Cilacap, memiliki tingkat kerentanan tinggi terhadap tsunami akibat aktivitas zona subduksi Lempeng Indo-Australia dan Eurasia. Penelitian ini bertujuan untuk: (1) memvalidasi model tsunami *Cornell Multi-grid Coupled Tsunami Model* (COMCOT) dengan data observasi tsunami Pangandaran 2006, (2) mengkalkulasi hasil simulasi tsunami di Widarapayung, Cilacap berdasarkan skenario terburuk, (3) mengoptimalisasi mitigasi bencana tsunami di Widarapayung, Cilacap berdasarkan hasil pemodelan. Hasil validasi menunjukkan RMSD 1,87 m dan NRMSD 0,29, yang termasuk kategori kesalahan kecil-sedang, menandakan COMCOT mampu merepresentasikan perambatan dan ketinggian tsunami dengan cukup baik. Pada skenario terburuk, gelombang tsunami pertama tiba di garis pantai Widarapayung sekitar 42 menit setelah gempa bumi dengan tinggi maksimum 12,5 m. Integrasi model COMCOT–MATSim menunjukkan bahwa penambahan TES di kawasan permukiman padat meningkatkan keberhasilan evakuasi dari 30% menjadi 43,7%, sekaligus mengurangi kepadatan jalur evakuasi. Hasil penelitian ini memberikan dasar ilmiah bagi perencanaan mitigasi dan peningkatan kesiapsiagaan masyarakat pesisir Cilacap.

Kata kunci: *Pemodelan Tsunami, COMCOT, Mitigasi Tsunami, Agent Based Model, MATSim*

ABSTRACT

The southern coast of Java Island, particularly Widarapayung in Cilacap Regency, is highly vulnerable to tsunamis due to active subduction between the Indo-Australian and Eurasian tectonic plates. The research aims to (1) simulate tsunami propagation using the Cornell Multi-grid Coupled Tsunami Model (COMCOT) and validate the model based on the Pangandaran 2006 tsunami data; (2) calculate the tsunami simulation result of Widarapayung, Cilacap, based on the worst-case tsunami scenario; and (3) optimize tsunami mitigation of Widarapayung, Cilacap, based on the modeling result. The validation results indicate an RMSD of the average of the model-observation-tsunami's high was 1.87 m and an NRMSD of 0.29. That result included a small-to-moderate error level, suggesting that COMCOT adequately represents tsunami propagation and wave height characteristics. The worst-case scenario simulated the first tsunami wave reaching Widarapayung's coastline 42 minutes after the earthquake, with a maximum run-up of 12.5 m. The COMCOT–MATSim integration showed that adding TES in densely populated areas increased evacuation success from 30% to 43.7% and reduced route congestion. These results provide a scientific foundation for tsunami mitigation planning and improving community preparedness along the Cilacap coast.

Keywords: *Tsunami Modeling, COMCOT, Tsunami Mitigation, Agent-Based Model, MATSim*