ABSTRACT

Indonesia is frequently hit by tectonic earthquakes and tsunamis of various scales. The giant tsunami in Aceh at the end of 2004 was one of the largest tsunami in the world that resulted in an estimated loss of U.S. $ 10 billion, equivalent to 100 trillion rupiahs. Such figure may be reduced if buildings have been constructed to withstand tsunami force. The calamity definitely confirmed that understanding of tsunami characteristics is most important to mitigate future tsunami disaster. The main purpose of this research is to test the performance of DualSPHysics in simulating 3D tsunami surge propagating along a focusing valley, including pressure and surge depth fluctuation data.

The numerical modeling was conducted using DualSPHysics code which applied Smoothed Particle Hydrodynamics (SPH) method in calculation as well as other supporting software/application. The case was designed based on physical modeling result of Triatmadja and Aslami (2013) together with additional cases for better validation. The simulation was run using a high specification computer with Graphics Processing Units (GPUs) system and NVidia CUDA-enabled GPU card. In this work, the computer used VGA card NVidia GeForce GTX 780 Ti with processor Intel® Core™ i7-3820 CPU @3.6 GHz and 16 GB memory of RAM. Finally, the numerical simulation result was compared with physical modeling result as well as analytical solution.

The results indicated that DualSPHysics had been able to simulate 3D tsunami surge propagates through V shape channel and had shown a good agreement with both experimental data and analytical solution. Moreover, DualSPHysics has also been able to simulate the real 3D geometry case of Kota Agung, Lampung. The pressure oscillation was happening at the beginning of the hydrostatic case simulation due to the Tait's equation applied in DualSPHysics. The friction factor between fluid and boundary particles in DualSPHysics is not adjustable so that the result of simulation could not perfectly fit with the experimental data. The experimental water depth is slightly higher than the SPH water depth and the SPH pressure is dramatically higher than the experimental pressure especially around the area which has higher particle density. The smaller the particle size used, the more accurate the results will be obtained. However, the lack of computer capability always limits the ability in simulating a large number of particles.

Keyword: Tsunami, numerical model, SPH, DualSPHysics, valley