

Multi scale tsunami simulation from earthquake initiation to tsunami run-up into the coastal area and high performance particle simulator

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Due to future tsunami disaster prevention planning, it is strongly desired a simulation tool that accurately predicts possible damage level for structures and human resources in the inundation area. For the tsunami run-up simulation, we must calculate the crustal deformation as an input of the initiation of tsunami wave around the seismic fault. A stagger elasticity theory, in which homogeneous and spatial infinity is assumed to formulate the theory, is applied in practical and conventional crustal deformation estimation. The elastic theory cannot consider the heterogeneous crustal structure in space and the fracture propagation in time. Therefore, there is no guarantee that the conventional tsunami simulation estimates the largest possible inundation. In this paper, we conducted a series of disasters simulation from earthquake scenario, crustal deformation and tsunami propagation sequentially in order to discuss the necessity of consideration of seismic fault rupture propagation in tsunami simulation.

When modeling the entire city with a high fidelity particle model, one must deal with an enormous number of degrees of freedom, and implementation of highly parallel calculation is indispensable. In this paper, we developed a computational algorithm with high parallelization efficiency for the liquid spreading phenomenon over a flat plane problem, for later apply on tsunami run-up simulation. In particular, we propose an expanding slice grid method with a dynamic load balancer to utilize maximum efficiency on memory utilization and computational speed.

At the end of this paper, high fidelity tsunami run-up simulation in Kochi City by the Expanding slice grid method were conducted, and the utility of the proposed method was discussed.

Keywords: Tsunami, Crustal deformation, Large Scale Computation