Geophysical Research Abstracts,
Vol. 11, EGU2009-14059, 2009
EGU General Assembly 2009

Modern Hardware Architectures for Tsunami Wave Simulation

M. Lavrentiev Jr. (1,2), A. Romanenko (2), V. Titov (3), and A. Vazhenin (4)

(1) Sobolev Institute of Mathematics SB RAS, Novosibirsk, Russia (mmlavr@nsu.ru), (2) Novosibirsk State University, Novosibirsk, Russia, (3) NOAA/Pacific Marine Environmental Laboratory, Seattle, WA, USA, (4) University of Aizu, Aizu-Wakamatsu, Japan

Strongest earthquake of December 26, 2004 generated catastrophic tsunami in Indian Ocean. This shows that, in spite of recent technology progress, population at coastal zone is not protected against tsunami hazard. Here, we address the problem of tsunami risks mitigation. Note that prediction of tsunami wave parameters at certain locations should be made as early as possible to provide enough time for evacuation. Therefore, fast tsunami propagation code that can calculate tsunami evolution from estimated model source becomes critical for timely evacuation decision for many coastal communities in case of a strong tsunami.

Numerical simulation of tsunami wave is very important task for risk evaluation, assessment and mitigation. Here we discuss a part of MOST [1] (Method of Splitting Tsunami) software package, which has been accepted by the USA National Ocean and Atmosphere Administration as the basic tool to calculate tsunami wave propagation and evaluation of inundation parameters. Our main objectives are speed up the sequential program, and adaptation of this program for shared memory systems (OpenMP) and CELL architecture. For caring out this research we use SMP server and a system build on IBM CELL BE CPU.
We perform optimization of the existing parallel and sequential code for the task of tsunami wave propagation modeling as well as an adaptation of this code for systems based on CELL BE processors. We achieve 10 times performance gain for SMP system using OpenMP technology compared to sequential application and about 50 times performance gain for single CELL BE CPU. Thus, we show that significant acceleration for this program is possible. The results also show that non-standard equipment for HPC like Sony PlayStation3 could be used for solving this kind of problems.

1. Chawla, A., J. Borrero and V. Titov, (2008), Evaluating wave propagation and inundation characteristics of the MOST tsunami model over a complex 3D beach, Advances in Coastal and Ocean Engineering, v. 10, 261-267 (in press).