Geophysical Research Abstracts
Vol. 16, EGU2014-3767, 2014
EGU General Assembly 2014

Speeding up tsunami wave propagation modeling

Mikhail Lavrentyev and Alexey Romanenko
Novosibirsk State University, Novosibirsk, Russian Federation (mmlavrentiev@gmail.com)

Trans-oceanic wave propagation is one of the most time/CPU consuming parts of the tsunami modeling process. The so-called Method Of Splitting Tsunami (MOST) software package, developed at PMEL NOAA USA (Pacific Marine Environmental Laboratory of the National Oceanic and Atmospheric Administration, USA), is widely used to evaluate the tsunami parameters. However, it takes time to simulate trans-ocean wave propagation, that is up to 5 hours CPU time to "drive" the wave from Chili (epicenter) to the coast of Japan (even using a rather coarse computational mesh). Accurate wave height prediction requires fine meshes which leads to dramatic increase in time for simulation. Computation time is among the critical parameter as it takes only about 20 minutes for tsunami wave to approach the coast of Japan after earthquake at Japan trench or Sagami trench (as it was after the Great East Japan Earthquake on March 11, 2011).
MOST solves numerically the hyperbolic system for three unknown functions, namely velocity vector and wave height (shallow water approximation). The system could be split into two independent systems by orthogonal directions (splitting method). Each system can be treated independently. This calculation scheme is well suited for SIMD architecture and GPUs as well.
We performed adaptation of MOST package to GPU. Several numerical tests showed 40x performance gain for NVIDIA Tesla C2050 GPU vs. single core of Intel i7 processor. Results of numerical experiments were compared with other available simulation data. Calculation results, obtained at GPU, differ from the reference ones by 10-3 cm of the wave height simulating 24 hours wave propagation. This allows us to speak about possibility to develop real-time system for evaluating tsunami danger.