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Towards near-realtime computation of tsunami inundation as part of the LEXIS project

Natalja Rakowsky[1], Harig Sven[1], Androsov Alexey[1], Goubier Thierry[2], Neuwirth Hannah[3], and Kersten Lucas[4]

[1]Alfred Wegener Institute, Computing Center, Bremerhaven, Germany (natalja.rakowsky@awi.de)
[2]CEA List, Gif sur Yvette Cedex, France
[3]Universität Münster, Münster, Germany
[4]Universität Göttingen, Göttingen, Germany

State of the art tsunami warning systems employ a combined approach of pre-computed scenarios and on the fly tsunami simulation in case of an event. The on the fly simulations are performed on rather coarse meshes (approx. 1km resolution), usually neglect e.g., the non-linear advection in the shallow water equations, and can deliver a reasonable estimate of the wave height at the coast within a few seconds of computation time. As in the early warning situation, the earthquake source is the major unknown, they can improve the hazard assessment compared to pre-computed scenarios based on idealized sources.

On the other hand, it requires a resolution of approximately 10m on land and the non-linear shallow water equations augmented by terms like the bottom roughness to simulate the inundation in the quality needed to derive risk maps for civil protection measures. With the simulation code TsunAWI, which employs an unstructured triangular mesh to seamlessly change the spatial resolution from a few meters in an area of interest to a few kilometers in the deep ocean, such simulations can be performed with a regional focus in less than 20min computation time.

Hence, with a coarsened resolution, a first estimate of the inundation could be provided within a few minutes, improving the near-realtime assessment of the hazard. We investigate which quality of inundation result can be achieved within a limited computation time, regarding computing platforms based on various generations of Intel Xeon from Broadwell to Cascade Lake.

This investigation is part of the EU funded LEXIS project lead by It4Innovations, Ostrava, Czech Republic. The overall aim is to build an advanced engineering platform at the confluence of HPC, Cloud and Big Data. Of particular interest is the development of time constrained workflows over HPC and cloud resources, with a pilot combining tsunami simulations and earthquake damage assessment. Fast tsunami inundation estimates are a key element of that pilot.