

GC11-solidearth-21, updated on 23 May 2024
<https://doi.org/10.5194/egusphere-gc11-solidearth-21>
Galileo Conference: Solid Earth and Geohazards in the Exascale Era
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Towards exascale-prepared codes for tsunami simulation

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The recently finished ChEESE European project aimed at establishing a center of excellence in the domain of solid earth by developing ten flagship European codes prepared for the upcoming exascale supercomputers. The EDANYA group, at the University of Malaga, Spain, has developed two of these flagship codes: Tsunami-HySEA and Landslide-HySEA, for the simulation of tsunamis generated by earthquakes and landslides, respectively. These two codes, although being already implemented for multi-gpu architectures at the beginning of the ChEESE project, underwent substantial changes during the lifetime of the project with the objective of improving several crucial aspects such as their efficiency, scaling or input/output requirements. Specifically, we added features such as an improved load balancing, direct GPU to GPU data transfers or compressed output files, among others. Additionally, we developed a version of Tsunami-HySEA, named Monte-Carlo, particularly suited for areas such as probabilistic tsunami forecast or machine learning, capable of performing multiple simulations in parallel. In this presentation we describe all these developments carried out during the ChEESE project, along with the two audits that the two codes went through, performed by the Performance Optimisation and Productivity Centre of Excellence in HPC (POP CoE). Finally, we show some comparative results using realistic scenarios achieved at the beginning and at the end of the project.