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The GTM global probabilistic tsunami hazard model

Stefano Lorito¹, Fabrizio Romano¹, Manuela Volpe¹, Roberto Tonini¹, Valeria Cascone¹, Finn Løvholt², Steven Gibbons², Sylfest Glimsdal², Carl Harbitz², Micheal Bader³, Alice Agnes Gabriel^{4,5}, Gareth Davies⁶, Jorge Macias⁷, Andrey Babeyko⁸, Jörn Behrens⁹, Kendra Johnson¹⁰, Helen Crowley¹⁰, Marco Pagani¹⁰, and Piero Lanucara¹¹

¹INGV - Istituto Nazionale di Geofisica e Vulcanologia, CAT ONT - Centro Allerta Tsunami, Osservatorio Nazionale Terremoti, Rome, Italy (stefano.lorito@ingv.it)

²NGI - Norwegian Geotechnical Institute (NGI), Oslo, Norway

³TUM - Technical University of Munich, Germany

⁴LMU - Ludwig-Maximilians-Universität, Munich, Germany

⁵UCSD - University of California San Diego, USA

⁶UMA - University of Malaga, Spain

⁷GA - Geoscience Australia, Canberra, Australia

⁸GFZ - GFZ German Research Centre for Geosciences, Potsdam, Germany

⁹UHAM - University of Hamburg, Germany

¹⁰GEM - Global Earthquake Model Foundation, Pavia, Italy

¹¹CINECA - Consorzio Interuniversitario, Rome, Italy

The EU ChEESE-2P project (Centre of Excellence for Exascale in Solid Earth, second Phase, <https://cheese2.eu/>) aims to developing Pilot Demonstrators (PD) in different areas of Solid Earth (SE) addressing 12 SE Exascale Computational Challenges.

One of these is a new Probabilistic Tsunami Hazard Assessment (PTHA) for earthquake-generated tsunamis at the global scale, in the framework of the GTM (Global Tsunami Model) initiative. The GTM PTHA model is meant to be an update of the previous one of its kind (Davies et al., 2018, Geological Society of London). The new model will present enhanced source variability (e.g. stochastic slip) and spatially higher resolution of the calculation points.

“Capacity” simulations will involve on the order of several 100k unit sources, using grids with a 30 arc-sec resolution. The offshore simulations will require on the order of a few million GPU hrs. Inundation simulations for some pilot localities may need up to 5-10 million GPU hrs. They encompass tens of millions of global tsunami scenarios and create high-resolution inundation maps for 10-20 hotspot locations. The global and local models will be distributed through EPOS-TCS Tsunami, showcasing EuroHPC resource utilization for local hazard and risk analysis.

Further than representing a new global reference hazard model, some tools will be provided to allow to:

- Take the global model as an input to perform local PTHA anywhere globally;

- Recalculate the hazard using a custom source treatment, including probability, rates, fault data, and earthquake source models with dynamic and heterogeneous slip, using pre-calculated or on-the-fly HPC-based tsunami modelling with the Tsunami-HySEA GPU code;
- Publish results via the EPOS-TCS Tsunami service delivery framework.

The GTM PTHA model and tools will be interoperable with the other seismic source models and risk calculation tools (e.g. OpenQuake), thus establishing a connection between the Global Tsunami Model (GTM) and Global Earthquake Model (GEM).

We will also seek to establish compatibility and potential coupling with the Digital Twins from different EU projects (DT-GEO, DT-Ocean) towards DestinE.