EGU22-5642
EGU General Assembly 2022

A hybrid ML-physical modelling approach for efficient approximation of tsunami waves at the coast for probabilistic tsunami hazard assessment

Naveen Ragu Ramalingam[1], Kendra Johnson[2], Marco Pagani[2], and Mario Martina[1]
[1]The University School for Advanced Studies - IUSS Pavia, Pavia, Italy (naveen.raguramalingam@iusspavia.it)
[2]Global Earthquake Model Foundation, Pavia, Italy

This work investigates a novel approach combining numerical modelling and machine learning, aimed at developing an efficient procedure that can be used for large scale tsunami hazard and risk studies. Probabilistic tsunami hazard and risk assessment are vital tools to understand the risk of tsunami and mitigate its impact, guiding the risk reduction and transfer activities. Such large-scale probabilistic tsunami hazard and risk assessment require many numerically intensive simulations of the possible tsunami events, involving the tsunami phases of generation, wave propagation and inundation on the coast, which are not always feasible without large computational resources like HPCs. In order to undertake such regional PTHA for a larger proportion of the coast, we need to develop concepts and algorithms for reducing the number of events simulated and more rapidly approximate the simulation results needed. This case study for a coastal region of Japan utilizes a limited number of tsunami simulations from submarine earthquakes along the subduction interface to generate a wave propagation database at different depths, and fits these simulation results to a machine learning model to predict the water depth or velocity of the tsunami wave at the coast. Such a hybrid ML-physical model can be further coupled with an inundation scheme to compute the probabilistic tsunami hazard and risk for the onshore region.