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Deterministic modelling of seismic waves in the Urgent Computing context: progress towards a short-term assessment of seismic hazard

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Seismic wave propagation is currently computationally prohibitive at high frequencies relevant for earthquake engineering or for civil protection purposes (up to 10 Hz). Developments of computational high-performance computing (HPC) infrastructures, however, will render routine executions of high-frequency simulations possible, enabling new approaches to assess seismic hazard - such as Seismic Urgent Computing (UC) in the immediate aftermath of an earthquake. The high spatial resolution of near-real time synthetic wavefields could complement existing live data records where dense seismic networks are present or provide an alternative to live data in regions with low coverage. However, time to solution for local near-field simulations accounting for frequencies above 1 Hz, as well as availability of substantial computational resources pose significant challenges that are incompatible with the requirements of decision makers. Moreover, the simulations require fine tuning of the parameters, as uncertainties in the underlying velocity model and in earthquake source information translate into uncertainties in final results. Estimating such uncertainties on ground motion proxies is non-trivial from a scientific standpoint, especially for the higher frequencies that remain an uncharted territory. In this talk we wish to address some of these key challenges and present our progress in the design and development of a prototype of a Seismic UC service. In the long run, we hope to demonstrate that deterministic modelling of ground motions can indeed in the future contribute to the short-term assessment of seismic hazard.