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Towards the development of a global probabilistic tsunami risk assessment methodology

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The assessment of tsunami risk is on many levels still ambiguous and under discussion. Over the last two decades, various methodologies and models have been developed to quantify tsunami risk, most of the time on a local or regional level, with either deterministic or probabilistic background. Probabilistic modelling has significant difficulties, as the underlying tsunami hazard modelling demands an immense amount of computational time and thus limits the assessment substantially, being often limited to either institutes with supercomputing access or the modellers are forced to reduce modelling resolution either quantitatively or qualitatively. Furthermore, data on the vulnerability of infrastructure and buildings is empirically limited to a few disasters in the recent years. Thus, a reliable quantification of socio-economic vulnerability is still questionable.
Nonetheless, significant improvements have been developed recently on both the methodological site as well as computationally. This study, introduces a methodological framework for a globally uniform probabilistic tsunami risk assessment. Here, the power of recently developed hardware for desktop-based parallel computing plays a crucial role in the calculation of numerical tsunami wave propagation, while large-scale parametric models and paleo-seismological data enhances the return period assessment of tsunami-genic megathrust earthquake events. Adaptation of empirical tsunami vulnerability functions in conjunction with methodologies from flood modelling support a more reliable vulnerability quantification. In addition, methodologies for exposure modelling in coastal areas are introduced focusing on the diversity of coastal exposure landscapes and data availability.
Overall, this study introduces a first overview of how a global tsunami risk modelling framework may be accomplished, while covering methodological, computational and data-driven aspects.