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Joint numerical study of the 2011 Tohoku-Oki tsunami: comparative propagation simulations and high resolution coastal models

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This study is part of the joint actions carried out within TANDEM (Tsunamis in northern AtlaNtic: Definition of Effects by Modeling). This French project, mainly dedicated to the appraisal of coastal effects due to tsunami waves on the French coastlines, was initiated after the catastrophic 2011 Tohoku-Oki tsunami. This event, which tragically struck Japan, drew the attention to the importance of tsunami risk assessment, in particular when nuclear facilities are involved. As a contribution to this challenging task, the TANDEM partners intend to provide guidance for the French Atlantic area based on numerical simulation. One of the identified objectives consists in designing, adapting and validating simulation codes for tsunami hazard assessment. Besides an integral benchmarking workpackage, the outstanding database of the 2011 event offers the TANDEM partners the opportunity to test their numerical tools with a real case.
As a prerequisite, among the numerous published seismic source models arisen from the inversion of the various available records, a couple of coseismic slip distributions have been selected to provide common initial input parameters for the tsunami computations. After possible adaptations or specific developments, the different codes are employed to simulate the Tohoku-Oki tsunami from its source to the northeast Japanese coastline. The results are tested against the numerous tsunami measurements and, when relevant, comparisons of the different codes are carried out. First, the results related to the oceanic propagation phase are compared with the offshore records. Then, the modeled coastal impacts are tested against the onshore data. Flooding at a regional scale is considered, but high resolution simulations are also performed with some of the codes. They allow examining in detail the runup amplitudes and timing, as well as the complexity of the tsunami interaction with the coastal structures.
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