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Constraining the characteristics of tsunami waves from deformable submarine slides

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The last decade has produced unprecedented increase in national and international relevance of coastal cities. Coastal cities are important links in the quickly globalizing economy. As a marine hazard, submarine slope failures have the potential to directly destroy offshore infrastructure, and, if a tsunami in generated, it also endangers the life of those who life and/or work at the coastline. Tsunami generated by earthquakes can be constrained by independent measurements of the parent earthquake by seismographs. Such measurements are impossible in case of landslides. Hence, the use of simulation tools in less effective and reliable due to the introduced unpredictable uncertainty. This uncertainty has to decrease.

To lower the uncertainty, we present a method that determines material parameters for the slide body that result in a more realistic rheological behavior and a constraint of the generated tsunami waves. Our method employs the distribution of landslide run-out masses and their comparison with simulations. If the characteristic of observed run-out masses is reproduced with a certain amount of confidence, then it is assumed that the dynamical behavior of the slide is known, and the tsunami waves are constraint. To demonstrate our method, we make use of Valdes run-out masses off the Chilean coast. Even though our method suffers from the basic assumption that the parameters describing the rheological behavior of the slide do not change during the slide motion, our method represents a first step toward a better and more constraint understanding of risk and hazard from tsunami waves generated by submarine landslides.