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Numerical modeling of submarine landslide-generated tsunamis for Alaska tsunami hazard assessment

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Tsunami waves are a threat for many Alaska coastal locations, and community preparedness plays an important role in saving lives and property. The Geophysical Institute of the University of Alaska Fairbanks participates in the National Tsunami Hazard Mitigation Program by evaluating and mapping potential tsunami inundation of selected coastal communities in Alaska. We develop hypothetical tsunami scenarios based on the parameters of potential underwater earthquakes and landslides for a specified coastal community. The modeling results are delivered to the community for local tsunami hazard planning and construction of evacuation maps.

For the community of Seward, located at the head of Resurrection Bay, tsunami potential from tectonic and submarine landslide sources must be evaluated for comprehensive inundation mapping. The 1964 Good Friday earthquake induced submarine landsliding in deltaic sediments underlying Seward. Numerical modeling of the 1964 underwater slides and tsunamis will help to validate and improve the models.

In order to construct tsunami inundation maps for Seward, we combine two different approaches for estimating tsunami risk. First, we observe inundation and runup due to tsunami waves generated by the 1964 earthquake. Next we model tsunami wave dynamics in Resurrection Bay caused by superposition of the local landslide-generated waves and the major tectonic tsunami. We compare modeled and observed values from 1964 to calibrate the numerical tsunami model. In our second approach, we perform a landslide tsunami hazard assessment using available characteristics of potentially unstable sediment bodies. The approach produces hypothetical underwater slides and resulting tsunami waves. We use a three-dimensional numerical model of an incompressible viscous slide with full interaction between the slide and surface waves to simulate Seward slope failures and associated tsunami waves.