Physical modeling of landslide generated tsunami

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Landslides may pose perceptible tsunami hazards to areas commonly regarded as immune. A large number of historic and prehistoric slope failures have been reported covering a broad range of landslide volumes and resulting tsunamis. Landslide generated tsunamis were investigated in a two-dimensional physical laboratory model based on the generalized Froude similarity. The slide impact characteristics were controlled by means of a novel pneumatic landslide generator. State-of-the-art laser measurement techniques such as digital particle image velocimetry (PIV) were applied to the decisive initial phase. The wave generation was characterized by an extremely unsteady three phase flow. PIV provided instantaneous velocity vector fields in a large area of interest and gave insight into the kinematics of the wave generation process. The main wave characteristics were related to the landslide parameters driving the whole wave generation process. The physical model results were compared to the giant rockslide generated tsunami which struck the shores of the Lituya Bay, Alaska, in 1958. Further the experimental results were used as a benchmark for numerical flow simulations. A full Navier-Stokes Eulerian compressible hydrodynamic (SAGE) has been applied by Dr. Charles Mader (LANL). Future modeling efforts focusing on three dimensional tsunami generation as well as advanced models of the coupling between landslide motion and tsunami generation are proposed. Finally analogies to other tsunamigenic mass flows such as pyroclastic flows and their implications are addressed.