Geophysical Research Abstracts
Vol. 14, EGU2012-11908, 2012
EGU General Assembly 2012

Landslide/reservoir interaction: 3D numerical modelling of the Vajont rockslide and generated water wave

G. Crosta (1), S. Imposimato (2), D. Roddeman (2), and P. Frattini (1)

(1) Università degli Studi di Milano-Bicocca, Dipartimento di Scienze Geologiche e Geotecnologie, Italy (giovannibattista.crosta@unimib.it), (2) FEAT Maaierhof 27 6418 JL Heerlen The Netherlands

Fast moving landslides can be originated along slopes in mountainous terrains with natural and artificial lakes, or fjords at the slope foot. This landslides can reach extremely high speed and the impact with the immobile reservoir water can be influenced by the local topography and the landslide mass profile. The impact can generate large impulse waves and landslide tsunami. Initiation, propagation and runup are the three phases that need to be considered. The landslide evolution and the consequent wave can be controlled by the initial mass position (subaerial, partially or completely submerged), the landslide speed, the type of material, the subaerial and subaqueous slope geometry, the landslide depth and length at the impact, and the water depth. Extreme events have been caused by subaerial landslides: the 1963 Vajont rockslide (Italy), the 1958 Lituya Bay event (Alaska), the Tafjord and the Loen multiple events event (Norway), also from volcanic collapses (Hawaii and Canary islands).
Various researchers completed a systematic experimental work on 2D and 3D wave generation and propagation (Kamphuis and Bowering, 1970; Huber, 1980; Müller, 1995; Huber and Hager, 1997; Fritz, 2002; Zweifel, 2004; Panizzo et al., 2005; Heller, 2007; Heller and Kinnear, 2010; Sælevik et al., 2009), using both rigid blocks and deformable granular" masses. Model data and results have been used to calibrate and validate numerical modelling tools (Harbitz, 1992; Jiang and LeBlond, 1993; Grilli et al., 2002; Grilli and Watts, 2005; Lynett and Liu, 2005; Tinti et al., 2006; Abadie et al., 2010) generally considering simplified rheologies (e.g. viscous rheologies) for subaerial subaqueous spreading.
We use a FEM code (Roddeman, 2011; Crosta et al., 2006, 2009, 2010, 2011) adopting an Eulerian-Lagrangian approach to give accurate results for large deformations. We model both 2D and fully 3D events considering different settings. The material is considered as a fully deformable elasto-plastic continuum and water as nearly incompressible.
In particular we modeled the Vajont rockslide both in 2D and 3D considering the landslide water interaction. More simulations have been performed to validate the model against 2D and 3D tank experiments considering different slope geometries and water depth.