Geophysical Research Abstracts
Vol. 16, EGU2014-6469, 2014
EGU General Assembly 2014

Firewaves: introducing a platform for modelling volcanic tsunamis

Raphaël Paris (1), Martina Ulvrova (1), Karim Kelfoun (1), Thomas Giachetti (2), and Adam Switzer (3)

(1) University Blaise Pascal, CNRS, Magmas & Volcans, France (raparis@univ-bpclermont.fr), (2) Rice University, Houston, USA, (3) Nanyang Technological University, Earth Observatory of Singapore

When embracing all tsunamis generated by eruptive processes, rapid ground deformation and slope instability at volcanoes, "volcanic tsunamis" represent around 5 % of all tsunamis listed for the last four centuries (>130 events since 1600 AD). About 20-25 % of all fatalities directly attributable to volcanoes during the last 250 years have been caused by volcanic tsunamis (e.g. Krakatau 1883, Mayuyama 1792).

Up to eight mechanisms are implied in the generation of volcanic tsunamis: underwater explosions, pyroclastic flows and lahars entering the water, earthquake preceding or during a volcanic eruption, and flank failure, collapse of coastal lava bench, caldera collapse, and shock wave produced by large explosion. It is unlikely that shock waves, lahars and collapses of lava bench can give birth to tsunamis with wave heights of more than 3 m. Pyroclastic flows, flank failures and caldera subsidence are the only source mechanisms likely to imply volumes larger than 1 km^3.

Volcanic tsunamis are characterised by short-period waves and greater dispersion compared to earthquake-generated tsunamis. With the exceptions of the 1888 Ritter Island and 1883 Krakatau tsunamis, 100 % of the victims of volcanic tsunamis in Southeast Asia were less than 20 km from the volcano. Travel time of the waves from the volcano to a distance of 20 km is typically less than 15 minutes (Paris et al. 2014).

In this setting, priority are (1) to improve population's preparedness around highlighted volcanoes, (2) to monitor sea / lake around volcanoes, (3) and to build a database of numerical simulations based on different eruptive scenarios.

The Firewaves platform, hosted at Magmas & Volcans laboratory in Clermont-Ferrand (FRance) is a numerical solution for modelling volcanic tsunamis of different sources. Tsunamis generated by volcanic mass flows (including pyroclastic flows, debris avalanches etc.) are simulated using VolcFlow code (Kelfoun et al. 2010), and underwater explosions and caldera subsidence using COMCOT (Liu et al. 1998). Three kinds of simulations are runned: (1) case-studies for calibrating the simulations (e.g. Stromboli 2002, Karymsky 1996, Mayuyama 1792), (2) comparisons of different scenarios for reconstructing past tsunamis (e.g. Kolumbo 1650), and (3) prospective scenarios from future eruptions at target volcanoes.