Geophysical Research Abstracts
Vol. 18, EGU2016-15570-1, 2016
EGU General Assembly 2016

Flank Collapse Assessment At Kick-'em-Jenny Submarine Volcano (Lesser Antilles): A Combined Approach Using Modelling and Experiments

Frédéric Dondin (1), Michael Heap (2), Richard E.A Robert (1), Jean-Francois M Dorville (3), and Steven Carey (4)

(1) Seismic Research Centre, The University of the West Indies, Trinidad and Tobago, WI., St Augustine, Trinidad And Tobago (fredericdondin@gmail.com), (2) Laboratoire de Déformation des Roches, Équipe de Géophysique Expérimentale, Institut de Physique de Globe de Strasbourg, UMR 7516 CNRS, Université de Strasbourg/EOST, 5 rue René Descartes, 67084 Strasbourg cedex, FRANCE., (3) MF-DIRAG, Météo France Direction Inter-Régional, Antilles-Guyane, BP 645, 97262 Fort-de-France cedex, FWI, (4) The Graduate School of Oceanography, University of Rhode Island, 215 South Ferry Road, Narragansett, RI, United States of America.

Volcanic landslides—the result of volcanic flank failure—are highly hazardous mass movements due to their high mobility, the wide area they can impact, and their potential to generate tsunamis. In the Lesser Antilles at least 53 episodes of flank collapse have been identified, with many of them associated with voluminous (Vdeposit exceeding 1 km3) submarine volcanic landslide deposits. The existence of such voluminous deposits highlights the hazard of potentially devastating tsunami waves to the populated islands of the Lesser Antilles.

To help understand and mitigate such hazards, we applied a relative stability assessment method to the only active submarine volcano of the Lesser Antilles island arc: Kick-'em-Jenny (KeJ). KeJ—located 8 km north of the island of Grenada—is the southernmost edifice in the arc with recognized associated volcanic landslide deposits. From the three identified landslide prehistoric episodes, one is associated with a collapse volume of about 4.4 km3. Numerical simulations considering a single pulse collapse revealed that this episode would have produced a regional tsunami. A volume estimate of the present day edifice is about 1.5 km3.

We aim to quantify potential initial volumes of collapsed material using relative instability analysis (RIA). The RIA evaluates the critical potential failure surface associated with factor of safety (Fs) inferior to 1 and compares them to areas of deficit/surplus of mass/volume obtained from the comparison of an high resolution digital elevation model of the edifice with an ideal 3D surface named Volcanoid. To do so we use freeware programs VolcanoFit 2.0 and SSAP 4.5.

We report, for the first time, results of a Limit Equilibrium Method (Janbu's rigorous method) as a slope stability computation analysis performed using geomechanical parameters retrieved from rock mechanics tests performed on two rock basaltic-andesite rock samples collected from within the crater of the volcano during the 1-18 November 2013 NA039 E/V Nautilus cruise. We performed triaxial and uniaxial deformation tests to obtain values of strength at the top and bottom of the edifice. We further characterised the permeability and P-wave velocity of the samples collected. The chosen internal structure for the model is composed of three bodies: (i) a body composed of basaltic andesite and pyroclastic deposit; (ii) the conduit composed of fresh basaltic andesite rocks; (iii) an hydrothermally altered body surrounding the conduit. Our combined approach hopes to improve previous quantification of initial volumes of potential collapses and therefore refine the tsunami hazards assessment related to flank instabilities at KeJ.