Geophysical Research Abstracts
Vol. 21, EGU2019-18326-1, 2019
EGU General Assembly 2019


# The devastating eruption tsunami of Anak Krakatau - 22nd December 2018

David Tappin (1,2), Stephan Grilli (3), Steven Ward (4), Simon Day (2), Annette Grilli (3), Steve Carey (3), Sebastian Watt (5), Samantha Engwell (6), and Muin Muslim (7)

(1) British Geological Survey, Nottingham, United Kingdom, NG12 5GG (drta@bgs.ac.uk), (2) University College London, Department of Earth Sciences, Gower Street, London, WC1E 6BT, UK (ucfbdta@ucl.ac.uk), (3) University of Rhode Island, Narragansett, RI 02882, United States of America (grilli@uri.edu), (4) University of Santa Cruz, Santa Cruz, California, CA 95064, United States of America (wardsn@ucsc.edu), (5) University of Birmingham, Edgbaston, Birmingham, United Kingdom, B15 2TT (annette_grilli@uri.edu), (6) British Geological Survey, The Lyell Centre, Edinburgh, United Kingdom, EH14 4AP (sameng@bgs.c.uk), (7) Institut Teknologi Bandung, Lebak Siliwangi, Coblong, Lb. Siliwangi, Coblong, Kota Bandung, Jawa Barat 40132, Indonesia (muslimmuin@gmail.com)

On Dec. 22, 2018 a major sector collapse of Anak Krakatau volcano, located in the Sunda Straits of Indonesia, generated a devastating tsunami as volcaniclastic material was discharged into the 250 m deep Krakatau caldera trough on its southwest margin. As it flooded the coasts of west Sumatra and southern Java, the tsunami caused over 437 fatalities, 14,000 people injured, 33,000 displaced and hundreds of buildings destroyed. Surveys on the coast of west Java reveal tsunami elevations of up to 13 m.

Anak Krakatau is a small strato/tuff cone that developed within the caldera of Krakatau following the major explosive eruption in 1883. The resulting tsunami claimed 33,000 lives. Since 1930, when it became subaerially exposed, Anak Krakatau has grown into a subaerial edifice with a pre-collapse height of 327 metres. Radar and visual images from before and just after the December collapse, reveal that approximately two thirds of Anak island has been removed, leaving a much smaller, remnant, edifice about 100 metres high.

The collapse on the 22nd can be attributed to several factors which we identify as predisposing Anak to south-westerly flank failure. First, the volcano is located on the northeast margin of a major bathymetric trough, 220 m deep, created during the final cataclysmic eruption of 1883. The steeper submarine slopes bounding this trough, compared to other adjacent slopes, form a major potential instability in this southwesterly direction. Second, during the evolution of Anak, there has been a continual southwest shift in the vent position towards the steeper submarine slopes of 220 m deep trough. Thirdly, significant lava flow deltas have extended the base of Anak to the southwest, west and northwest. In the southwest these lava flows likely overlie weak, hydrothermally-altered tuffs produced by the Surtseyan activity of the eruption period 1930-1960. Finally, the very rapid growth of the volcano during the last 90 years has built a steep-sided cone, consisting dominantly of unstable volcaniclastic material on top of the earlier Surtseyan deposits.

Here we present the results of tsunami modelling using state-of-the-art landslide tsunami generation and propagation models for the sector collapse event. The landslide collapse volume (between 0.2 and 0.4 km3) and geometry are based on pre-event bathymetry and topography, and pre- and post-event cloud penetrating radar and visual images which are used to initialize slide and hydrodynamic models of tsunami generation and propagation. Results of our initial simulations using the suite of three-dimensional and two-dimensional models agree well with observations of flow depth along the West Java coast, as well as arrival times and/or surface elevation time series measured at 4 tide gauges on both coasts of Sumatra and Java. In particular, as reported by eyewitnesses, simulations predict that multiple large waves of fairly short period impacted the coast, with the second or third wave being the largest.