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Modelling 2018 Anak Krakatoa flank collapse and tsunami – effect of landslide failure mechanism and dynamics on tsunami generation

Thomas Zengaffinen[1,2], Finn Løvholt[1], and Geir Pedersen[2]
[1]Norwegian Geotechnical Institute, Norway (thomas.zengaffinen@ngi.no)
[2]University of Oslo, Norway

The 2018 Anak Krakatoa volcano flank collapse and tsunami caused several hundred fatalities. There was no early warning system in place for the landslide triggered tsunami, and there is a lack in understanding on how the failure mechanism affected landslide dynamics and tsunami generation, which we focus on in this study. While researchers previously have modelled the collapse as an instantaneous release, we here illuminate how different landslide failure scenarios, including a gradually released flank failure, influence the tsunami generation. We simulate the material movement by using a viscoplastic flow model with Herschel-Bulkley rheology and we employ a depth-averaged model to both the landslide and the tsunami propagation. A sensitivity study to the gradual mass release, total release volume, the material yield strength, the remoulding coefficient, and landslide directivity is used to shed light on the tsunami generation. Our analysis indicates that an instantaneous mass release in 125 degree SW direction fits the observed waveforms at coastal gauge stations best. In our simulations, we observe, as many other authors, discrepancies between simulated and observed arrival times and wave periods offshore Sumatra. Hence, we have also investigated sensitivity to the bathymetric depth by varying the water depth in areas near the source. Finally, we simulate the tsunami inundation at two coastal sites in southwestern Java using open-source topographic data. Given the limitations in the topographic data, a reasonably good agreement between the simulations and observations are obtained.