Two-Dimensional Simulations of Explosive Eruptions of Kick-em Jenny and other Submarine Volcanoes

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Kick-em Jenny, in the Eastern Caribbean, is a submerged volcanic cone that has erupted a dozen or more times since its discovery in 1939. The most likely hazard posed by this volcano is to shipping in the immediate vicinity (through volcanic missiles or loss-of-buoyancy), but it is of interest to estimate upper limits on tsunamis that might be produced by a catastrophic explosive eruption. To this end, we have performed two-dimensional simulations of such an event in a geometry resembling that of Kick-em Jenny with our RAGE adaptive mesh Eulerian multifluid compressible hydrocode. We use realistic equations of state for air, water, and basalt, and follow the event from the initial explosive eruption, through the generation of a transient water cavity and the propagation of waves away from the site. We find that even for extremely catastrophic *explosive* eruptions, tsunamis from Kick-em Jenny are unlikely to pose significant danger to nearby islands. For comparison, we have also performed simulations of explosive eruptions at the much larger shield volcano Vailulu'u in the Samoan chain, where the greater energy available can produce a more impressive wave. In general, however, we conclude that explosive eruptions do not couple well to water waves. The waves that are produced from such events are turbulent and highly dissipative, and don't propagate well. This is consistent with what we have found previously in simulations of asteroid-impact generated tsunamis. Non-explosive events, however, such as landslides or gas hydrate releases, do couple well to waves, and our simulations of tsunamis generated by sub-aerial and sub-aqueous landslides demonstrate this.