Effects of vent asymmetry on plume dynamics for explosive eruptions

Shi Sim, Darcy Ogden

Scripps Institution of Oceanography, USA

E-mail: shsim@ucsd.edu

Models of volcanic eruptions are typically based on symmetric vent and conduit geometries. However, in natural settings, these features are rarely perfectly symmetric. For example, the May 18, 1980 eruption of Mount St Helens (MSH) took place through a highly asymmetrical crater due to the preceding landslide and subsequent vent erosion. In supersonic, high pressure eruptions, such as what may have occurred at MSH, vent and crater asymmetry can strongly affect the directionality of the gas-thrust region. These effects on eruption direction have implications for spatial distribution of the initial blast phase, tephra fallout patterns, and plume stability.

Here we explore flow dynamics resulting from supersonic, high pressure eruptions though asymmetric volcanic vents using a combination of numerical and semi-analytic methods. Our time-dependent numerical simulations are performed using CartaBlanca, a Java based simulation tool for non-linear physics from Los Alamos National Laboratory. Preliminary results from these numerical tests suggest that vent asymmetry may have a first-order effect on the dynamics of the initial phases of explosive eruptions. Semi-analytic methods are used to determine the combinations of eruption explosivity (overpressure) and vent asymmetry (shapes) where this effect will be most pronounced.