Department of Mechanical Engineering
William Maxwell Reed Seminar Series

Shock Tube Modeling of Explosive Volcanic Eruptions

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Abstract: Explosive volcanic eruptions—strombolian, vulcanian, or plinian—present a harmful destructive natural force. Aggravating the situation, many urban population centers and air traffic routes are adjacent to explosive volcanoes. To prepare for and mitigate the potential damages inflicted by an eventual eruption, a thorough understanding of the process tacking place during an eruption is needed.

Of particular interest is the study of the onset of the eruption and the conditions acting at the vent during eruptions. The outcomes of these two processes dictate the initial conditions for the buoyant ash plume. The onset of the eruption is characterized, among other signatures, by the formation of a pressure wave. Depending on the amount of energy released by the eruption, that pressure wave can travel faster than the speed of sound. This pressure wave is followed by the release of a jet mixture of gasses and tephra into the atmosphere. This jet mixture can also reach supersonic speeds.

Many aspects of the complex fluid mechanics and thermodynamics occurring at the vent of the volcano are not well understood. To study the dynamics of explosive volcanic eruptions under controlled laboratory conditions, an atmospheric shock tube has been built at Michigan Technological University. Analog modeling at the shock tube have been used to investigate the correlation between the energy released by the eruption and the speed of the leading pressure wave, the potential source of multiple pressure waves observed during an eruption, the effect of particle content in the dynamics of the jet mixture, and the correlation between particle content in the jet mixture and its acoustic emission.

Bio: Dr. Médici is a Research Assistant Professor at the Department of Mechanical Engineering-Engineering Mechanics at Michigan Technological University. Dr. Médici received a PhD in Mechanical Engineering from Michigan Technological University, an MS in Mechanical Engineering from University of Puerto Rico at Mayaguez, and a BA in Mechanical Engineering from the National University of Río Cuarto in Argentina. Dr. Médici has been working over the past ten years on modeling of heat and mass transport for fuel cell applications. He also has extensive experience in numerical and experimental modeling of heat and mass transport for a broad range of interdisciplinary applications. His current projects include: modeling heat and mass transport in thin porous media, modeling explosive volcanic eruption, and modeling phase change in cryogenic fuel propellants.

Date: December 2, 2016
Place: CB 106

Time: 3:00p to 4:00p
Contact: Dr. Alexandre Martin 257-4462

Meet the speaker and have refreshments
Attendance open to all interested persons

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