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On modeling volcanic eruptions with open-ended shock tubes SUSAN W. KIEFFER, ANDREAS HASELBACHER, S. BALACHANDAR, University of Illinois at Urbana-Champaign — The flow from open-ended shock tubes may be viewed as a simple model for vertical Plinian eruptions and lateral eruptions such as the blast at Mount St. Helens, 1980. In such models, the volcanic chamber is represented by the driver section and the atmosphere by the open driven section. Previous models have placed the diaphragm at the exit plane; however, although not much is known about conditions at volcanoes, we do know that this is an oversimplification because craters develop rapidly in response to high stresses. We modeled this by assuming that the diaphragm was not exactly at the exit plane. In examining the effects of pressure ratio and gas properties, we have discovered an effect not previously considered: that in the start-up, unsteady phase of discharge, choked conditions may be approached from either subsonic or supersonic conditions. For a given gas, at high pressure ratios the flow behind the contact discontinuity is supersonic. Consequently, the expansion fan not only propagates into the chamber, but also into the atmosphere, introducing an unsteadiness as the flow adjusts to sonic conditions.

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