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Using infrasound to constrain ash plume height

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Airborne volcanic ash advisories are currently based on analyses of satellite imagery with relatively low temporal resolution, and numerical simulations of atmospheric plume dispersion. These simulations rely on key input parameters such as the maximum height of eruption plumes and the mass eruption rate at the vent, which remain loosely constrained. In this study, we present a proof-of-concept workflow that incorporates the analysis of volcanic infrasound with numerical modelling of volcanic plume rise in a realistic atmosphere. We analyse acoustic infrasound records from two explosions during the 2009 eruption of Mt. Redoubt, USA, that produced plumes reaching heights of 12-14 km. We model the infrasonic radiation at the source under the assumptions of linear acoustic theory and calculate variations in mass ejection velocity at the vent. The estimated eruption velocities serve as the input for numerical models of plume rise. The encouraging results highlight the potential for infrasound measurements to be incorporated into numerical modelling of ash dispersion, and confirm their value for volcano monitoring operations.