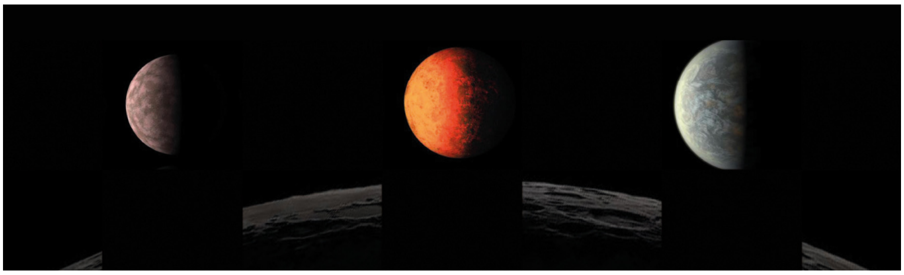

Contribution ID: **6** Type: **Poster**

New ballistic trajectories model for Mars ground-truthed by the discovery of pyroclastic bombs in Ceraunius Fossae, Tharsis

Friday 24 October 2025 18:00 (1 hour)

Numerical modelling is essential in planetary sciences to simulate, explore, and understand the magmatic processes that are otherwise inaccessible for direct study. Models often rely on uncertain parameters, mainly due to remotely sensed observations or assumptions, leading to false confidence or uncertain interpretations. Therefore, real, ground-truthed data gathered from the planetary surface allows scientists to develop conceptual and numerical models of volcanic processes. At present, growing evidence points to explosive eruptions being widespread, albeit of variable magnitude, throughout the Martian geological record. Therefore, to characterize Martian explosive eruptions both qualitatively and quantitatively, we utilized a new ballistic emplacement model, encompassing a variable drag coefficient, to newly documented small-scale, conical-shaped volcanic edifices located at the edge of Ceraunius Fossae in Tharsis. They comprise coarser pyroclastic material such as spatter and show accumulations of volcanic bombs on the cone slopes and bases, observable in the high-resolution images. By integrating the sizes and spatial distribution of the mapped volcanic bombs with the ballistic emplacement model, we calculated their exit velocities (mean value of 72 m s-1) and maximum heights attained during flight for a given bomb density and launch angle. Overall, our model results were able to reproduce the observed bomb range to within ± 1 m difference for the horizontal range, and the resting bomb elevations upon landing to within <4 m for a 37° launch angle, <7 m (for 81.8°) and <17 m (for 89°), across both densities of 1500 and 2700 kg m-3. These findings, based on ground-truthed observations, enhance the accuracy, confidence, and interpretability of numerical models in revealing the evolution of Martian explosive eruptions.
This study was funded by the National Science Centre of Poland (2024/53/B/ST10/00488).

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Session Classification: Poster session