Formation of Tianwen-1 landing crater and mechanical properties of nearby Martian soil

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China's Tianwen-1 successfully landed on Utopia Planitia in 2021, forming the deepest landing crater on Mars. The landing crater and plume-surface interaction can provide valuable insights into the mechanical properties of the nearby Martian soil. We first derived the digital elevation model (DEM) of the landing crater based on the image data from Zhurong's NaTeCams. The depth and diameter were obtained. After that, we established numerical models for the PSI and the crater formation based on Computational Fluid Dynamics (CFD) methods. The increase in cohesion and internal friction angle leads to a decrease in erosion rate and maximum crater depth, with the cohesion having a greater impact. While the influence of the nozzle height is not clear, as it interacts with the position of the Shock Diamond to jointly control the erosion process. We categorized the evolution of landing craters into the dispersive and the concentrated erosion modes based on the morphological characteristics, and estimated the upper limits of internal friction angle and cohesion of the nearby Martian soil via the comparative case studies.