Effects of lunar topography on the near-surface dusty-plasma environment

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Abstract. Due to interactions with the solar wind and solar ultraviolet radiation, the lunar surface develops a complex plasma environment, especially around geological features like craters. Various phenomenon have been observed taking place in this dusty plasma environment including dust levitation and even horizontal dust transport [1,2,3]. The Surveyor 5, 6 and 7 cameras have recorded such phenomena including what has been dubbed 'horizon glow'. This glow has been explained as forward-scattered light off of levitating dust particles. Dust levitation and transport could also result in dust ponding, as has been observed on asteroid 433 Eros [4,5,6]. To understand these phenomena a three-dimensional particle-in-cell (PIC) code was ran using the commercial code, VORPAL©. The plasma environment was modeled above various topographies with changing solar angles to simulate a full days worth of plasma conditions. To model dust dynamics within the near-surface lunar plasma environment, we developed a two dimensional dust tracing code, based on earlier work where individual dust grains are introduced into the PIC-modeled plasma environment [7]. To look for any net dust transport or topographical effects we simulated multiple lunar days of dust dynamics by interpolating between the modeled plasma environments and allowed charged dust to leave the surface and dynamically interact with the plasma environment. [1]

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