Experimental Simulation of Solar Wind Interaction with Magnetic Dipole Fields above Insulating Surfaces

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Abstract. Magnetic anomalies on the surfaces of airless bodies such as the Moon interact with the solar wind, resulting in both magnetic and electrostatic deflection/reflection of the charged particles. Consequently, surface charging in these regions will be modified. Using the Colorado Solar Wind Experiment facility, this interaction is investigated with high-energy flowing plasmas (100-800 eV beam ions) that are incident upon a magnetic dipole (0.13 T) embedded under various insulating surfaces. The dipole moment is perpendicular to the surface. Using an emissive probe, 2D plasma potential profiles are obtained above the surface. In the dipole lobe regions, the surfaces are charged to significantly positive potentials due to the impingement of the unmagnetized ions while the electrons are magnetically shielded. At low ion beam energies, the results agree with the theoretical predictions, i.e., the surface potential follows the energy of the beam ions in eV. However, at high energies, the surface potentials in the electron-shielded regions are significantly lower than the beam energies. A series of investigations have been conducted and indicate that the surface properties (e.g., modified surface conductance, ion induced secondary electrons and electron-neutral collision at the surface) are likely to play a role in determining the surface potential.