Simulating solar energetic electron precipitation and drift at Mars

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Solar disturbances release energetic charged particles that are expected to directly precipitate into the atmospheres of weakly magnetized planets like Mars. However, draped magnetic fields can influence the motion of energetic electrons. Using a test particle model of 1 keV - 100 keV electrons moving in magnetic fields from a multifluid magnetohydrodynamic simulation, we find that energetic electrons with steep pitch angles are affected by gradient drifts over the dayside of Mars. For an interplanetary magnetic field directed in the away sector, electrons will drift southwards, perpendicular to the direction of the draped magnetic field. Gradient drifts at Mars can facilitate increased precipitation by directing electrons towards the magnetized southern hemisphere and into magnetic field cusps. These findings suggest energetic electrons precipitate non-uniformly and are attenuated at low altitudes above the dayside northern hemisphere of Mars.

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