ENERGY INPUT OF SOLAR ENERGETIC PARTICLES AT MARS. R. D. Jolitz, D. A. Brain, C. O. Lee, R. J. Lillis, D. L. Larson, J. S. Halekas, and B. M. Jakosky, Laboratory for Atmospheric and Space Physics, University of Colorado (rebecca.jolitz@lasp.colorado.edu), Space Sciences Laboratory, University of California Berkeley, Department of Physics and Astronomy, University of Iowa.

Introduction: Solar energetic particles (SEPs) represent an important but episodic energy source for the Martian atmosphere. Released during periods of intense solar activity, SEPs can “precipitate” into planetary atmospheres and cause increased heating and ionization. While Earth has an intrinsic magnetic field that confines SEP precipitation to the poles [1], SEPs at Mars are influenced by draped magnetic fields from the global induced magnetosphere and intensely magnetized crustal anomalies localized in the Southern hemisphere. Particularly energetic SEPs can cross these barriers unhindered and globally precipitate [2, 3, 4, 5]. SEP precipitation at Mars has been suggested to have facilitated increased atmospheric escape, particularly in the early solar system when SEP-producing events were likely stronger and more frequent.

However, the energy imparted by SEPs compared to other energy inputs such as solar wind and EUV has not been quantified.

Approach: The Mars Atmosphere Volatile Evolution (MAVEN) spacecraft has monitored the energetic particle environment at Mars since 16 November 2014. Due to the spacecraft’s elliptical orbit, MAVEN has occasional access to the pristine solar wind. On these passes, the Solar Wind Ion Analyzer (SWIA) measures the energy fluxes of the impinging solar wind, while the Solar Energetic Particle (SEP) instrument measured fluxes of ions of energies 20 keV to 5 MeV and electrons of energies 10 keV to 100 keV. Using these measurements, we can compute the total energy flux from SEPs and the solar wind.

Results: We compare the energy input from SEPs to the solar wind between 2014 December 1 and 2015 March 15 (Figure 1). We observe that there are the times of apparent elevated SEP fluxes such as the four day period between March 3 and March 8. These are likely caused by extremely energetic particles (∼GeV) depositing energy in the SEP detector stack, which can appear as excessive fluxes of lower energy SEPs. Neglecting observations from these times, we find that the energy input of SEP ions and electrons imparted between 0.01% and 10% of the energy from the solar wind. However, it should be noted that the solar wind was relatively disturbed during this time period. We can compare these results to other times in the mission when the solar wind isn’t disturbed. We can also expand the study to use proxy measurements of solar wind velocity and density to estimate solar wind fluxes when MAVEN does not have access to the solar wind.

References: