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Channels of solar wind induced escape on Mars and their variability

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Abstract

Variability in solar wind due to the presence of high and low-speed streams, corotating interaction regions (CIRs), interplanetary coronal mass ejections (ICMEs) produce a large variability in escape of volatiles on Mars. There are several important channels through which planetary ions are lost to space - a fountain of pick-up ions, the plasma sheet, the boundary layer/mantle, a direct scavenging of the ionospheric plasma, 'polar' wind, localized auroral flux tubes in regions of strong crustal magnetization. Mechanisms of ion energization and escape in these channels are very different. We present the ASPERA-3 observations demonstrating such a variety of loss channels, physical processes therein and variations due to solar wind enhancements [1-4].

References

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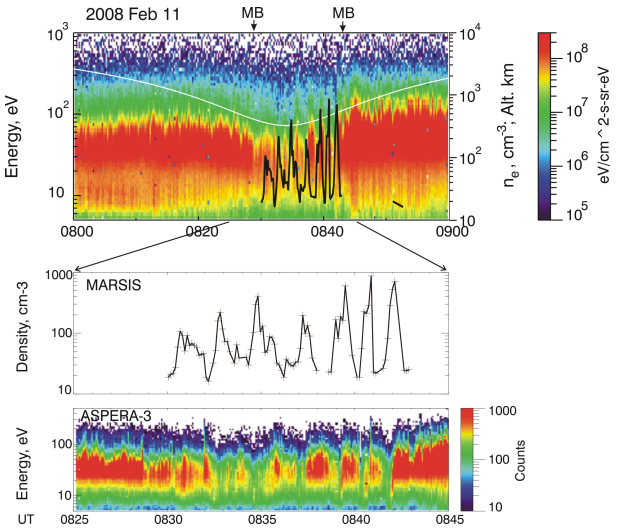

Figure 1: Energy-time spectrogram of electron fluxes measured by ASPERA-3 during the CIR impact on Mars. The black curve shows the filamentary structure of the electron number density in the upper ionosphere inferred from the measurements by the sounding experiment MARSIS. The white curve depicts the altitude of the MEX spacecraft above the martian surface. The bottom panels show the ionospheric structure in more detail. Dips in the ionospheric density are measured at the times (or locations) when (or where) the intruded clouds of solar wind plasma are observed. The scavenging effect caused by the intrusions of solar wind plasma clouds enhances significantly the losses of volatile material from Mars.