Geophysical Research Abstracts
Vol. 12, EGU2010-13368, 2010
EGU General Assembly 2010

Heavy Ion Loss from Mars: Effects of Corotating Interaction Regions

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The induced magnetosphere at Mars is highly variable due to the variable solar wind conditions as well as structured due to the spatial variability of the crustal magnetic fields. A potential consequence of this time and spatial variation is the potential loss of ions from the Martian plasma environment. We study atmospheric escape from Mars during solar wind pressure pulses. During the solar minimum of 2007-08, and during favourable conjunctions between Mars and Earth, we have observed 41 high pressure events, which are predominantly identified as corotating interaction regions (CIR) while a few are coronal mass ejections (CME), in data from the Advanced Composition Explorer (ACE) upstream of the Earth. Of these 41 events, 36 are also identified using Mars Express (MEX) data at Mars. We use MEX measurements at Mars to compare the antisunward fluxes of heavy planetary ions during the passage of these pulses to the fluxes during quiet solar wind conditions. The ion fluxes are observed to increase by a factor of $\sim$2.5, on average. Hence, a third of the total outflow from Mars takes place $\sim$15% of the time, when a solar wind pressure pulse impacts on the planet. This can have important consequences for the total time-integrated outflow of plasma from Mars.