A Statistical Analysis of Radar Blackout Events at Mars

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The loss of signal detection by the sub surface radars currently operational on Mars Express and Mars Reconnaissance Orbiter can be evidence of enhanced ionisation at lower altitudes in the Martian atmosphere as a result of solar energetic particles penetrating to these altitudes. The MARSIS instrument on Mars Express and SHARAD on MRO operate at different frequencies, with MARSIS up to 5 MHz and SHARAD between 10 and 20 MHz. In addition MARSIS can operate in an additional mode as an Active Ionospheric Sounder, although here we focus only on the sub surface mode. We present an analysis of the data during the lifetimes of both instruments, extending from 2005 to 2018. Here we identify the radar blackouts as either total or partial and investigate their occurrence as a function of solar cycle. We find a clear solar cycle dependence with more events occurring during the solar maximum years, as expected. However, we also note the duration of events is often much longer than expected, in excess of several days, sometimes reaching 10 – 14 days. Investigation of other data sets, notably from the MAVEN SEP instrument complements the analysis. We finally compare our observations at Mars with similar observations at Earth.
