Temporal Perturbations in Mars' upper atmosphere due to a strong solar flare event of September, 2017

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It is well-established that the solar radiation is responsible for various photochemical processes in the upper atmosphere of Mars, such as photodissociation and/or photoionization, that triggers the entire ion chemistry thus determining the structure and composition of its various regions. Solar flare ionizes and heats the upper atmosphere of Mars. Similar to all other planetary atmospheres, Mars also responds to the enhanced x-ray and UV fluxes produced during flares that significantly enhance the plasma number densities thereby resulting in a substantial change in the structure and composition of its topside ionosphere. Significant enhancements of the orders of 200% or more in the number densities during flares have been reported from earlier observations.

In Sept. 2017, a strong solar flare of magnitude X8.2 erupted from the Sun which impacted Mars on 10 Sept. 2017. NASA's MAVEN spacecraft provided a unique opportunity to observe the response of Mars' upper atmosphere to this flare event. In the present work, we have made an attempt to study the temporal variation in the structure of Martian upper atmosphere caused due to this solar flare using Langmuir Probe and Waves (LPW) data. The electron density and electron temperature data obtained from LPW have been analysed for both pre-flare and post-flare periods. Preliminary analysis shows a significant enhancement of electron density at all altitudes indicating a clear flare induced effect on the upper atmosphere of Mars. The variation in the electron density over a period of time before and after the flare have been systematically studied to decipher the temporal variation in the upper atmospheric structure of Mars caused due to this event. Details of these analysis and results will be discussed.