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CO_2^+ ion escape from Mars

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Abstract

CO_2 is the main constituent of the Martian atmosphere, and CO_2^+ is thus also an important part of the ionosphere. Therefore it is important we can reliably measure the escaping CO_2^+, as it is an important part of the mass loss from the Martian atmosphere. To this end we use data from the SupraThermal And Thermal Ion Composition instrument (STATIC) on board MAVEN, which can separate ion species by deploying a time-of-flight method. CO_2^+ ions are difficult to measure, however, because in the time-of-flight spectrum, the O_2^+ and CO_2^+ peaks are wide enough to overlap. This causes the O_2^+, which usually dominates over $CO2^+$, to obscure the CO_2^+ peak. We therefore use a peak fitting method to separate the O_2^+ and CO_2^+ (and other ions).
In this statistical study we use data from the end of 2015 until the end of 2018 to examine the density of low energy (<100 eV) CO_2^+ ions throughout the Martian magnetosphere and its surrounding. We estimate the outflowing fluxes and analyze their escape channels. These low energy CO_2^+ ions are observed, sporadically but significantly, up to the highest altitudes of MAVEN's orbit (~6000 km).