Mars' Atmospheric Escape: Exobase Altitude Variation

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The Martian atmosphere has been a subject of extensive research for the past several decades, mainly to study the possibilities of life having existed on the red planet. Evidence of past liquid water suggests that Mars' atmosphere must have been thicker. The thin atmosphere we see today is thus thought to be a result of atmospheric escape to space. Our research hopes to add to the picture by studying the outer edges of the current Martian atmosphere and how it varies with time. Specifically, we look at the exobase: the boundary above which molecules are free to escape to space if given enough energy. The data we are working with comes from the Neutral Gas and Ion Mass Spectrometer (NGIMS) on the Mars orbiter MAVEN. Using the inbound CO_2 number densities, we create an exponential fit and extract a CO_2 scale height unique to each orbit. We then use this scale height to find the number density at the exobase and calculate an exobase altitude. We also extract the corresponding spacecraft location parameters such as latitude, local time and solar zenith angle to investigate variations in the altitude. We repeat the process for all orbits with data in the months of October, November, and February to June. Finally, we look for correlations of the calculated altitudes with time and location to see what factors affect the variability of the exobase. It is still too early to make conclusions about what drives the change, but we can definitely see it. The next step of this project would be to use these exobase altitudes as an input into a model to estimate an escape rate for the molecules in the upper atmosphere.