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SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 3 (3C)

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ASTRONOMICAL ASPECTS OF ENTRY, DESCENT AND LANDING SEQUENCE ON MARS

Abstract

Due to the high eccentricity of Mars orbit, which is almost six times larger than the Earth's, there are large differences in energy received from the Sun throughout a Martian year. This difference between the perihelion and aphelion of Mars orbit is more than 45%, comparing to less than 7% for the Earth. This large difference and near coincidence of southern summer solstice with the orbital perihelion are the most important causes of very dynamic behavior of the atmosphere of Mars. Beside this, the solar activity and the amount and distribution of suspended dust also have significant influence on the variability of the Martian atmosphere. These astronomical phenomena, separately or together, can significantly alter not only the level of some atmospheric parameter but also the characteristics of its diurnal and seasonal cycle. Considering that entry, descent and landing (EDL) sequence is mainly driven by the density profile of the atmosphere and aerodynamic characteristic of an entry vehicle, it is very important to analyze EDL scenarios under different atmospheric conditions. We performed the analysis of the influence of the mentioned phenomena on the EDL profiles by using Mars Global Reference Atmospheric Model (Mars-GRAM) and European Mars Climate Database (EMCD). The obtained results show that the influence of these phenomena can be significant enough to alter the possible landing site elevation for several kilometers. This fact could be taken into account in planning of landings on the higher elevations on Mars, mainly in the southern hemisphere.