Paper ID: 87112
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IAF SPACE EXPLORATION SYMPOSIUM (A3)
Interactive Presentations - IAF SPACE EXPLORATION SYMPOSIUM (IP)

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CORRELATION OF OCCURRENCE OF DUST DEVILS WITH MARTIAN DICHOTOMY AND THEIR VARYING NATURE WITH MARS'S CRUSTAL MAGNETIC FIELD & APPLICABILITY IN FUTURE MARS MISSIONS

Abstract

The dichotomy is referred to as a partition of a whole thing into two parts different from each-other. This division creates a stark contrast between the heavily-cratered terrain of the Southern Hemisphere and relatively smoother plains of the Northern Hemisphere, a phenomenon known as North-South Asymmetry and Dust Devils referred as DDs are very common on Earth and Mars as well. These atmospheric convective vortices, induced by daytime surface heating and planetary boundary layer turbulence, and able to uplift surface dust particles. As we know Mars presently lacks global magnetic field of internal origin but must have had one in the past, MGS (Mars Global Surveyor) unveiled the Crustal Magnetic Fields (CMF).

We have presented a comprehensive examination of these three pivotal facets of Mars: DDs, Martian Dichotomy, and CMF. Our findings unveiled a compelling association between these elements. Notably, a majority of DDs occurrences are concentrated along the Martian dichotomy and its proximate regions. These locations harmoniously align with the serpentine-like boundary of the dichotomy and the distinctive pattern of CMF.

Our results showed that there are 76.25% of DDs (Proxy Active) and about 75.00% of Active DDs are found in the Southern part of Mars. Which shows the seasonal variation in the occurrence of DDs dominantly in the southern part of Mars. Secondly DDs predominantly occur in the -4to+4-kilometer range of relative elevation and depth zones, with a significant concentration around the 0-kilometer range along with the Dichotomy regions which shows the elevational preferences of DDs and importantly the DD's occurrence is $>85\pm2\%$ in the CMF regions. The radial field(Br) component of the magnetic field, whereas the median value of this quantity (ΔBr) is an estimate of the change in the radial magnetic field along the track of the observation by MGS, where Br falls below a threshold value, which is 0.3nT per degree of latitude (5x10-3 nT/km) which traversed by MGS. So, the DDs occurrence shows the high variability and occurrence on those locations where the values Magnetic fields ranges from +0.3to-10 ΔBr/ΔLat(nT/deg).

This synergy between DDs, Dichotomy, and CMF offers fresh insights into the genesis and distribution of DDs across the Martian landscape, marking a significant contribution to our understanding of the Red Planet which is going to be useful for future missions in terms of study of DDs, finding the appropriate locations to prevent the mission's instrument from damage due DDs activity etc.