Comprehensive analysis of EMM-EXI dust storm database and data coverage from Martian year 36 to 37.

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Abstract: The Emirates Mars Mission (EMM) utilizes the Emirates eXploration Imager (EXI), a multi-wavelength dual-lens camera system, to observe Mars' atmosphere and surface [1, 2]. EXI's operation in visible and UV light wavelengths is coupled with the spacecraft's unique orbit. EXI enables the observation of Martian dust storms at a sub-hourly time scale, achieving an image resolution of approximately 2–4 km per pixel in the nadir-looking direction [4, 5, 6]. Recent EXI observations facilitated the creation of a dust storm database for Martian Year (MY) 36 [6]. This study extends the dust storm database development by tracking dust storms throughout MY 37, using EMM-EXI images. The database encompasses dust storm information such as their commencement and cessation times, spatial extent, and geographical coordinates, with special attention given to characterizing sub-diurnal variability which has not been well-explored before. A comprehensive catalog comprising 153 dust storms until around solar longitude 180° of MY 37 (excluding polar cap edge dust storms) has been compiled since the initiation of the EMM science phase. The spatiotemporal variability of these dust storms has been examined in conjunction with surface wind stress derived from EMM-EMIRS (Emirates Mars Infrared Spectrometer) data assimilation into numerical models [8]. Furthermore, this study investigates the variability in EMM's data coverage over two Martian years to evaluate its influence on the observed distribution of dust storms. To contextualize this impact, we compare our dust storm database with the distribution of dust storms obtained from the Mars Dust Activity Database and from the Column Dust Optical Depth daily maps [3, 7]. This comprehensive analysis sheds light on the dynamics of dust storms and the significance of EMM's observational capabilities in advancing the understanding of these phenomena.

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