A dust storm database from the early high-dust-loading season to the beginning of the solsticial pause based on EMM/EXI images

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Abstract:

Emirates eXploration Imager (EXI) onboard Emirates Mars Mission (EMM) is a multi-wavelength double lens camera suitable for observing the Martian lower atmospheric phenomena such as dust storms. The visible channel is capable of producing full Martian disk (~2-5 km per pixel resolution) images, which we have used in this work to characterize the dust storms of the current season. Notably, the dust storm research is directly aligned with the EMM science objective on the lower atmosphere and also to the objective of correlating the lower and upper atmosphere [2]. It is worth mentioning EMM orbit with an inclination of 25° enables EXI to get a local time coverage throughout the longitude range every 9-10 days [1, 4]. This unprecedented observation allows analyzing the dust storm characteristics with a sub-diurnal time scale, which has not been well explored. One of such high temporal resolution observations from EXI is given here as an example (Figure 1).

The high-dust-loading season typically starts near solar longitude (L_S) 180°, which can be marked from significantly high background opacity [3]. However, EXI reported the first regional dust event of MY 36 at L_S ~152° around the Syrtis Major region. Furthermore, the climatological record of dust storms has a so-called 'solsticial pause' in the local-regional dust storm occurrence during L_S ~230 – 300° [5]. Therefore, we chose the study period from the beginning of the EMM science phase until L_S ~230° of MY 36, which includes a significant part of the high-dust-loading season. In this study, we present a dust storm database, derived from camera images by the EMM instrument EXI. This will include the start and end time of dust storms, their latitude, longitude, and area. Also, the origination region, pathway, and morphological characteristics of dust storms are relevant.

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Figures:

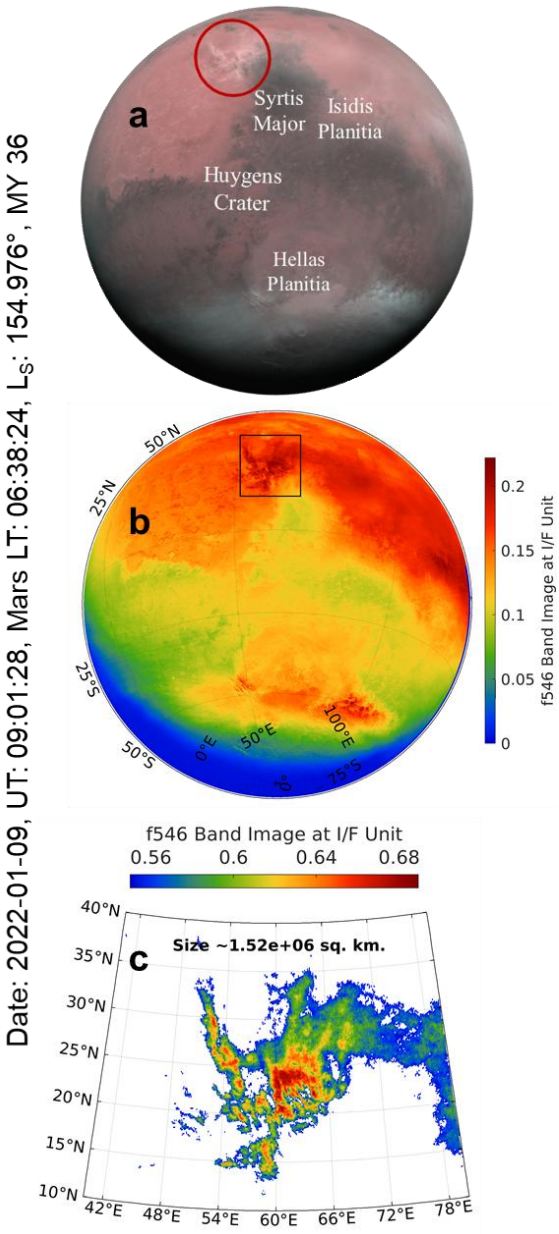

Figure 1. (a) RGB image (the red circle highlights a dust storm), (b) f546 band image at I/F unit, (c) I/F (magnitudes are mulitiplied by a factor of 10) showing the area of the dust storm (using a threshold I/F>0.55).

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