Characterizing thermodynamics of small-scale dust storms from varying resolution simulations of the MarsPCM model and EMM-EXI observation. Sara Jamal AlKaabi[1,2], Bijay Kumar Guha[1], Shaikha Mohammed Aldhaheri[1,2], Claus Gebhardt[1,2], Roland Young[1,2,3], Ehouarn Millour[4], Michael J. Wolff[4,6], and Luca Montabone[4,5,6]. [1]National Space Science & Technology Center, UAE University, Al Ain, UAE. [2]Department of Physics, College of Science, UAE University, Al Ain, UAE. [3]Department of Physics, SUPA, University of Aberdeen, King's College, Aberdeen, UK. [4]Laboratoire de Météorologie Dynamique, IPSL/CNRS/Sorbonne Université, Paris, France. [5]Centre for Mars Meteorology Monitoring, Paneureka, Le Bourget-du-Lac, France. [6]Space Science Institute, Boulder, CO, USA.

Abstract: This study investigates the influence of dust storms on Mars' climate and weather patterns. The dust storms can significantly alter atmospheric dynamics and redistribute surface dust, making them an interesting event for Martian weather research [4, 5]. Our objectives include comprehending the physics and dynamics of local dust storms by comparing their occurrences in the Northern and Southern Hemispheres, as observed by the Emirates Mars Mission's (EMM) Emirates eXploration Imager (EXI) during Martian Year 36 [1, 2, 3, 6]. Additionally, we seek to evaluate the Mars Planetary Climate Model (PCM) [7] in representing daily weather changes through simulations at varying resolutions. We have checked the feasibility of using the model simulation by comparing the input column dust optical depth map with the EMM-EXI images. The findings from observations and MarsPCM simulations reveal distinct characteristics of the studied dust storms. We find that the diurnal thermal structure is influenced by the dust's altitudinal distribution, density, and its interaction with solar radiation, factors well-replicated in the simulations. Additionally, the model simulations demonstrate the impact of surface wind stress and circulation patterns on the evolution and growth of dust storms, indicating the potential of high-resolution PCM simulations in capturing daily weather changes. Furthermore, we present a comparison between low and high-resolution simulation to evaluate the model's performance under varying grid setups.

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