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**Master Thesis Defense**

Entitled

*THE THREE-DIMENSIONAL VISUALIZATION OF MARS DUST STORMS BASED ON DERIVING  
DIGITAL ELEVATION MAPS FROM SATELLITE IMAGERY*

By

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Abstract

This work focuses on generating a Three-Dimensional Visualization of Mars's local dust storms utilizing satellite images from publicly available archives. The work aimed to create a Three-Dimensional Visualization of two Local Dust storms, the first local dust storm occurred on May 20, 2020, in the Chryse Planitia Region of Mars, while the second one occurred on 8 June 2021, on the northern side of the Utopia Planitia Region of Mars. The visualization will assist to provide a better understanding of the dynamics of Dust Storms on Mars by indicating and analyzing the main features of dust storms on Mars. Also, describe the steps required to create a Three-Dimensional Visualization using several missions, tools, and software. The workflow began with the MeteoMARS tool identifying the Local Dust Storm by viewing global maps of Mars from the Mars Color Imager\ Mars Reconnaissance Orbiter Mission. Following that, observation of Local Dust Storms. Then, using The Cartography and Imaging Sciences Discipline Node of the Planetary Data System to download the images and The Integrated Software for Imagers and Spectrometers processes the images and generates the files required for calculating the main features of a Mars dust storms such as the Sun azimuth angle and the Sun incidence angle of the dust storm. Then, the calculations of the dust height from the dust storm's shadow began. Furthermore, for the visualization, a generation of two tables listing the Dust Storm Heights associated with each longitude and latitude. The visualization was then created using PYTHON and QGIS software. According to the findings, the first dust storm (20 May 2020) had a maximum height of 43.02 km at -28.8534 longitude and 24.6740 latitudes, while the second dust storm (8 June 2021) obtained a maximum vertical height of 47 km at 117.401 longitude and 54.892 latitudes. Moreover, the horizontal expansion for both was less than 2000 km; the first dust storm obtained around 1200 km horizontally, while the second dust storm reached around 1700 km, indicating local dust storm characteristics (local dust storms have an area of less than 1.6 million square km and under 2000 km horizontal expand).

**Keywords:** Three-Dimensional Visualization, Mars, Local Dust Storms, Dust, Satellite Images, Dust Storm Height.