ATMOSPHERIC AND TOPOGRAPHIC ANALYSIS OF MARS. Fares M. Howari*[1], Manish Sharma[1], Yousef Nazzal[1], Fatima AlAydaroos[2], and Cijo M Xavier[1], [1]College of Natural and Health Sciences, Zayed University, P.O. Box 144534, Abu Dhabi, UAE (*Fares.howari@zu.ac.ae),[2] UAE Space Agency, P.O. Box 7133, Abu Dhabi, UAE.

Introduction: Mars also known as the Red Planet is the second smallest planet in the solar system, has many hidden valuable sources for exploration. Mars has more similarity with earth, with respect to rotation, paleo tectonics, icecaps at both the poles, largely transparent atmosphere, and yearly cycle of seasons. Humans are most interested in the lowest few meters of the Martian atmosphere, as this is the portion of our own atmosphere with which we have the most contact. Scientists are exploring Mars to find the sources of water and oxygen, its geological properties, climatic conditions so that mars can be made as a next earth to live in. On the other hand, the Martian atmosphere differs from ours in its low pressure and temperature, in its atmospheric composition (mainly CO_2 with only minute concentrations of atmospheric water), and in the crucial role played by atmospheric dust [1].

The study area (Latitude 0°N-45°N, Longitude 60°E-120°E), having a total area of 9,080,730 square kilometers (5642505 square Miles) is shown in Fig.1. The study area lies near to the landing site of Viking 2 and MSL (Mars Science Laboratory) as can be shown in fig 1. The Viking 2 mission was part of the American Viking program to Mars and consisted of an orbiter and a lander, which landed in Utopia Planitia [2]. whereas, Mars Science Laboratory (MSL) was a robotic space probe mission to mars launched by NASA on November 26, 2011, with objectives of investigating Mars habitability of past and present environments within Gale crater, studying its climate and geology, and collecting data for a human mission to Mars [3].

Data obtained from the Mars Orbiter Laster Altimeter (MOLA) was used to study the statistical properties of topography on Mars using the digital elevation model (DEM) data [4], an instrument on NASA's Global Surveyor (MGS) Spacecraft [5], downloaded from the USGS. As shown in Figure 2 (a), the elevation difference in study area is 10.754 Km. The cross-section profile of the study area can be seen in figure 2 (b), Whereas detailed 3D visualization of the area in 2D can be seen in figure 2 (c) with respect to their sight view, for detailed topographic analysis.

The atmosphere of Mars is similar to Earth's; it is thin and relatively transparent to sunlight. Mars spin rate and axial tilt are also Earthlike. Thus, the Martian atmosphere falls into the category of a rapidly rotating, differentially heated atmosphere with a solid lower boundary. However, the Martian atmosphere is primarily carbon dioxide with a much lower surface pressure than Earth's; and Mars does not have an Earthlike hydrological cycle, so latent heat release is not as important as it is for Earth. The characterization of Martian surface wind speed as a function of time, of day, and season at one location can increase our knowledge of Mars surface conditions and assist in planning for future unmanned and manned missions, since the probability of the wind speed exceeding a given value is often required for both engineering and geophysical applications. Wind is currently the dominant geological agent acting on Mars. To Characterize the wind speed according to their components, the data is downloaded from Mars Climate Database (MCD). MCD is a database of meteorological fields derived from General Circulation Model (GCM) numerical simulations of the Martian atmosphere and validated using available observational data [6]. Figure 3 shows the surface wind speed maps of the study area and daily wind speed rate along with the direction.

Surface temperature and pressure measurements help to achieve a better understanding of the main dynamical phenomena occurring in the atmosphere of a planet. Surface pressure variations depend on many processes. On seasonal time-scales, variations in the bulk atmospheric mass due to the condensation and sublimation of the seasonal polar caps cause large pressure variations across the planet [7] [8]. Whereas, the values and variability of surface temperature are mainly governed by the surface radiation budget, which depends on the time of year, location, atmospheric opacity, and the thermal and physical properties of the terrain. Figure 4 shows the surface temperature and pressure of the study area and daily cycle of temperature and pressure.

Summary: Understanding the climate of Mars is important to facilitate human exploration and to determine if Mars could have the conditions to support life. Elevation differences on Mars are large and, consequently, there are large variations in the surface pressure around the planet. Because of thinness of the atmosphere, the temperature varies greatly from day to night. Dust in the atmosphere absorbs heat and changes the temperature structure of the atmosphere, even when present in small amounts. This paper is brought out with the aim to bring out the results from topographic and atmospheric point of view from Martian satellite datasets which would help in providing new opportunities for future explorations.

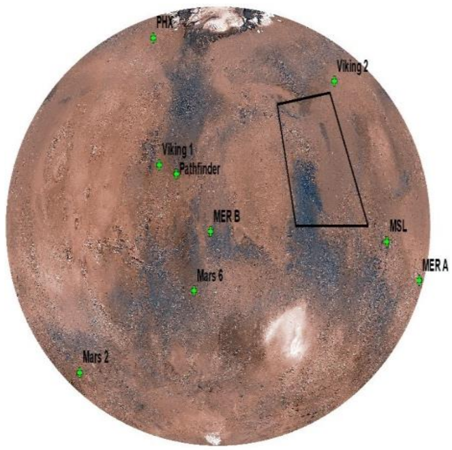
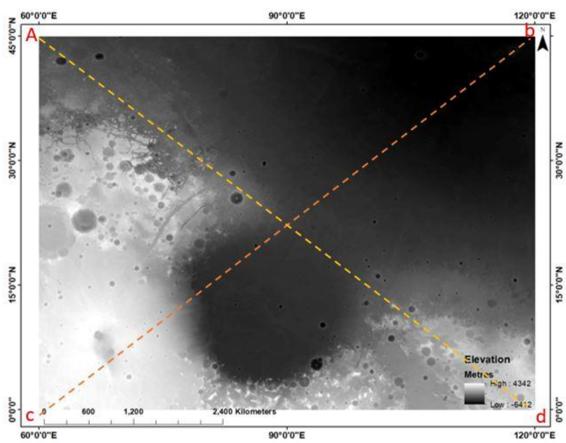
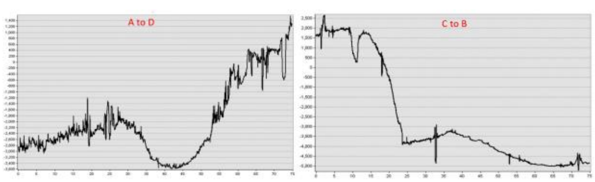


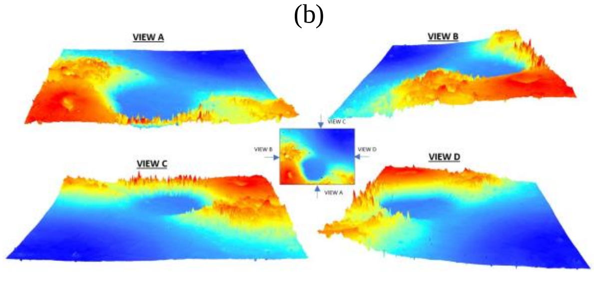
Figure 1- Study area marked in black polygon near Viking 2 and MSL Landing sites.



(a)



(b)



(c)

Figure 2- (a) MOLA- DEM Map of study area. (b) Cross section Profiles from A to D and C to B. (c) 3D Visualization of study area in 2D with respect to their view.

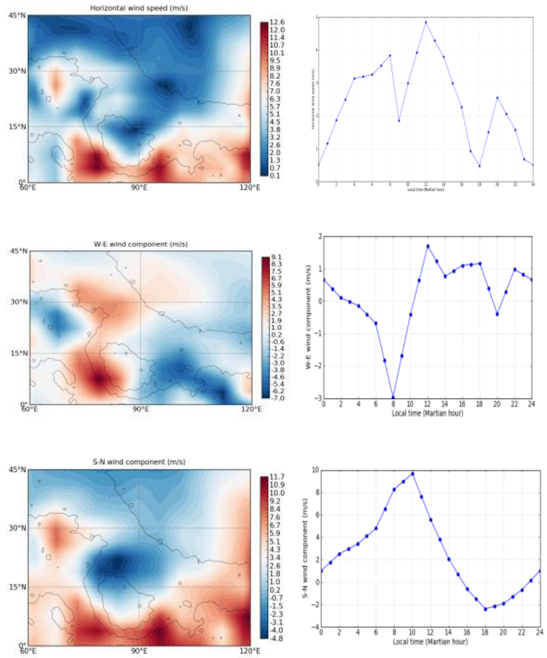


Figure 3- Wind speed maps along with daily wind cycle in Horizontal Component, W-E wind Component and S-N Wind Component respectively.

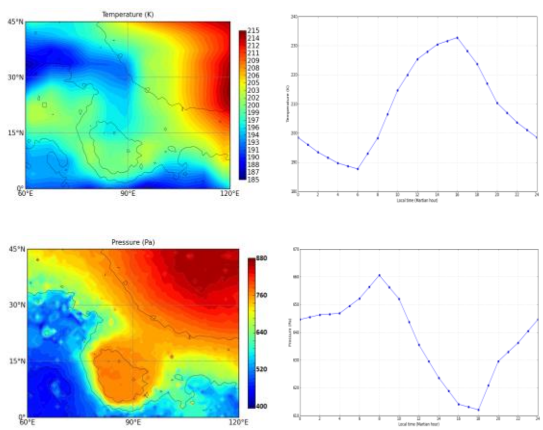


Figure 4- Temperature and Pressure Maps of the study area with daily rate cycle.

Acknowledgments: The author would like to extend our thanks and appreciation to UAE Space Agency for funding this research Z01-2016-001.

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