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Meteorological predictions for Jezero crater (NASA's Mars 2020 rover landing site) through Mars Regional Atmospheric Modeling System (MRAMS)

Jorge Pla-García[1,2]
[1]Centro de Astrobiología (CSIC-INTA) Carretera de Ajalvir, km.4, 28850 Torrejón de Ardoz, Madrid, Spain
[2] Space Science Institute, Boulder CO 80302, USA

Abstract

Having established the ability of the Mars Regional Atmospheric Modeling System (MRAMS) [1] to simulate the observed meteorological conditions at Gale crater [2] and in an effort to better understand the atmospheric circulations of NASA's Mars 2020 landing site [3], in this study MRAMS has been applied to describe the broader meteorological scenarios of Jezero Crater region.

Introduction

Jezero is a ~45 km diameter impact crater located in the Nili Fossae region of Mars, an outstanding site to address key questions of ancient Mars climate, habitability, and volcanic history. The diverse geologic units in Jezero are in clear stratigraphic context [4]. Both the fluvial features [5] and the lacustrine [6] environments that can be guessed in the Jezero´s area are the most striking morphological features that indicate a habitable past of this area. On the other hand, it has been determined the presence of certain redox chemical pairs that indicate possible energy sources.

Meteorological predictions

We provide meteorological predictions for Jezero crater, using MRAMS nested grids with a spacing of 330 meters on the innermost grid (centered over the landing site) as a function of season for solstices and equinoxes (*Ls=0, Ls=90, Ls=180 and Ls=270*) including derived atmospheric variables, air and ground temperature (Figures 1 and 2), pressure (Figure 3), wind direction and speed (Figures 4 and 5), relative humidity derived from [7, 8] UV data in all the RDS channels derived from [9]. An atmospheric circulation interpretation and an astrobiology and geology approach to the landing site are also performed. The meteorological conditions are expected to change in Jezero crater due to the increasing influence of topographically-induced thermal circulations that have been predicted by numerous previous studies [10, 11, 12, 13]. It is possible that Mars 2020 could make its way over to Midway at some point during a potential extended mission, so the same study was performed to explore this latter site. The origin of the nocturnal turbulence shown in turbulent kinetic energy (Figure 6) is explored, and may be caused by a combination of gravity waves activity and shear driven turbulence.

Figures

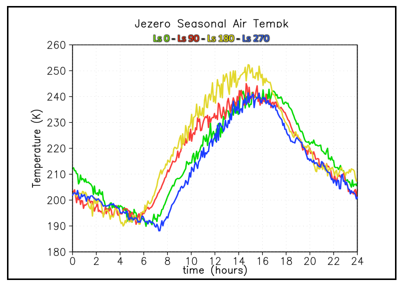

Figure 1: Air Temperature

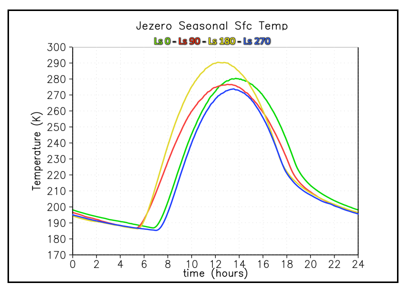

Figure 2: Surface Temperature

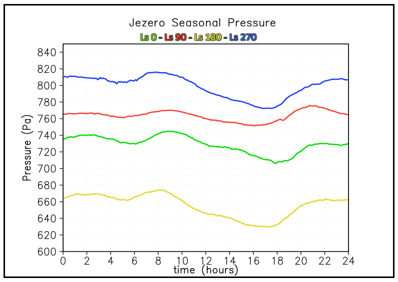

Figure 3: Pressure

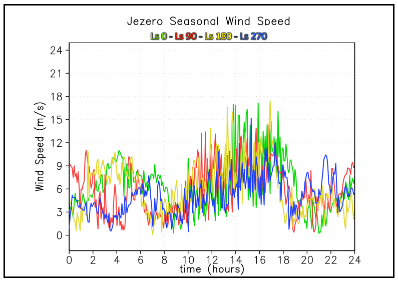

Figure 4: Wind Speed

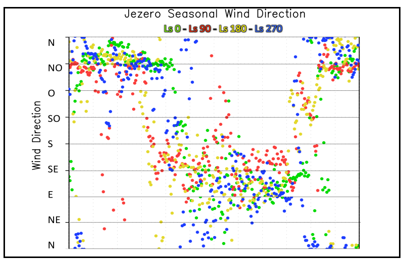

Figure 5: Wind direction

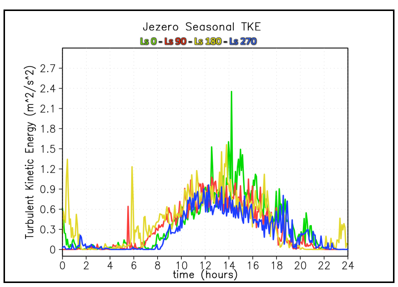

Figure 6: Turbulent Kinetic Energy

Acknowledgements

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