ASTROBIOLOGICAL IMPLICATIONS FROM MEDA ATMOSPHERIC MEASUREMENTS.

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Introduction: The Jezero crater delta on Mars presents several evidences of a watery past with astrobiological potential. These evidences allow us to infer the potential past habitability in the delta. Thus, Fassett and Head [1] reported in 2005 the existence of entry and exit valleys that could have filled out the crater. These authors interpreted the crater Delta as a formation caused by the presence of a lake feeded by water flooding the Jezero crater. There is also evidence of the presence of Phyllosilicates and carbonates with probability of a detrital origin [2,3]. On the other hand, the curvilinear strata identified in the Delta have been interpreted as evidence of Delta [4]. The alluvial fan mineralogy with the presence of Mg carbonates and olivine is linked with units in the watersheds and identified as alteration minerals of detrital origin [5]. The morphological features present inside the crater have been interpreted as inverted fluvial channels deposited during lake level rise [6]. The same author determines that the delta stratigraphy is consistent with a single flood episode, but the delta must have formed over geological timescales. Likewise, the remnant outcrops near the delta have been interpreted as lake deposits. Other authors identify marginal carbonates present as possible lake deposits formed during a closed-basin phase [7]. All these features allow us to inferred a high habitability potential for the region in the past.

One way to monitor water-related processes is by identifying features that originate during the presence and evaporation of water, such as certain mineral deposits, or by identifying features on the regolith surface, such as duricrust formation. Duricrust is a surface layer on substrate that has been hardened due to waters movement (upward, downward or laterally) by capillary action. The water movement in this case occured in strong interaction with minerals including disolution and precipitation in evaporation processes which finally originated duricrust. Direct observations at spacecraft landing sites and remote-sensing data from orbit have reported duricrust to be likely common surface type on Mars [8].

By other side, the interaction of minerals and water can be followed by the measurement of environmental parameters such as relative humidity, atmospheric pressure and air and soil temperature by MEDA instrument onboard of Perseverance rover.

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MEDA: The Mars Environmental Dynamics Analyzer (MEDA) [9] is made up of a set of meteorological sensors including wind sensor, a barometer, a relative humidity sensor, a set of 5 thermocouples to measure atmospheric temperature at 1.5 m and 0.5 m above the surface, a set of thermopiles to characterize the thermal IR brightness temperatures of the surface and the lower atmosphere. MEDA adds a radiation and dust sensor to monitor the optical atmospheric properties that can be used to infer bulk aerosol physical properties such as particle size distribution, non-sphericity, and concentration. MEDA continuos measurements are Pressure (PS) inside rover body, Surface temp by Thermal Infrared Sensor (TIRS), Air temp at 0.5,1,1.5m (ATS), Air temp at ~40m (from TIRS), Wind speed and direction at 1.5m (WS), Relative humidity at 1.5m by the Humidity Sensor (HS), IR and visible downward / upward radiation fluxes by the Radiation and Dust Sensor (RDS), Aerosol properties and ozone column (RDS), Cloud images and Column optical depth (‘tau’) at ~10am, 2pm.

Observations: The meteorological environment provides fundamental conditions relevant for life and habitability. The radiation conditions directly influence the possibility for life and organic matter preservation, but the weather conditions and its influence on the water cycle also determine the availability of water. These parameters, that will help us to determine the real possibilities of potential signs of past life and organics preservation, are predicted at four different seasons (solstices and equinoxes) for the Mars 2020 Perseverance rover landing site in Pla-García et al. [10]. The highest solar fluxes are found at fall equinox -Ls 180-, with a value of 570 W/m2 for 190–3000 nm range (Fig. 1), in agreement with the highest surface temperatures of ∼290 K, also at that season. The lowest surface temperatures are ∼182 K during all nights. The most humid season is Ls ∼120–180, peaking at Ls ∼150 with a water vapor volume mixing ratio vmr of 371 ppmv.

Among the objectives pursued for inferring the potential past habitability we will monitore the interaction between the water cycle and regolith by, firstly, looking for and identification of duricrust formed on surfaces, in addition, secondly, to the MEDA measurements such as the water vapor, atmospheric pressure and seasonal variations, and measurement of soil and air temperature with special attention to possible variations that could indicate hygroscopic processes. First results after landing on February 18th will be presented.

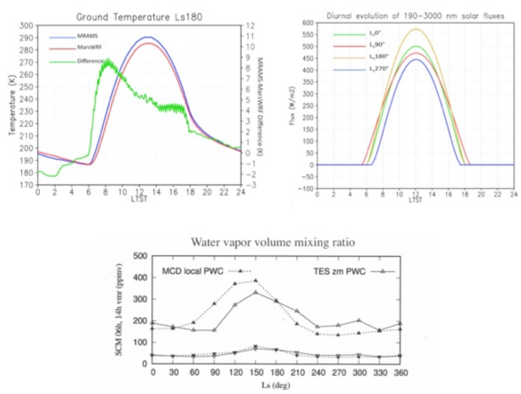

Figure 1: Jezero crater modeled diurnal *surface temperature* at Ls 180 using MRAMS (blue curve) and MarsWRF (red curve), *radiation* of 190–3000 nm solar fluxes using COMIMART and daily max (14 h) and min (06 h) *water vapor vmr* at 1.6 m using SCM, initialized either via the MCD local PWC or via the TES MY26 zonal mean PWC. Adapted from [10].

Acknowledgments: FGG acknowledge the funds provided by the Spanish State Research Agency (AEI) Project No. MDM-2017-0737 Unidad de Excelencia "María de Maeztu"- Centro de Astrobiología (INTA-CSIC).

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