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Introduction: Using measurements from the Mars Environmental Dynamics Analyzer (MEDA) instrument [1], we calculate the broadband (0.3–3 μm) hemispherical albedo (α) and thermal inertia (TI) of the terrain traversed by the Mars 2020 Perseverance rover for the first 777 sols of this mission (Fig. 1, top). This includes the ‘Three Forks’ area, where ten sample tubes were deposited between sols 652 and 690. We also compare these values with collocated satellite retrievals of albedo from OMEGA, and of TI from THEMIS.

Figure 1. (Top) Map of Jezero crater with the rover traverse (white line), parking spots (white circles), and areas and periods covered in each of the campaigns (colors) through sol 777. (Bottom) Example of MEDA’s field of view on sol 30, covering an ellipsoid area of 3–4 m² (shaded green area). The arrows point toward the location of TIRS and RDS on the rover. A zoomed-in view of TIRS field of view is shown in the top left insert.

This work expands and improves the results presented in [2], where values of α and TI were determined for the first 350 sols. Here, we use recent corrections for dust deposition in the MEDA’s Radiative and Dust Sensor (RDS) and Thermal Infrared Sensor (TIRS) [3,4], which result in more accurate values of the downwelling and reflected solar fluxes, allowing for a refinement in the calculation of α and TI.

Data and Methods: MEDA measurements and the methodology to calculate α and TI are similar to those described in [2], except for two aspects. First, this work extends the coverage from sol 350 to 777 (Ls ~ 57° in MY 37). Second, we use recent corrections for dust deposition in the RDS and TIRS [3,4]. MEDA measurements used to obtain α and TI cover an ellipsoid area of ~3–4 m² (Fig. 1, bottom).

OMEGA retrievals of bolometric albedo in the 0.25–2.9 μm range have a spatial resolution between 1 and 2 km. Here, we use observations from the 2004-2010 period between 10:00 and 17:000 LTST, which were processed by removing the aerosol contributions to derive surface-only reflectance, and by accounting for non-Lambertian photometric effects to estimate a hemispherical albedo [5].

THEMIS retrievals of TI have a spatial resolution of 100 m per pixel [6]. As in [2], we obtain TI values as the average over 0.001°×0.001° lat/lon boxes of three collocated stamps (“I02413002,” “I36033008,” and “I45156005”) queried with the JMARS software and processed with the MARSTHERM model to derive TI values as a function of longitude and latitude.

Results: Figs. 2a and 2b show MEDA-derived values of α and TI as a function of sol number and Ls. Values at Three Forks are highlighted in purple. Due to the non-Lambertian behavior of α, with a strong diurnal variation as a function of illumination and viewing geometry [2], we decided for reference purposes to show values at noon, when α is lowest. Values of α and TI within Three Forks vary between 0.13 and 0.15 (absolute uncertainty of ~0.08), and between 200 and 240 SI units (relative uncertainty of 10%), with 0.14 and 220 SI units as the median values.
Figs. 2c and 2d show $\alpha$ and TI maps with values derived from MEDA in colored crosses and retrieved from OMEGA and THEMIS in squares. MEDA-derived $\alpha$ values range between 0.09 and 0.2, while OMEGA retrievals show an average value of 0.13. Similarly, MEDA-derived TI values range between 200 and 680 SI units, while THEMIS retrievals range between 180 and 400 SI units. These departures are caused by the different spatial resolutions (and local time in the case of albedo) of the various datasets.

**Future Work:** Two interesting aspects are the gradual increase in MEDA-derived $\alpha$ during the dusty perihelion season (Fig. 2a, sols ~320–600), possibly linked to dust deposition brightening the surface, and the markedly different range of $\alpha$ and TI values between the first 600 sols and later sols (Fig. 3), coinciding with the ascent of the rover to the upper fan (Fig. 1). We plan to analyze both aspects in future research. In addition, we plan to analyze the effect of changing geophysical properties of the terrain on the local near-surface environment.

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![Figure 2](image1.png)

**Figure 2.** (a-b) MEDA-derived values of $\alpha$ at noon and TI for the first 777 sols of the Mars 2020 mission when the rover was parked for an entire sol. Highlighted in purple are values corresponding to Three Forks, where the tube samples were deposited. (c-d) Color-coded $\alpha$ and TI map obtained from MEDA (crosses), and OMEGA and THEMIS (squares). The black line represents the rover traverse for the first 777 sols of the mission.

![Figure 3](image2.png)

**Figure 3.** MEDA-derived set of TI and $\alpha$ values for the first 777 sols of the M2020 mission.

**References:**