A NEW DATASET OF UV FLUXES AT GALE CRATER FROM REMS MEASUREMENTS. Álvaro Vicente-Retortillo[1], Germán Martínez[1,2], Nilton Renno[1], Mark Lemmon[3] and Javier Gómez-Elvira[4]. [1]University of Michigan, Ann Arbor, USA (alvarode@umich.edu), [2]Lunar and Planetary Institute/USRA, Houston, Texas, USA, [3]Space Science Institute, College Station, Texas, USA, [4]Centro de Astrobiología, Torrejón de Ardoz, Spain.

Introduction: The Mars Science Laboratory Curiosity rover has been measuring UV radiation for approximately four Martian years. These measurements have been used to characterize the seasonal evolution of dust opacity [1], dust particle size [2] and dust lifting processes [3], as well as to study the radiative environment during the MY 34 global dust storm [4,5].

Due to the attenuation caused by dust accumulated on the sensor and to inaccuracies in the angular response calibration functions [6], those studies were performed using the photocurrents instead of the higher level fluxes that are available at the NASA Planetary Data System as ENVRDR and MODRDR products. However, the use of the photocurrents is limited because it requires an in-depth knowledge of the sensor's hardware features.

We have generated a new dataset of REMS UV fluxes and made them available via the Atmospheres node of the Planetary Data System as UVRDR products.

The generated UV fluxes are important to study the effect of UV radiation on the variability of dust and gas molecules [7,8], to recreate the UV conditions at the Martian surface for models of habitability, and to allow accurate comparisons with measurements of future missions.

Inaccuracies in REMS UV fluxes: The ENVRDR and MODRDR UV fluxes available in the NASA PDS lack corrections due to dust accumulation on the sensor and due to the model of the angular response of the UV sensor.

Inaccuracies caused by dust accumulation. Due to its location on the rover deck, the REMS UV sensor is exposed to dust deposition. Figure 1 shows the REMS UV sensor on sol 36, at the beginning of the mission, and on sol 1498, more than two Martian years later. Dust accumulation on the sensor becomes apparent, particularly on the circular magnets that surround each photodiode.

Inaccuracies in the angular response calibration functions. UV fluxes stored as ENVRDR products are also affected by inaccuracies in the angular response calibration functions that are used to convert the photocurrents (TELRDR products) to these higher level products. Figure 2 shows the TELRDR and ENVRDR products (photocurrents and fluxes, respectively) of REMS channel UVE on sol 1402. While the photocurrents show a smooth behavior, the ENVRDR products contain two discontinuities, the first one at 9:30 LMST and the second one at 13:30 LMST. These discontinuities occur when the solar zenith angle relative to the rover frame is 30º, and are caused by a discontinuity in the angular response calibration functions at that angle [2,6].

Figure 1. *MAHLI images of the REMS UV Sensor approximately at the beginning of the mission (sol 36, top) and more than two Martian Years later (sol 1498, bottom).*

Generation of the corrected UV fluxes: We have developed a technique to correct UV fluxes from the effect of dust deposition by calculating a Dust Correction Factor (DCF) [3,6]. A DCF of 1 indicates a clean sensor, while a DCF of 0.7 indicates that only 70% of the incoming radiation is transmitted through the dust accumulated on the sensor. Figure 3 shows the seasonal evolution of the Dust Correction Factor of the UVE channel for MY 32 (black) and 33 (red). The amount of dust can cause an attenuation exceeding 30%, and it does not increase continuously: there is a net dust removal period during the perihelion season until L_s~300º. The analysis of sudden pressure drops detected by REMS and of simulations from the MarsWRF mesoscale model suggests that daytime convective vortices and nighttime winds are likely responsible for this seasonal dust cleaning [3].

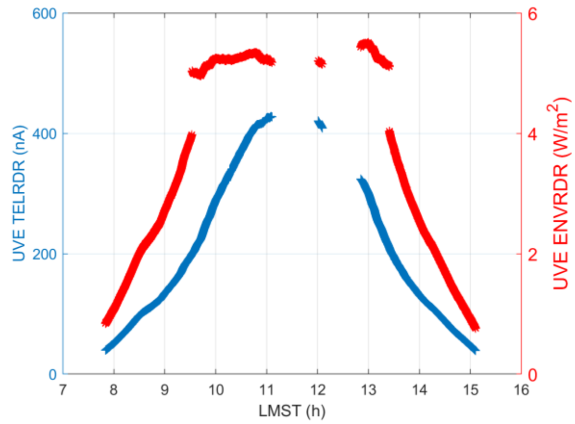

Figure 2. *Photocurrents (blue) and ENVRDR products (red) for the UVE channel on sol 1402.*

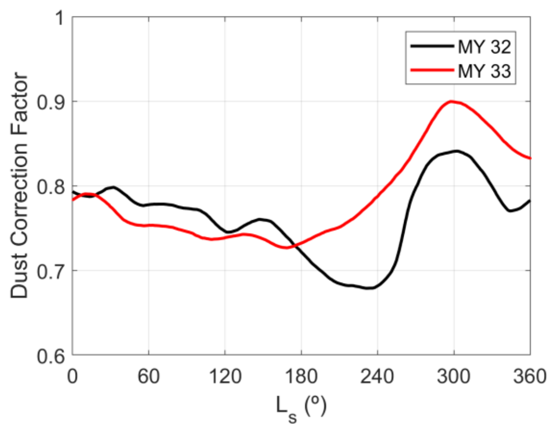

Figure 3. *Seasonal evolution of the Dust Correction Factor of the UVE channel for MY 32 (black) and 33 (red).*

We have also developed a technique to derive new empirical angular response calibration functions for the six REMS UV channels. The new angular responses are in good agreement with the previous functions for zenith angles $\theta < 30º$, especially for $\theta < 20º$. In contrast, for $\theta > 30º$ there is a dramatic change in the behavior of previous and new angular responses. While the previous functions showed a discontinuity at 30º and a constant value beyond, the new angular responses show a smooth behavior and their values depend on the zenith and azimuth angles [6].

As an example of the generated corrected dataset, Figure 4 shows in red the corrected UVE fluxes (UVRDR products) on sol 1402 of the mission. For comparison, ENVRDR products are shown in gray. For $\theta < 30º$ (between the discontinuities in the gray curve at 9:30 and 13:30 LMST), the corrected values are around 100% larger (black curve). Beyond the discontinuities at 30º, relative differences show a markedly increase with θ, reaching values well above 100%.

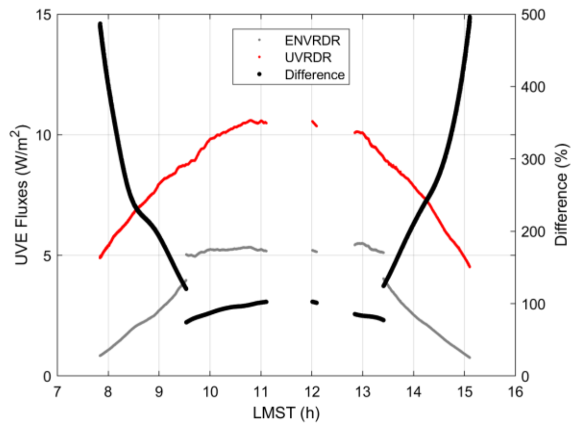

Figure 4. *UVE fluxes on sol 1402 stored in ENVRDR products (gray) and after the correction for the effects of dust deposition and sensors' angular response (UVRDR products, red). Their relative difference is shown in black.*

The corrected REMS UV fluxes and the associated uncertainties can be found now in the NASA PDS as UVRDR products: https://atmos.nmsu.edu/PDS/data/mslrem_1001/DATA_UV_CORRECTED/.

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