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Mars during the 2018 apparition: spatial analysis of the global dust storm using ArcGIS

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Abstract

During the 2018 Mars opposition a global dust storm developed from May to August. We have investigated the nature of the terrain at three different locations of the storm using ArcGIS software and a detailed elevation map of Mars with particular emphasis on the Valles Marineris region.

1. Introduction

Mars was imaged during the 2018 apparition using a Celestron C8 SCT (E.S., Curaçao) and a C14 (J.S., The Netherlands), respectively. Since the altitude of Mars was the highest on Curaçao and this Caribbean island has often excellent seeing conditions the most detailed information was collected on Curaçao. Starting at the end of May a big dust storm developed, which at the end of June 2018 covered almost the entire Martian surface. In September 2018 the storm had vanished again.

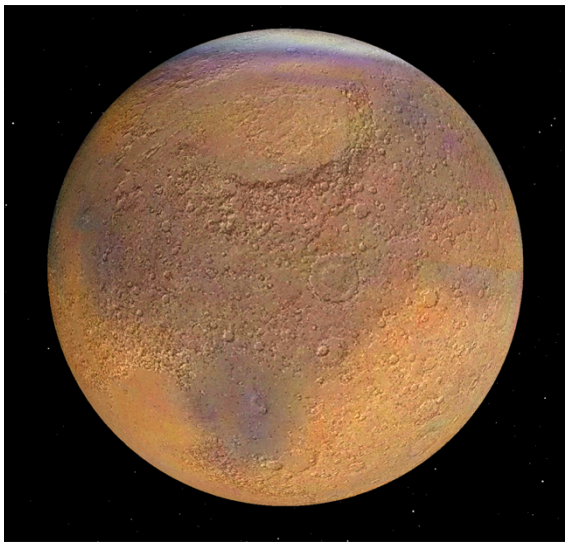

Figure 1: Mars image superimposed on the MOLA USGS map using ArcGIS (7 June 2018, Curaçao)

2. ArcGIS analysis

Using ArcGIS and the USGS MOLA Elevation map of Mars albedo features in our Mars images can be correlated with the elevation and geological features at specific sites (Fig.1). We have investigated whether there is a correlation between the accumulation of dust and the local nature of the terrain with emphasis on three different locations, viz. at Syrtis Major, Solis Lacus and Valles Marineris, respectively. We have looked whether there is a preference of dust accumulation in valleys In particular the distribution of dust in the Valles Marineris region was interesting (Fig. 2 and 3).

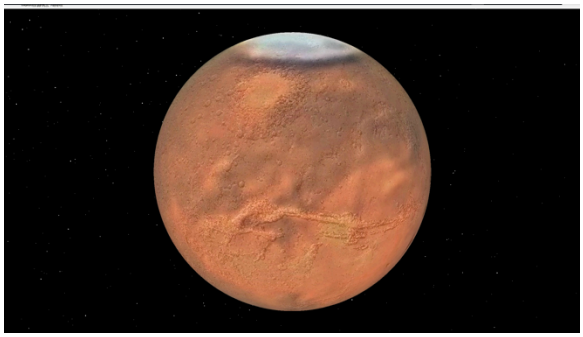

Figure 2: Dust in the Valles Marineris on 1 August 2018

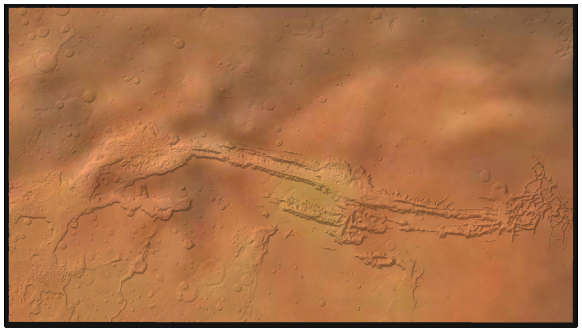

Figure 3: 3D Projection of dust on 1 August 2018 in the Valles Marineris region.

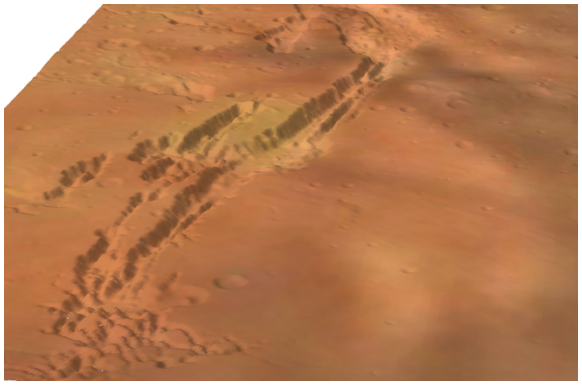

Figure 4: Dust accumulation in Sinai Planum on 1 August 2018.

Close to Valles Marineris, we found a region in Sinai Planum where several short-lived storms seemed to originate (Fig. 4). The MOLA Elevation Map shows that this location is positioned on an inclination with a flat slope at the transition of two geological structures. Also during other oppositions local dust storms have been detected in this region [1]. Further studies are required to understand the meaning of this phenomenon. We also investigated the storm in relation to elevation patterns in Solis Lacus and Terra Sirenum where distinct dust clouds have been were detected.

3. Conclusion

The application of ArcGIS in combination with the elevation and structural maps obtained with the Mars Global Surveyor is a useful tool to get more insight in dynamic processes on Mars e,g, storm development and dust distribution. In addition, using Jupiter images obtained in different spectral ranges, ArcGIS might also be a useful tool to obtain more insight in cloud structure and formation on this gas giant [2]. Interestingly, application of ArcGIS is now also available to amateurs and adds an extra dimension to their images.

4. Acknowledgements

We acknowledge the USGS (Unites States Geological Survey) for publishing the MOLA Elevation dataset in ArcGIS format.

5. References

[1] McKim, R.: Telescopic Martian dust storms: a narrative and catalogue, Memoires 0f the British Astronomical Association, Vol. 44, pp. 120-121, 1999.

[2] Sussenbach, J. and Sussenbach, E.: ArcGIS analysis of the Jovian atmosphere using Methane band and RGB images, RAS-Juno Europlanet Meeting, 10-11 May 2018, London, UK 2018. See also:

https://www2.le.ac.uk/departments/physics/people/leighfletcher/ras-juno-europlanet-meeting-2018

https://drive.google.com/file/d/1xr6pefXooah6dn_eJoxY1nxxqwgc3nnU/view