Imaging Mars from Curaçao in 2018 JBAA 2018/21

Eric Sussenbach[1] and John Sussenbach[2]
[1] Curaçao and [2]Houten, The Netherlands

Introduction

The 2018 apparition of Mars was very interesting, because at opposition at 2018 July 27 the apparent size of Mars reached a comfortable 24.3“. Unfortunately, for European observers Mars stood only 12° above the horizon. From these locations Mars could the best be observed in the months January and February (average altitude about 18°) and November and December (average altitude 30°). However, during those periods, the apparent size of Mars was only 6” and 10”, respectively.

For observers on the Dutch Caribbean island Curaçao the situation was quite different. At its latitude of 12° North, Mars stood 40° higher above the horizon. In this communication we describe the fine observing conditions for planets on Curaçao in general and the imaging of Mars during the 2018 apparition in particular. The Mars observations in the early and late phase are complemented with observations from the Netherlands.

Equipment and protocols

E.S. started in July 2017 with planetary imaging with a Celestron Maksutov 90SLT and a NexImage5 camera and from March 2018 he uses a Celestron 8 (20 cm) Edge HD Schmidt-Cassegrain telescope in combination with an ASI290MC color camera. J.S. uses a Celestron C14 telescope with a monochrome ASI290MM camera plus different filters or an ASI290MC camera plus ADC (ASH). The cameras were equipped with Barlow lenses from 1.5 x to 3 x. For imaging of Mars, videos in SER format were collected containing 10.000 frames. The frames were centered with the software program PIPP. Subsequently, the best frames were stacked with Autostakkert 3 and subjected to sharpening using the wavelet functions of Registax 6.1 or Photoshop.

Weather conditions on Curaçao

The seeing conditions on Curaçao can in general be characterized as good to very good. The reason for this qualification is the specific location of the island. The surrounding sea stabilizes the atmospheric temperature on the island which varies over the year from 29 to 32 degrees. The temperature at night is only a few degrees Celsius lower. Most of the year the continuous Northeastern trade winds provide a laminar airflow, which also contributes to the stability of the atmosphere leading to excellent conditions

Fig. 1 Location of Curacao and the daily sky

for planetary imaging. The island does not have seasonal atmospheric changes with the exception of the months November and December when it rains more often than usual and cloudy skies prevent imaging. Curaçao lies outside the hurricane belt, and rarely gets hit by a hurricane.

There is one thing the serious planetary imager must consider and that is the fact most of the nights the skies are partially clouded. The strong trade winds let these clouds fly along the sky and their presence often interferes the capturing of contiguous series of R, G and B videos. Due to these clouds an RGB series is often incomplete. For that reason, most of the time we used the ASI290MC camera. Fig. 2 illustrates the difference in imaging conditions on Curaçao (latitude 12°N) and Houten, The Netherlands (latitude 52° N). Clearly the C8 telescope performs much better than the C14. The C8 result was obtained with an ASI290MC camera; for the C14 image an ASI290MM cameras was used in combination with an RGB filter set.

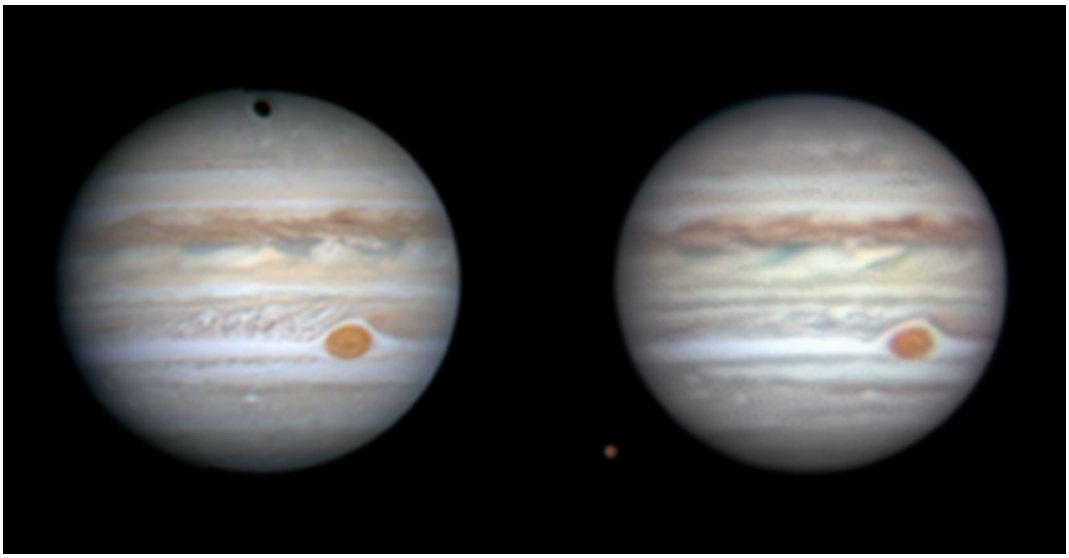

Fig. 2 Comparison of the performance of a C8 telescope on Curaçao (2018 June 26 f/30 alt. 60°)(left)(E.S.) and a C14 telescope in Houten, The Netherlands (2018 July 13 f/11 alt. 20°)(right)(J.S.). North is up.

Imaging of Mars through the year

At our own locations we have both imaged the growing image of Mars during the year. From 2018 July 19 till 2018 August 1 we imaged Mars together from Curaçao. A compilation of the results obtained at the two locations is presented in Fig.3. In all Mars images South is up. The Mars images are presented at the same relative size. Most of them were collected on Curaçao. In the first months of the year the image of Mars gradually grew and the familiar darker albedo features became visible (Fig 4, 2018 June 7). The Southern Polar cap was very distinct. In May other observers had detected dust storms in the neighborhood of Mare Acidalium moving Southwards[1]. As this side of the globe was invisible from our locations we were unable to capture any images of these early events. However, in the second half of June we were able to detect dust storms in the regions of Mare Erythraeum and Solis Lacus (See Fig. 3, 2018 June 20 and 23, respectively). The development of the dust storm is nicely illustrated in Figs. 4-7. Note how on 2018 June 23 the storm covered Aonia Terra, Solis Planum and Terra Sirenum. Only Daedalia Planum was still visible in this region. The Southern Polar Cap was big. Furthermore, Olympus Mons could be distinguished as well as the Tharsis volcanoes.

Mars Apparition 2018

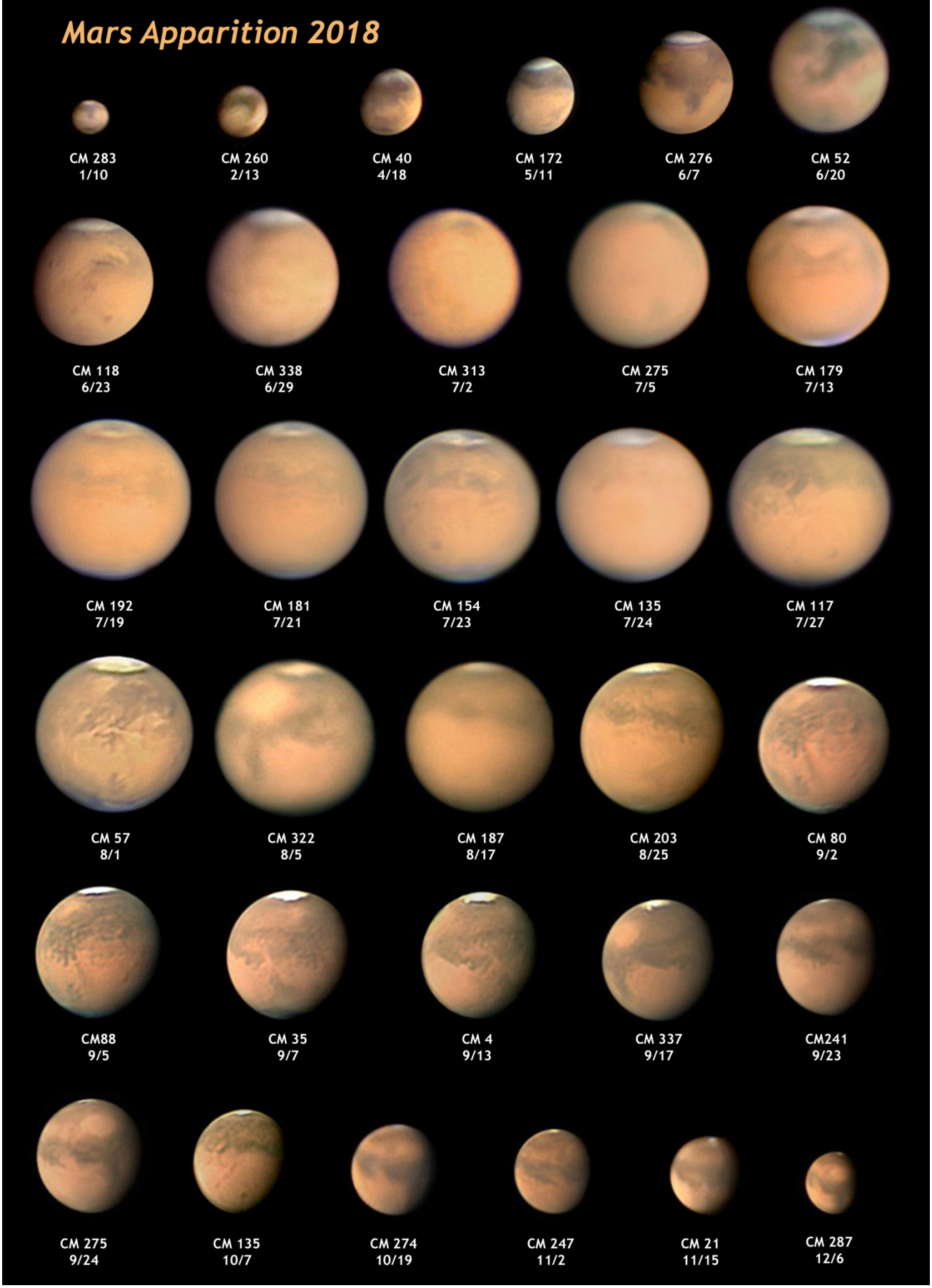

Fig. 3 Compilation of Mars images obtained by Eric and John Sussenbach using a C8 and a C14 Schmidt-Cassegrain telescope, respectively.

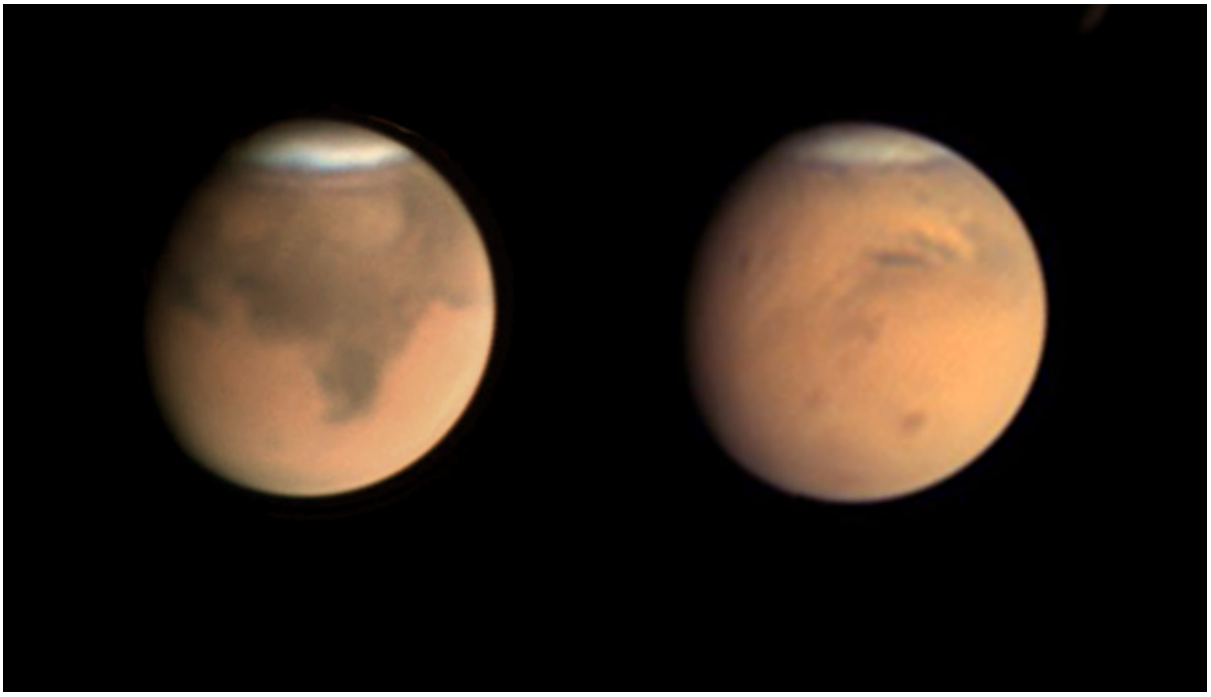

Fig. 3 Mars on 2018 June 7 C8 f/30 (l) and 2018 June 23 (r)(E.S.)

In the course of the end of June also other regions of Mars could be observed. Images of that period showed that regions such as Solis Lacus, Mare Erythraeum and the area around Sinus Meridiani were invisible in RGB images (Fig 5). Using IR filters e.g 742 nm pass filters revealed more details, but still most of the surface was invisible.
On the 2018 July 2 we imaged the region of Syrtis Major and also here dust clouds covered large areas of the surface, like Syrtis Major and the Hellas basin (Fig. 6). In the RGB image hardly any detail can be distinghuised. In the 742 nm image the Northern tip of Syrtis Major could be detected.

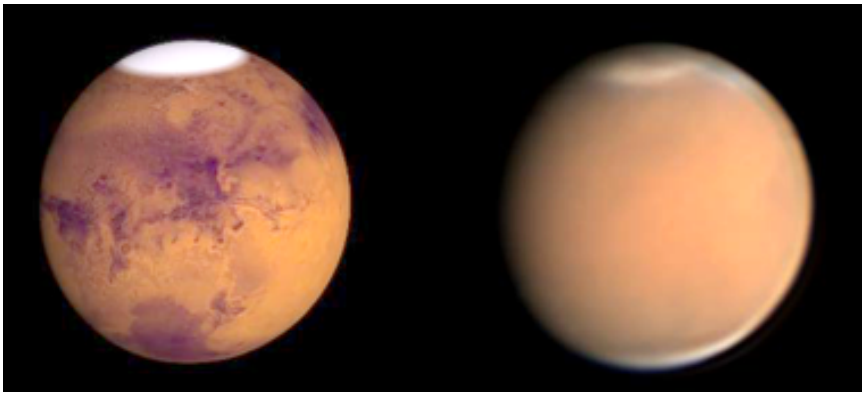

Fig. 5 Mars on 2018 June 27. C8 f/30 and ASI290MC camera (E.S.)

Fig. 6. Mars 2018 July 2 C14 f/11. Left image: RGB (ASI290MC camera), middle 742 nm (ASI290MM camera) and right Winjupos animation (J.S.)

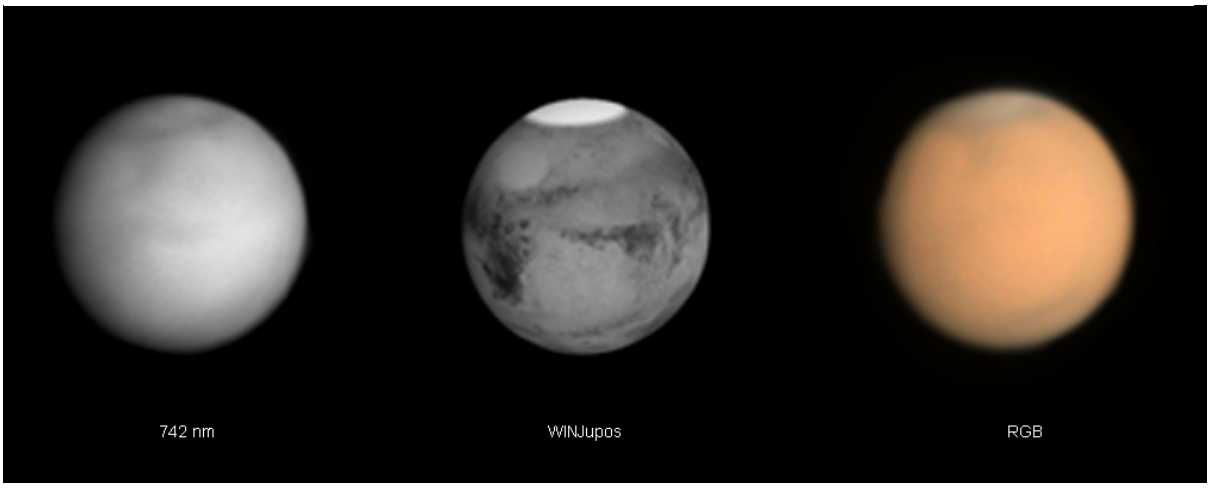

Fig.7 Mars on 2018 June 30 C14 f/11 (J.S.)

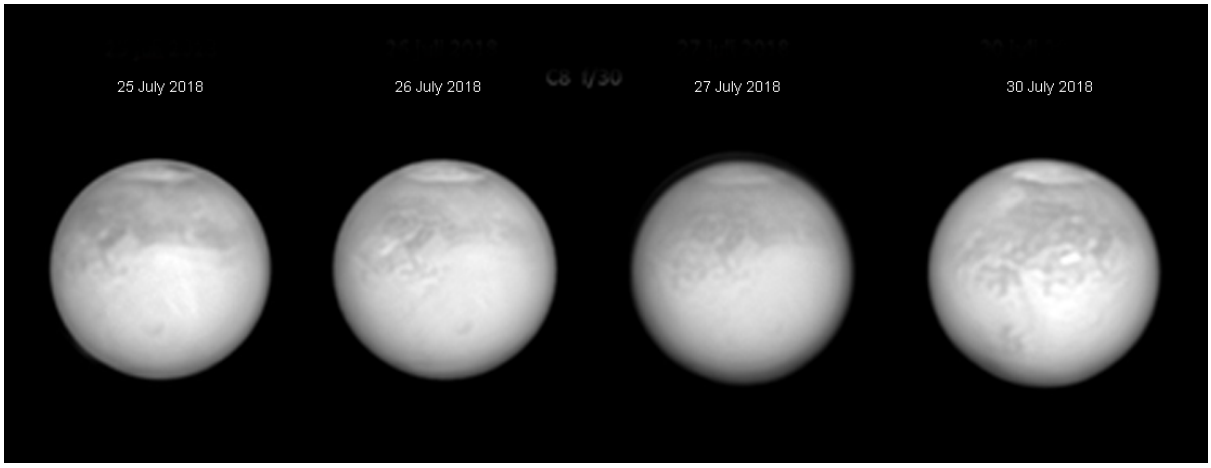

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Fig.8 Short living storms on Mars C8 f/30, ASI290MC camera and IR filter (E.S and J.S.)

Fig. 7 taken on 2018 June 30 reveals almost no details. The dust storm covered almost the entire globe. The dust seems to have reached the Southern ice cap. It is yellowish instead of grey-white. On the day of the opposition 2018 July 27 we made an image clearly demonstrating the potential of a C8 under ideal conditions (Fig 3). Fig 8 reveals some short-lived dust storms in the region of

Gangis Chasma in the period of 2018 July 25 - 30. On July 26 a small dust storm was seen, which was not detectable on July 27. A new storm close to the previous one was found on 2018 July 30. At the end of July, the global storm was gradually setting with some interesting side effects illustrated in Fig. 9 showing Mars on 2018 August 1. Note how the settling dust exposes quite well the contours of the Mariner Valley. It was interesting to follow the shrinking southern polar cap in the course of the year. In Fig.9 the region of Novus Mons first appeared as a bright area. On 2018 September 17 the region was partly detached from the major body of the polar cap (Fig.10).

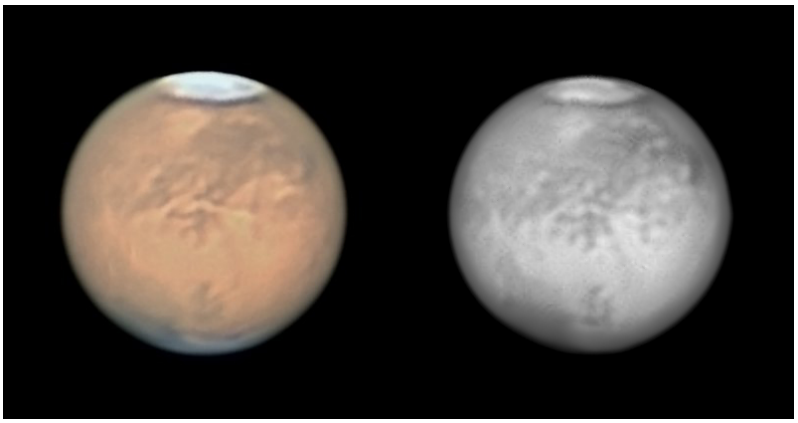

Fig. 9 Mars on 2018 August 1. Note the Mariner Valley. RGB (l) and 742 nm (r) C8/ f 30 (E.S.

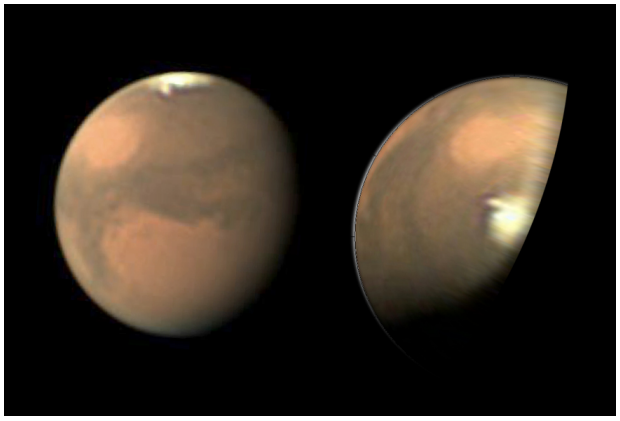

Fig. 10 Mars on 2018 September 17. C8 f/30 (E.S.)

Discussion.

In this communication we have illustrated that the Island of Curaçao is an excellent place for planetary imaging. The presence of the Caribbean Sea in combination with the steady Northeastern trade winds has a very favorable effect on the stability of the local atmosphere. Most of the year, with the exception of the months November and December, the seeing conditions are very good and stable, whereas also the transparency is most of the time very good. On the other hand, the omnipresence of wind requires a sturdy mount and sometimes good wind shields.

The better performance of a 20 cm C8 telescope on Curaçao over a 36 cm C14 telescope at higher latitudes is impressive. Angular size measurement on the Mars surface revealed details of 0.3" which is even smaller than the theoretical angular resolution of a 20 cm instrument (Dawes limit 0.58").

In this communication we have focused on the Mars apparition 2018. Mars reached its maximum size on July 31 viz. 24.3". Whereas till May the resolution of Mars increased gradually, in the course

of June a massive dust storm developed, eventually covering almost the entire globe. The least details were detectable in RGB images. In the IR (742 nm) surface details were a bit better discernable. The situation reminded us of the 2001 global dust storm that interfered during the opposition and lasted many weeks[2,3].
We also detected some smaller and short-lived local dust storms in Mare Erythtraeum (Fig.8). At the end of July, the dust was setting again, but at opposition a major part of the Mars surface was still not fully visible.
An interesting phenomenon was that when most of the dust had settled at the end of August and the beginning of September the Mariner Valley was detectable as a yellowish streak of dust. At the end of September, the Martian surface revealed itself as usual.

During the year the Southern polar cap was disappearing gradually. In July the global dust storm also affected the brightness of the polar cap. Interestingly, in August and September the region of Novus Mons first appeared within the cap as a bright area and later became a detached outlier of the cap (Figs. 9 and 10).

References

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2. R.J. McKim, 'The opposition of Mars, 2001 Part 1', *J.Brit.Astron. Assoc.***119** (3) 123-143, (2009).
3. R.J. McKim, 'The opposition of Mars, 2001 Part 2', *J.Brit.Astron. Assoc.***119**(4), 205-201, (2009).