

# Activity of The Martian Encircling Duststorm 2018

From the public image of MRO

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Almost a year has passed since the 2018 Encircling Dust storm. Based on the public image of NASA's MRO, I traced the growth process of the dust storm that occurred from the end of May. This report is a part of the public image where dust storm shows active activity.

The public image records the highest part of the Dust storm from the spacecraft, but the developed Dust storm appears to be waving when taken from the spacecraft. I examined the image paying attention to this situation. This time, we mainly checked the occurrence points and confirmed a total of 31 occurrence points.

It should be noted in advance that the images of MROs used for the survey did not cover all the occurrence points, as there are parts that can not be recorded during the survey period.

## 1 From distribution map of occurrence point

### 1-1 What can be understood from the overall distribution

When the MRO image is examined, where a dark dust storm has occurred, the image of the Martian image that has been wrinkled when viewed from a spacecraft is recorded. By observing the appearance and position of the wrinkles, it is possible to find out in which direction the dust storm is moving. Therefore, we tracked this figure from May 21, 2018 to September 30, 2018, before the outbreak.

Dust storms have converged considerably by the end of September, and their frequency has dropped significantly. We decided to create a distribution map by setting the end of September, when the pattern became easy to see by visual observation, as a temporary break.

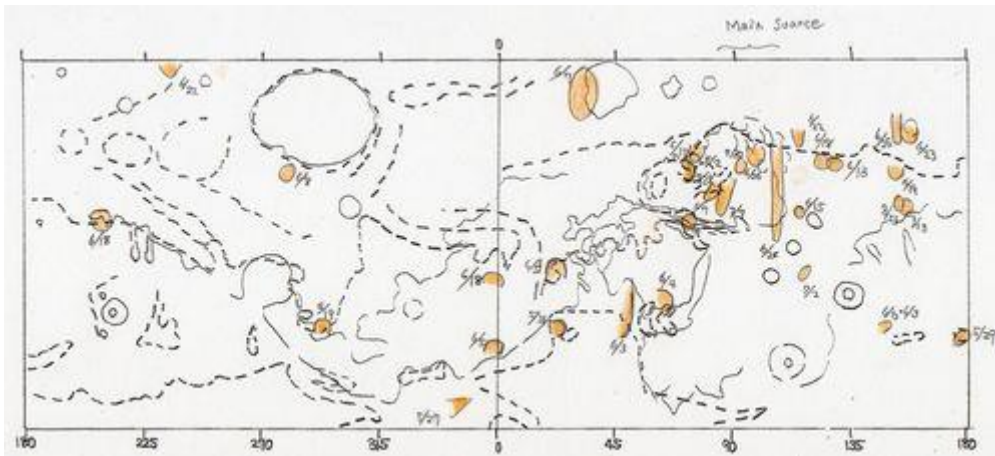


Figure1: Occurrence point of dust storm (May 21, 2018-September 30, 2018)

Of these, the July 30 outbreak point also occurs on August 1 at the same place. In addition, the same thing happens on September 19 in the place of September 13. These locations are locations on the first day of development, and do not include the later developed locations.

From these distributions, it can be understood that Dust storm occurred almost all over Mars. In terms of longitude, the area around  $0^{\circ}$  to  $180^{\circ}$  increases.

#### 1-2 Feature of occurrence place

Based on the MRO image, I added the monthly occurrence place to the map. As a result, it became as follows. It can be clearly seen how it became very active in June after it occurred in May. The outbreak has not been seen rapidly since July. For this reason, it is thought that the active period of this Dust storm was until the beginning of July.

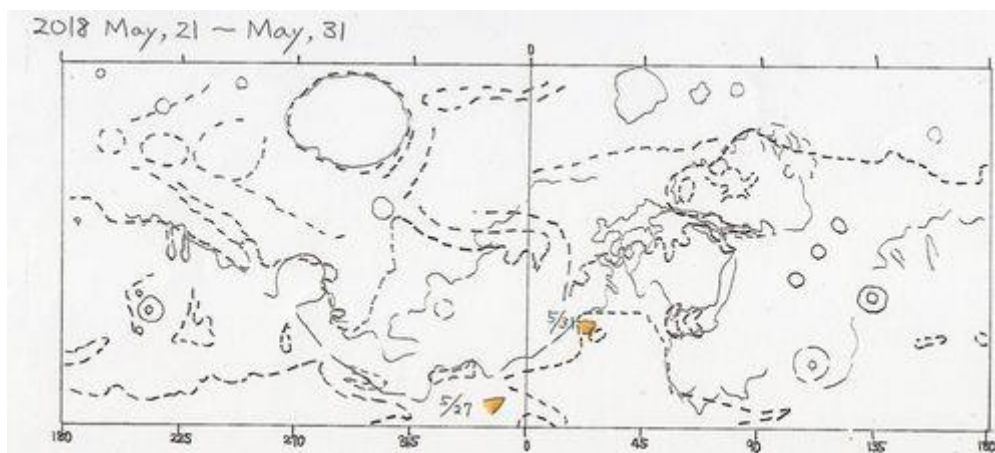


Figure 2: The 11-day occurrence point from May 21, 2018 to May 31

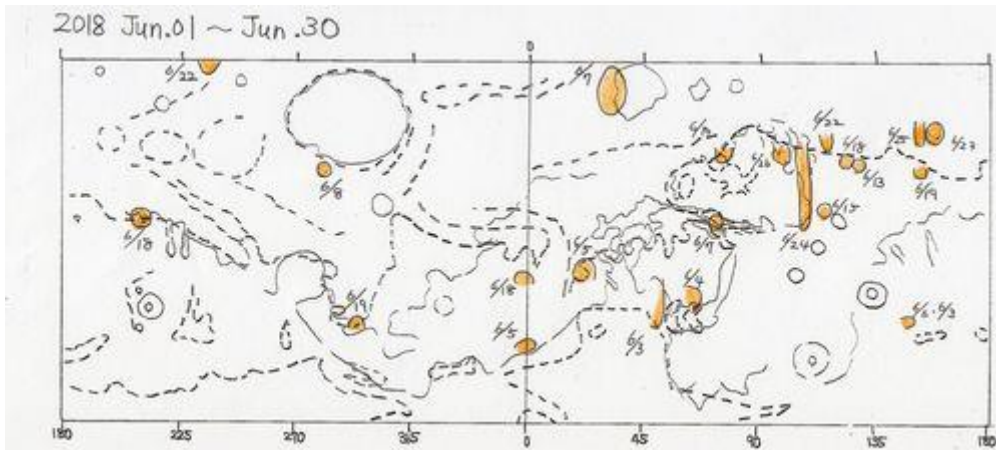


Figure 3 Occurrence point of June 2018

It spreads over the entire surface of Mars. There are many from 0 ° to 180 ° west.

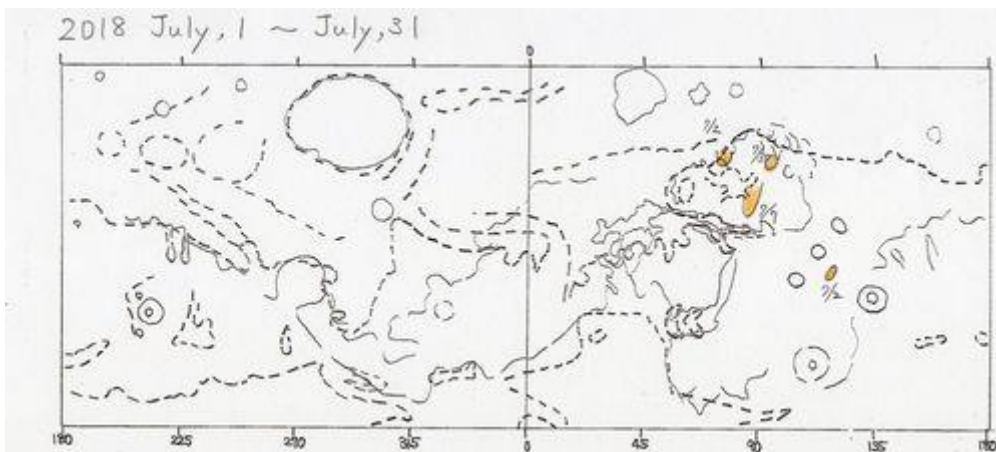


Fig. 4: Occurrence point of July 2018

It was concentrated in the area which occurred in June, and the other area did not occur.

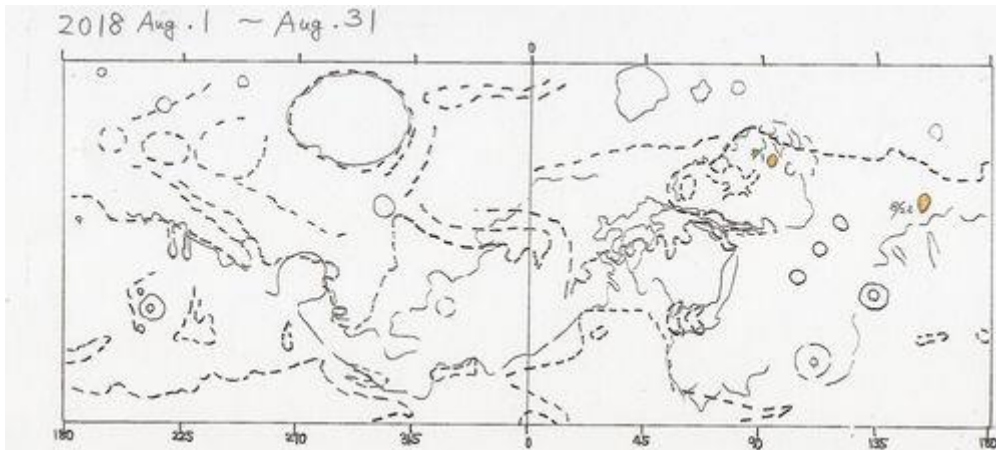


Fig. 5: Occurrence point of August 2018

It occurred only in 2 places.

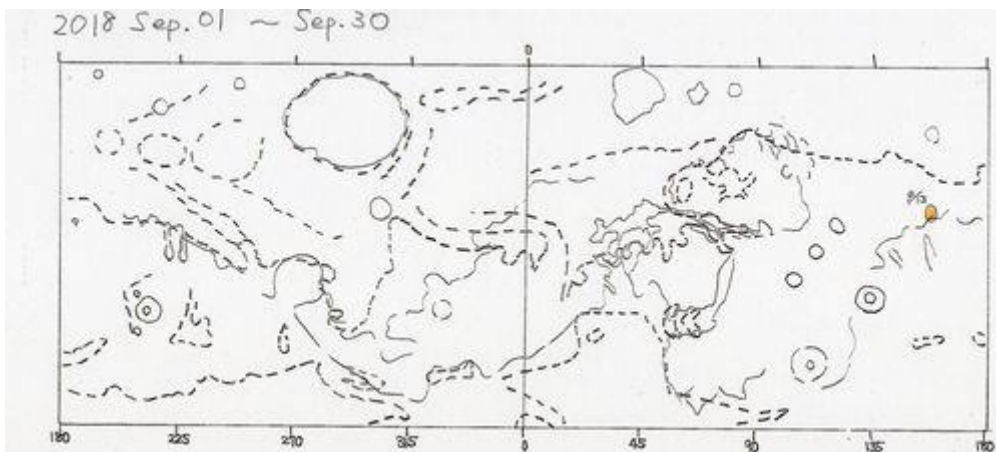


Fig. 6: Occurrence point of September 2018

It occurred only in one place. Since mid-July, new dust storms have become less likely to occur.

### 1-3 Occurrence point of dust storm activity period

When Dust storm is active, it is an activity that can be seen in the expansion phase immediately after the outbreak. How to spread the dust storm during expansion will be summarized on another occasion, and here the situation after the dust storm has spread globally will be shown.

The occurrence is concentrated from June 10th to July 7th according to the date of

occurrence.

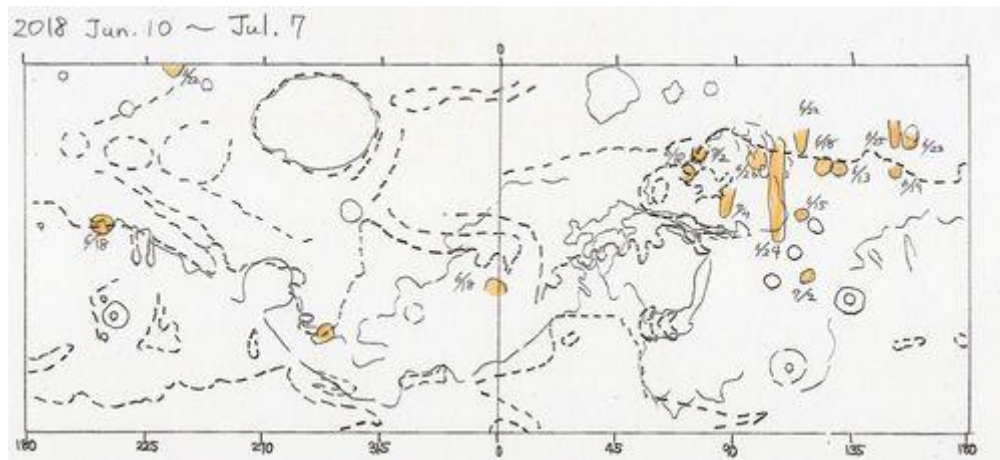


Fig. 7: Occurrence point of expansion period from June 10, 2018 to July 7, 2018  
It can be seen from this distribution map that the image is concentrated between 70 ° west and 170 ° west. If you check the image you can see that the cold air from the Antarctic crown is triggered. As you can see in the figure, it can be seen that things happened one after another in the southern hemisphere, not in the northern hemisphere.

It can be seen that the globally spread Dust storm spread from this region mainly to the east region.

#### 1-4 What can be understood from the image of MRO

The right figure is a typical image of June 24th. In this image, the cold air of the SPC is flowing out in the latitudinal direction I understand that.

There are three major streams on this day. Fortunately Especially in the image of this day, the Antarctic crown is recorded, It was possible to know from which place it flowed.

The appearance of the polar crown on June 24 is entirely covered with dust storm, and is blocking radiation heat from the sun. This may be the cause of the cold.

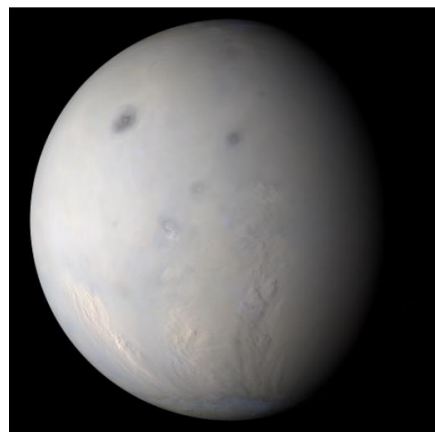


Figure 8:24 Jun. 2018 MRO

## 2 About frequency and scale

The plotted locations were examined on the map, and the plotted was created. Since the position can not be read by software, I have projected the image on the map by experience, but the position is shown as the longitude.

From this table, two peaks, the early stage from May 31 to June 9, immediately after the outbreak, and the expansion period from around June 15 to around June 24, were observed. In the early days, the activity is centered on the south of the Mare Acidarium, mainly from north to south. On the other hand, the expansion period seems to have become activity from the Antarctic crown to the north.

Frequency and scale of occurrence

date(2018)	Number of occurrences	Ls	De
May,21 - May,25	0	180-182	-15
May,26 - May,30	2	182-185	-14.9
May,31 - Jun.04	5	185-188	-15.1
Jun.05 - Jun.09	7	188-191	-15.2
Jun.10 - Jun.14	1	191-193	-15.1
Jun.15 - Jun.19	6	193-196	-14.9
Jun.20 - Jun.24	4	196-199	-14.7
Jun.25 - Jun.29	2	199-202	-14.3
Jun.30 - Jul.04	3	202-205	-13.9
Jul.05 - Jul.09	1	205-208	-13.3
Jul.10 - Jul.14	0	208-211	-12.7
Jul.15 - Jul.19	0	211-214	-12.1
Jul.20 - Jul.24	0	214-217	-11.5
Jul.25 - Jul.29	1	217-221	-10.9
Jul.30 - Aug.03	2	221-224	-10.4
Aug.04 - Aug.08	0	224-227	-10
Aug.09 - Aug.13	0	227-230	-9.7
Aug.14 - Aug.18	0	230-233	-9.6
Aug.19 - Aug.23	1	233-236	-9.6
Aug.24 - Aug.28	0	236-239	-9.8
Aug.29 - Sep.02	0	239-243	-10.2
Sep.03 - Sep.07	0	243-246	-10.6

Sep.08 – Sep12	0	246–249	-11.2
Sep.13 – Sep.17	1	249–252	-12
Sep.18 – Sep.22	1	252–255	-12.8
Sep.23 – Sep.27	0	255–258	-13.6
Sep.28 – Oct.02	0	258–261	-14.4

( 17 March 2019 :Makoto Adachi)