

## The martian climate observed by the amateurs

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### Abstract

In the recent years, as for other planets like Jupiter and Saturn, the quality of amateur observations have been greatly improved, first by more powerful cameras and software but as well by taking advantage of their organization in a global network of observation with leading organizations. They used the most up-to-date scientific theories to analyze their work, and made a few propositions to contribute to scientific knowledge of the planet. We describe the result of all that work on a few topics: dust storms, repeated daily water cloud activity or the influence of solar activity.

### 1. Introduction

Observations of Mars from the ground by amateurs have advantages and constraints that are well known. But as for other planets in the recent years, amateurs improved their strengths to produce data of ever growing quality. They are organized in an international network that allows an almost continuous following of the planet when it is visible. They can use new informatics software that set powerful tools both for imaging and analyzing the data. Amateur groups or associations dedicate their time to a scientific goal: analyzing images and publishing articles to promote the knowledge of the planet as seen from Earth. Among them we will refer especially to the work by the International Society of the Mars Observers (ISMO) and its supporting publication, Communications in Mars Observations (CMO) [1].

### 2. Some results: the cross-equatorial dust storms

The study of data obtained by the Mars global surveyor probe lead to a new theory for the origin of martian dust storm: the cross-equatorial storm [2].

During some martian seasons, dust fronts are generated by storm systems permanently located on near polar low lands (Acidaliu, Utopia, Arcadia) and if some conditions are fulfilled, they can cross the equator to trigger a higher level of dust activity.

During the 2003, 2005 and 2007 oppositions of Mars, several episodes of cross-equatorial storms have been observed from Earth. The task of amateur organizations has been to spread among amateurs the knowledge of this kind of storm that was previously ignored, and to show that almost all the observed storms of those years were actually belonging to the cross-equatorial type. We describe here in detail the episode of October 2005 that has been completely imaged by amateurs from the very early hours of the activity [3]. The study raises a few questions that has been presented during the International Workshop on one Century of Mars Observations (IWCMO) that took place in Meudon, France, in 2009 : why do cross-equatorial storms apparently don't lead to global storms ? Are dust clouds travelling or are they re-generated every morning by air convection [4]?

### 3. Some results: the precise trend of the Tharsis clouds from morning fog to evening orographic

This topic is where the quality of the amateur data is the most enhanced. It combines both the interesting level of resolution obtained from Earth bound telescopes with the very good time coverage offered to terrestrial observers. We describe here the very precise daily trend of the Tharsis late spring cloud activity as observed during the 2012 opposition of Mars. The activity begins with morning radiation fogs that dissipate as the Sun rises; some more remarkable formations of haze can be correlated with the martian relief. Activity shifts from noon to evening to the unequal development of orographic clouds over the martian volcanoes. The WinJupos

software is used to determine the local time of each phenomenon observed and a complete pattern of activity is identified.

#### **4. An ISMO proposition: the link between solar activity and special Mars cloud activity**

In 2012, a very special cloud has been imaged outside the martian apparent disk [5]. The occurrence of this phenomenon recalls older ones that have been imaged previously by amateurs and by the HST. The ISMO proposes to link martian phenomena like this one and triggering solar activity [1].

#### **6. Summary and Conclusions**

There is an interest for the study of the martian weather activity among the amateur world. Amateurs are able to detect fine atmospheric phenomena, and they benefit from the knowledge brought by dedicated associations. They can study the planet during several hours to watch for rapid change in the clouds. They form as well, an area where scientists can broadcast their theories or ask for any supporting observation from the ground.

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