EPSC Abstracts
Vol. 6, EPSC-DPS2011-1526, 2011
EPSC-DPS Joint Meeting 2011

Amateur observations of Saturn's 2010 Great White Spot

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Abstract

The occurrence of huge giant storms on Saturn, called Great White Spots (GWSs), is once per Saturnian's year (29,5 years). For the last GWS (1990, cf. [1]), amateur astronomers did not have the means to image planets as they have nowadays, and could not participate to the study of that rare event. Since Dec. 2010, a new GWS appeared in Saturn's northern hemisphere, around 34° planetocentric latitude. This event have been covered by all amateurs around the world using up to date imaging technology, leading to professional papers using their data and analysis. Their coverage allowed a daily tracking of this GWS evolution.

2. Amateur observations

2.1 Amateur data

Since a few years, amateurs images were used as a complementary coverage for Saturn's storm studies (cf. [2]). Amateur astronomers use mostly reflectors with an aperture from 15 to 40 cm, their image coverage being very good 6 months around Saturn's opposition.

With the 2010 GWS accessible to lower apertures, the number of amateur Saturn images has increased dramatically. From Dec. 2010 to end of May 2011, more than 1500 images from around 130 observers have been available from different sources (French Astronomical Society planetary observations commission, ALPO Japan, IOPW cf [3], ...), most of them showing the GWS, usually in visual wavelengths, in red long pass or near infrared, but also for some advanced observers in UV, Violet or 889nm Methane absorption band.

So many images from observer all around the world, allowed to cover in detail the evolution of the GWS on Saturn almost rotation after rotation.

2.2 Measurements

Winjupos software (cf. [4]) is used by amateur astronomer associations to measure positions, calculate drifts and produce reports on features evolutions on Jupiter and Saturn (cf. [2]). It was used to measure the position of features within GWS, and derive their drift rates in longitude.

3. Results

3.1 Contribution to first phase evolution study

Several findings have been derived from amateur data regarding the birth and evolution of the GWS from Dec. 5th to end of Dec. 2010.

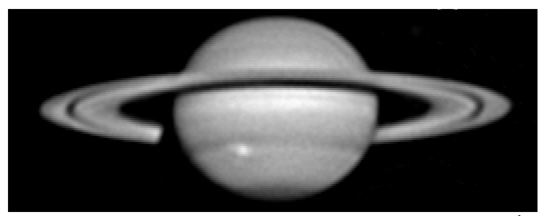

Figure 1: Observation of the storm on Dec. 11th 2010, 6 days after its first observation
(M.Delcroix, red long pass filter)

The GWS first appeared as a small bright spot at a 32°N planetocentric latitude, which drifted in latitude to 34°N latitude on Dec. 14th (latitude of a strong westward jet). The size of the GWS evolved to 15 000 km in longitude by Dec. 22nd. The good coverage from amateur observations and the derived data was used for professional studies (cf. [5], [6])

3.2 Morphology evolution

Amateur images covered very well the whole apparition period, allowing amateurs to watch the change of morphology of the GWS, especially the creation of a south and a north tail east of the head of the storm, its spread over the whole North Tropical Zone until it totally encircled the planet along with its extension in latitude, changing the bands around the zone.

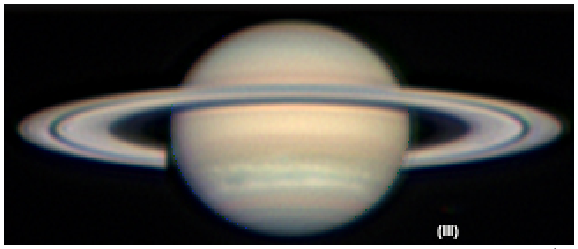

Figure 2: GWS encircling the planet on March 11th 2011 (M.Delcroix, RGB)

Many distinct white and sometimes dark spots/zones could be also distinguished, in the growing head and in the tails.

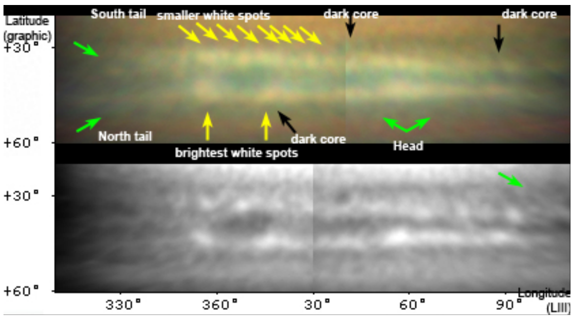

Figure 3: Identification of smaller features on cylindric projection maps of RGB and R+IR images from March 11th 2011 (M.Delcroix, RGB)

3.2 GWS features drifts and zonal wind speeds

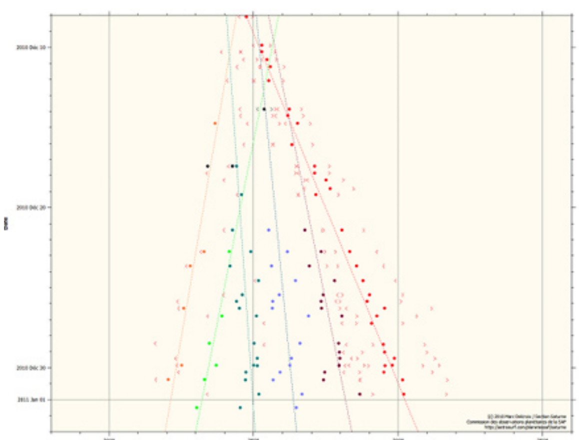

Figure 4: Position GWS spots in longitude (x-axis) over time (y-axis, from Dec. 8th 2010 to Jan 3rd 2011) from amateur images – lines are calculated drift rates

Measurement on amateur data lead to the calculation of features drifts rate in longitude, which could be compared to the known zonal wind speeds as observed by Cassini.

In particular the western most point of the head of the storm drifted from Dec. 10th 2010 to Dec. 22nd 2011 at a rate of 2.82° LIII/day ±0.12°/day.

4. Summary and Conclusions

Saturn's 2010 GWS had an exceptional coverage by amateurs,. their data being used by professional to study this rare event. This coverage was also useful to study the evolution of the GWS globally and of its largest features, bringing an unprecedented detailed tracking of such rare events.

Acknowledgements

We would like to thank all amateurs who have been providing their images for their time and dedication.

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