OBSERVATIONAL AND PHYSICAL PARAMETERS OF TYPE I CHAINS AND THEIR ASSOCIATION WITH FLARES IN X-RAY

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Abstract

We report the analysis of the observational parameters of the two Radio Noise Storms (RNS): one day in the occurrence of the solar flares in X-rays and one day without the presence of the flare. The spectral information about the chains of type I in the events obtained of the network e-CALLISTO (Compact Astronomical Low-cost Low-frequency Instrument for Spectroscopy and Transportable Observatory) revealed in 07/05/2011 (day without flare) bandwidth in the range 5.7 -- 91 MHz, the duration varied from 7 -- 361 seconds, and the frequency drift-rate was in the range -5.2 -- +2.5 $MHzs^{-1}$. Day whit flare (01/08/2011) presented bandwidth in the range 4.7 -- 60 MHz, duration between 6 and 214 seconds and frequency drift-rate varied from -6 to +1.8 $MHzs^{-1}$.

Introdution

Radio Noise Storms (RNS)

- lasting from a few hours to several days;
- non-thermal electrons trapped in a closed magnetic field generate Langmuir waves;
- the Langmuir waves are converted into O-mode radio waves and registered as type I emissions and
- are the signature of acceleration of electrons, as well as the flares.

The observational parameters of a type I storm are [1]:

- bandwidth: few tens of MHz to ≈ a maximum of 100 MHz;
- lifetime (duration): increasing with decreasing frequency and
- frequency drift-rate: in the interval a few tens of $MHzs^{-1}$ to about 200 $MHzs^{-1}$ (positive or negative)

Associated with the storms are found the chains of type I, whose predominant feature is a drift and this drift suggests the displacement of the source through the solar corona.

Storms are related to the active regions (ARs), but not directly to flares [2].

The noise storms is a quasi-continuous electron acceleration and the circumstances of this acceleration is still poorly know [3].

This study presents the observational parameters of chains of type I associated with a storm that took place in one day with the occurrence of flares (01/08/2011), and a day without the occurrence of flares (07/05/2011).

Methodology

The procedure for select the data for this study was:

- identification of days with RNS for the year 2011 (NOAA);
- identification of the presence or absence of solar flares in the days of the RNS (GOES);
- identification of the longer lasting RNS for day with flare (01/08/2011) and without flares (07/05/2011) (NOAA);
- identification of the observational characteristics of the storms (BLEN7M) and
- data analysis.

It was considered day without the flare that presented class flare up to $'B'$.

Results

	01/08/2011 (with flare)	**07/05/2011** (without flare)
Number of the Chains	104	72
Bandwidth [MHz]	4.7 -- 60	5.7 -- 91
Duration [s]	6 -- 214	7 -- 361
Frequency Drift-Rate [$MHzs^{-1}$]	-6 -- +1.8	-5.2 -- +2.5

Table 1: Observational Parameters

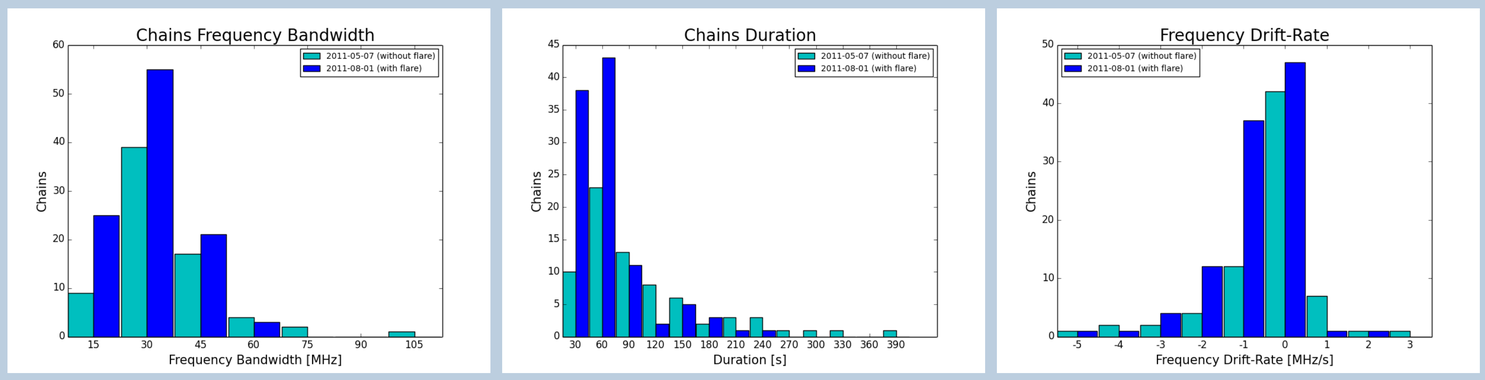

Figure 1: Frequency Bandwidth (left); Duration (center); Frequency Drift-Rate (right)

Conclusion

- condition to sustain RNS ⇒ constant acceleration of electrons;
- day without flare ⇒ small changes in ARs could be enough for generate Langmuir waves converted into radio waves and observed as emission of type I;
- day with flare ⇒ storm is longer-lasting (≈ 2 ×);
- day with flare ⇒ energy released by them can be added to the released by small changes in ARs, increasing its duration;
- observational parameters ⇒ were not found significant differences in days with or without flare and
- because of the limited amount of data analyzed is not possible to say that there are no differences in the observational parameters of the days with and without the occurrence of solar flares in X-rays.

References

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