Explosive Events and Associated Periodicities

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Abstract

We studied an explosive event which occurred in the transition region line O VI, in particular we investigate whether this event produced periodicities in the line intensity during its evolution.

Data

We used data obtained with the Solar Ultraviolet Measurements of Emitted Radiation (SUMER) spectrometer on-board the Solar and Heliospheric Observatory (SoHO) satellite. We observed the event in the O VI $\lambda \sim 1032$ Å line.

Date	:	30 April 1996
Starting Time	:	22:29:01 UT
Observing Time	:	105 mins
Coordinates	:	x=+199 y=+102 measured in arcsecs from Solar center (0,0)

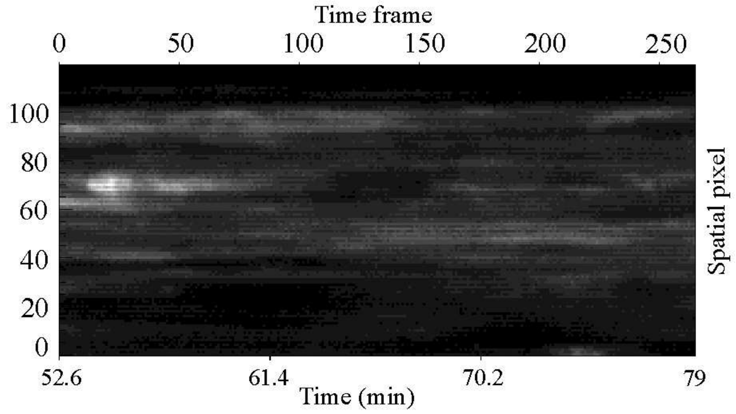

Figure 1. One of the four data sets used. This one is covering the interval between 52.6 and 79 mins (out of the 105 minutes of observations in total).

X-axis corresponds to time (or timeframes). Time Frame exposure = 6.027 sec
Y-axis corresponds to along the slit. Pixel size : 1x1 arcsec

We studied the way in which 2 Network and 2 Internetwork regions evolve with time. The pixels of Fig. 1 corresponding to the above regions are as follows :

Region	Spatial Pixels	Region Type
1	70 - 75	Network
2	77 - 83	Internetwork
3	85 - 90	Internetwork
4	93 - 99	Network

Data Analysis

For each timeframe of the specific spatial region under investigation, we averaged the spectral data spatially. The result was a dataset consisting of spectrum profiles, one for each time frame of every spatial region. A typical profile is given in Fig. 2. A Gaussian fit was applied manually to each profile, allowing us to

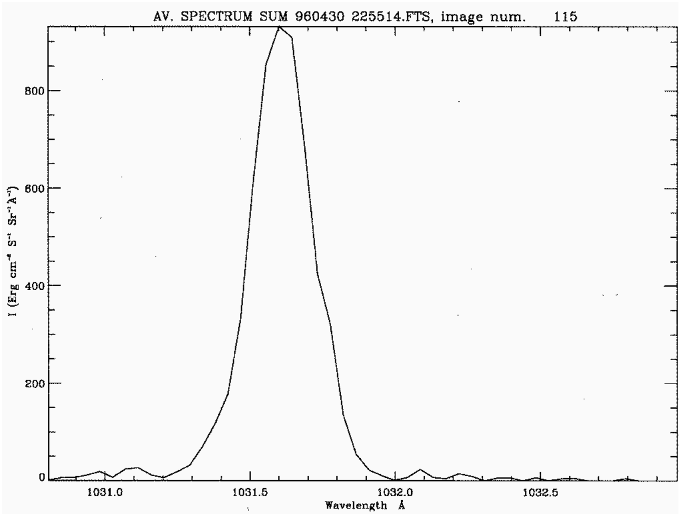

Figure 2. spatially averaged spectrum

determine the position of the line center, the line intensity and the Full Width at Half Maximum (FWHM). Subsequently, using a Wavelet analysis, we searched for existing periodicities during the phenomenon's evolution.

Results

We initially examined the data for the 18 minute period between 44.5 and 62.8 mins. From the line-center shifts we derived the Doppler velocities for Regions 2,3 & 4 of Table 1. These regions exhibit weak periodicities as can be seen in the corresponding figures (Figure 3 a,b,c)

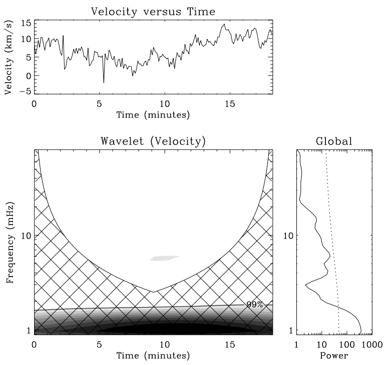

Figure 3a Region 2

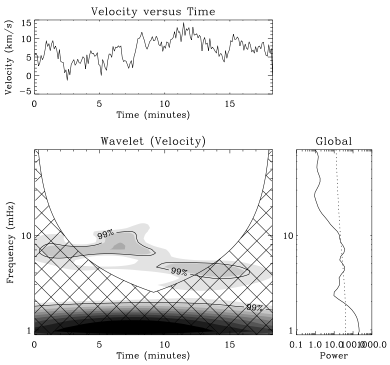

Figure 3b Region 3

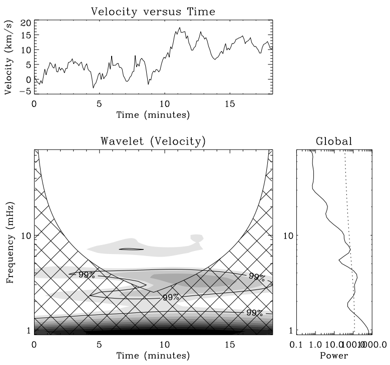

Figure 3c Region 4

Region 1

The blue wing of the O VI line in the spectra of Region 1 turned out to be so broad, that in some cases it extended beyond the spectral window (Figure 4). This behavior characterizes a **turbulent event**, better known as an UV explosive event.

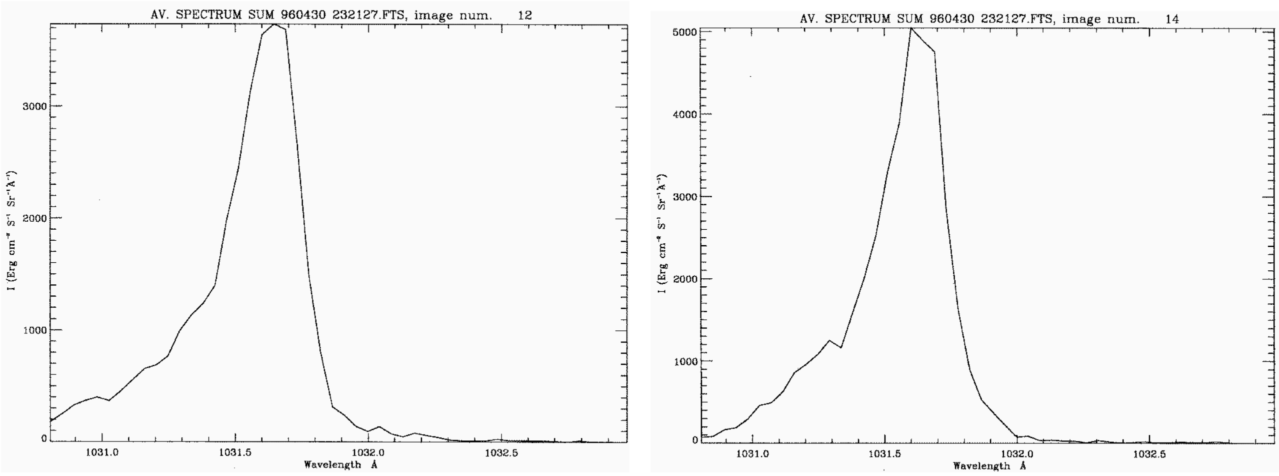

Figure 4

In Figure 5a we plot the changes in the intensity for the line core and the wing. A noteworthy feature is the appearance of a broad wing to the line for the time interval between 5.9 and 11.4 mins of the first study. This corresponds to an interval between 50.3 and 55.7 mins for the whole dataset.

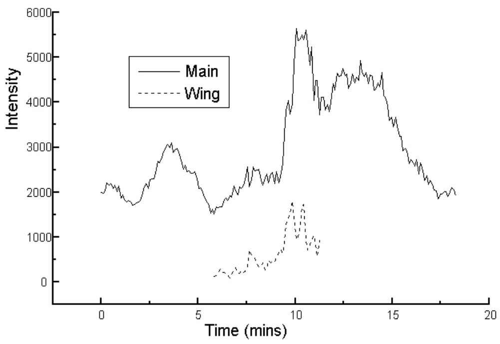

Figure 5a Intensity Profile

In Fig. 5b we plot the changes in position of the line core and wing with time.

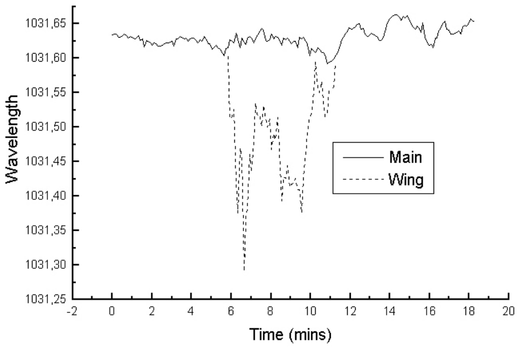

Figure 5b Line Center Position

Explosive events usually occur in the boundaries between network and internetwork cells. Region 1 is such a boundary. Furthermore it exhibits the additional feature of an uncommonly broad wing of the O VI line. Hence, we decided that a more detailed and extensive investigation of this particular region would be necessary.

For this particular region (**Region 1**) we applied the wavelet method for the whole dataset i.e. for the whole 105 mins and not just for 18 mins, and obtained the following results (Figure 6a, b & c) :

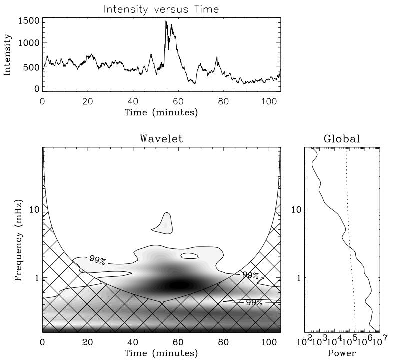

Figure 6a
Intensity Periodicities

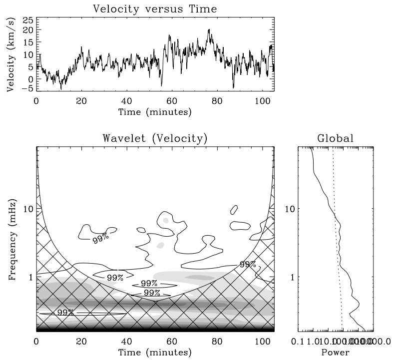

Figure 6b
Velocity Periodicities

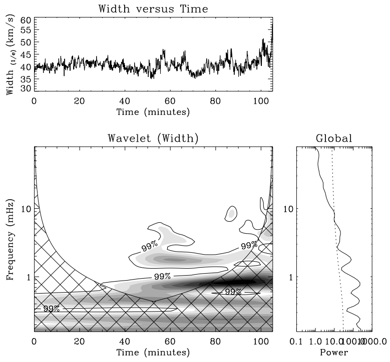

Figure 6c
Width Periodicities

Conclusions

Contrary to our expectations the periodicities found were only weak. Whether this phenomenon is particular to the specific sample investigated, remains uncertain. We must keep in mind that the data correspond to a 105 minute observation of a single phenomenon that may not be indicative of the general behaviour of similar events.

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