ON THE BEHAVIOUR OF A BLINKER IN CHROMOSPHERIC AND TRANSITION REGION LAYERS

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Abstract. Analysis of a blinker, observed with the SUMER/SOHO spectrometer in the C II 1036.34 Å, C II 1037.01 Å, O VI 1037.61 Å lines and in C I continuum, is presented. Results show that the blinker is highly pronounced in both the chromosphere and transition region. Intensities of chromospheric and transition region lines behave similarly although the blinker is more pronounced in the upper transition region.

1. Introduction

Since the late 80-ties the variability of the upper solar atmosphere has been studied on temporal scales of minutes and spatial scales of few arc-seconds using various instruments (e.g., Brueckner and Bartoe, 1983; Dere et al., 1984; Innes et al., 1997; Harrison, 1997; Bewsher et al., 2002; Parnell et al., 2002). Thus Harrison (1997) reported on blinkers to describe EUV brightenings in quiet Sun transition region. The blinkers were most apparent in transition region O II 599 Å, O IV 554 Å and O V 629 Å lines and no relevant brightenings in coronal Mg IX 368 Å and Mg X 624 Å lines were detected. Brković et al. (2001) found significant flux enhancements in the He I 584 Å lines as well. Bi-directional jets, a non-typical feature of blinkers, were also observed in a particular blinker (Tomasz et al., 2003a). An investigation of the response of the chromospheric and the coronal layers to this blinker using TRACE Ly α and Fe IX filtergrams and SUMER H I Ly β spectra showed significant chromospheric effects of the blinker but no emission of the coronal plasma was detected (Tomasz et al., 2003b). Goal of this paper is to investigate the response of the chromosphere and the lower/upper transition region to this particular blinker using C I continuum, two C II and one O VI lines.

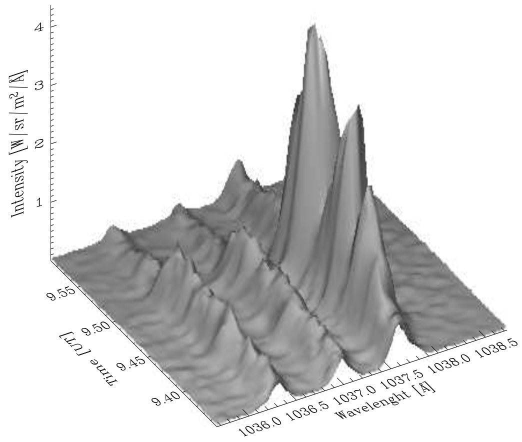

Figure 1. Time evolution of the spectral profiles of C II and O VI lines during the blinker.

2. Observations and data analysis

Spectral profiles of C II 1036.34 Å (CII1) and C II 1037.01 Å(CII2) (3×10^4 K) as well as O VI 1037.61 Å (3×10^5 K) lines were acquired on May 5, 1999, using the SUMER/SOHO spectrometer (Wilhelm et al., 1995). In almost 5 hours 1200 spectra were taken using the 0.3"×120" slit with an exposure time of 14.25 s. Compensation of the solar rotation was applied in order to track the target on the surface. Standard instrumental corrections were applied to the data. Each spectrum was fitted by a triple Gaussian. The line intensity, the Gaussian width and the Doppler shift of all three lines were calculated after subtraction the underlying continuum intensity. The most pronounced transient event in the internetwork – identified as blinker (Tomasz et al., 2003a) – was selected for this study.

3. Results

Three enhancements of the O VI intensity are observed during the entire evolution of the blinker (Fig. 1). They appeared due to 'jumping' of the spectrograph slit for 0.38" correcting for solar rotation (Tomasz et al.,

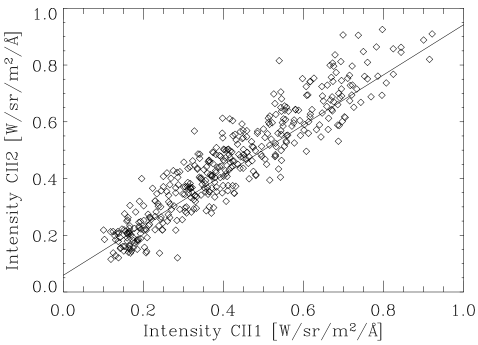

Figure 2. Scatter-plot of the C II line intensities during the blinker. The least-square fit of these data is shown as solid line.

2003a). Line intensities increased gradually only in the C II lines but remarkably in the O VI line. The smallest peak appears at the beginning of the blinker, the intermediate peak reveals a more complicated structure with three small intensity decreases in the O VI line. The third peak is the highest one, which falls off rapidly at the end of the blinker.

The dependence of intensities CII1 on CII2 lines during the blinker tends to be linear (Fig. 2). Deviations from linearity increase with increasing line intensities as their uncertainties grow as the square root of these intensities. A linear trend is expected because both lines are emitted from the identical excited level of the same ion. Therefore hereafter only the C II 1037.02 Å line was used for our analysis. Dependencies of the C II line intensity and the C I continuum intensity on the O VI line intensity during the blinker are shown in Fig. 3. Both dependencies are not linear within the whole range of the measured values: for small values of the O VI line intensity a rapid increase of the C II line intensity was detected; for higher values of the O VI line intensity (≥ 1 W/sr/m^2/Å) only a weak relation was found with few particular pixels for which saturation was deduced; relation of the C I continuum intensity to the O VI line intensity seems to be more linear but large scatter as well as signature of saturation for high O VI line intensities were found.

4. Conclusions

Signatures of the blinker were observed in the chromosphere and as well in the lower and upper transition region. Increase of the line intensities was found to be higher in the upper transition region (O VI) than in the lower transition region (C II) and these increases seem to appear simultaneously. This is in agreement with results of Brković et al. (2003). A small but clear

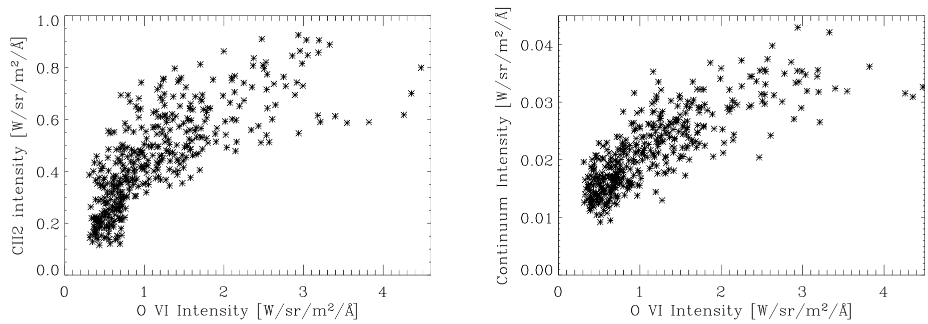

Figure 3. Dependencies of the C II 1037.02 Å line intensity (left panel) and the C I continuum intensity (right panel) on the O VI line intensity during the blinker.

increase was also detected in the chromospheric emission (C I continuum) during the blinker. Therefore it can be concluded that the inter relationship between the upper and the lower transition region and chromospheric plasmas exists during (this particular) blinker. However relations between the studied parameters do not seem to be linear.

5. Acknowledgments

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