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Poster

2. Chromospheric heating and dynamics

Magnetic field variations associated with umbral flashes and penumbral waves

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Oscillations in sunspots are extensively studied phenomenon for last several decades. These studies mostly concentrate on variations in the intensity and Doppler velocities. Fewer observational studies focused on variations in the magnetic field in the photosphere, report contradicting results. Some recent studies have reported variations in the chromospheric magnetic field strength associated to umbral flashes (UFs) and running penumbral waves (RPWs). These changes could be explained by opacity effects or by intrinsic changes in the magnetic field strength. In this study we investigate the origin of these periodic variations of the magnetic field strength by analyzing a time-series of high temporal cadence observations acquired in the Ca II 8542 Å line with the CRISP instrument at the Swedish 1-m Solar Telescope. In particular, we investigate the temporal variations in the magnetic field associated to UFs and RPWs and their relation to opacity changes in the Ca II 8542 Å line. We obtained stratified atmospheric parameters by performing non-LTE data inversion of the Fe I 6301.5 & 6302.5 Å and Ca II 8542 Å spectral using the NICOLE code. Our results indicate that the Ca II 8542 Å line in sunspots is greatly sensitive to magnetic fields at $\log \tau_{500} = -5$ during UFs and quiescence. However this optical depth value does not correspond to the same geometrical height during the two phases. Our results indicate that during UFs and RPWs the $\log \tau = -5$ is located at a higher geometrical height than during quiescence. Additionally, the inferred magnetic field values are higher in UFs (up to $\sim$ 270 G) and in RPWs ($\sim$ 100 G). Our results suggest that opacity changes caused by UFs and RPWs cannot explain the observed temporal variations in the magnetic field, as the line seems to form at higher geometrical heights where the field is expected to be lower.