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Stratification of physical parameters in a C-class solar flare using multiline observations

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We present high-resolution and multiline spectropolarimetric observations of a C2-class solar flare (SOL2019-05-06T08:47). The rise, peak, and decay phases of the flare were recorded continuously and quasi-simultaneously in the Ca II K line with the CHROMIS instrument and in the Ca II 8542 Å and Fe I 6173 Å lines with the CRISP instrument at the Swedish 1 m Solar Telescope. At the flare footpoints, a non-LTE inversion code (STiC) was employed to infer the temperature, magnetic field, line-of-sight (LOS) velocity, and microturbulent velocity. All the observed lines are inverted simultaneously in order to infer the stratification of the inferred parameters in the flaring and non-flaring atmosphere. The temporal analysis of the inferred temperature at the flare footpoints shows that the flaring atmosphere is heated up to ~11 kK in the chromosphere. During the flare peak time, the LOS velocity shows both upflows and downflows around the flare footpoints in the chromosphere. Moreover, the temporal analysis of the LOS magnetic field at the flare points exhibits a maximum change of ~600 G in the chromosphere. After the flare, the LOS magnetic field decreases to the non-flaring value, exhibiting no permanent or step-wise change. We also notice that the Ca ii lines exhibit enhanced sensitivity to the deeper layers of the flaring atmosphere compared to the non-flaring atmosphere. We suggest that a fraction of the apparent increase in the LOS magnetic field at the flare footpoints may be due to the increase in the sensitivity of the Ca II 8542 Å line in the deeper layers, where the field strength is relatively strong. The rest may be due to magnetic field reconfiguration during the flare. In the photosphere, we do not notice significant changes in the physical parameters during the flare or non-flare times. Our observations illustrate that even a less intense C-class flare can heat the deeper layers of the solar chromosphere, mainly at the flare footpoints, without affecting the photosphere.

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