Background

Supra-arcade downflows (SADs) have been observed above flare loops during the decay phase of flare. They appear as radiape-like dark plasma voids traveling towards the Sun. In areas surrounding where they appear, temperatures are often high. We aim to investigate temperature and heating mechanism of SADs. We apply our analysis to the M1.7 flare that occurred on 2012 July 12 and was observed by the Atmospheric Imaging Assembly (AIA) on the Solar Dynamics Observatory. There are many obvious SADs above the arcade during this event in the AIA 131 Å channel. We calculate the differential emission measure and emission measure weighted temperature with AIA data in the region where SADs are concentrated. We find that the temperature in SADs region tends to be lower than the surrounding plasma. We also calculate and was observed by the Atmospheric Imaging Assembly (AIA) on the Solar Dynamics Observatory. There are many obvious SADs above the arcade during this event in the AIA 131 Å channel. We calculate the differential emission measure and emission measure weighted temperature with AIA data in the region where SADs are concentrated. We find that the temperature in SADs region tends to be lower than the surrounding plasma. We also calculate and was observed by the Atmospheric Imaging Assembly (AIA) on the Solar Dynamics Observatory. There are many obvious SADs above the arcade during this event in the AIA 131 Å channel. We calculate the differential emission measure and emission measure weighted temperature with AIA data in the region where SADs are concentrated. We find that the temperature in SADs region tends to be lower than the surrounding plasma. We also calculate and was observed by the Atmospheric Imaging Assembly (AIA) on the Solar Dynamics Observatory. There are many obvious SADs above the arcade during this event in the AIA 131 Å channel. We calculate the differential emission measure and emission measure weighted temperature with AIA data in the region where SADs are concentrated. We find that the temperature in SADs region tends to be lower than the surrounding plasma. We also calculate adiabatic heating in front of the SADs.

Abstract

We use Fourier Local Correlation Tracking (FLCT, Fisher & Welsch, 2008) method to derive velocities in the supra-arcade region. Using corks to track the calculated velocities, we find our velocity results are consistent with the SAD motions of the FLCT, Fisher & Welsch, 2008) method to derive velocities. FLCT calculates cross-correlation of two images to find the most similar points in order to get displacement. There are three parameters in this process: contrast, threshold and low-pass filter (k value), r is Gaussian width. Threshold is set to exclude dim pixels And k value is to remove high spatial frequency noise. We calculate the adiabatic heating of SADs. Adiabatic heating is caused by the compression of plasma and is determined by the following equation: \[ H_a = -\frac{1}{\gamma - 1} \frac{1}{V_a} \cdot v \] (Reeves et al., ApJ, 2017).

Conclusions

1. There is heating in front of SADs and cooling behind them.
2. Adiabatic heating is on the order of about 0.05MK/s.
3. Heating is enough to overcome conductive cooling.
4. SADs help heating plasma.

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