M36a Hydrodynamic Simulation of GOES Soft X-ray Light Curves: Relationship with the Time Scales of Magnetic Reconnection and Thermal Processes

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Soft X-ray light curves obtained by the GOES spacecrafts are widely used to measure the timing and duration of solar flare emission. However, the relationship between the observed light curves and the time scales of magnetic reconnection and thermal processes (radiation, conduction, and enthalpy drainage) is not yet understood. To this end, we use the hydrodynamic simulation code HYDRAD and synthesize GOES light curves for bundles of flare loops with varying lengths. We first simulate light curves of individual loops, which we then use to construct a composite light curve assuming a bundle of loops with ever-increasing lengths as the reconnection event proceeds. The delay of the reconnection start times between the loops is calculated based on the typical speed of flare ribbon expansion (20 km s^{-1}: e.g., Asai et al. 2004). As a result, we find that the times scales of light curves (FWHM duration and e-folding decay time) linearly correlate with the sizes of loop bundles (represented by ribbon separation), which is well consistent with the previous observational results. While the reconnection primarily determines the time scale of light curves, we also show that cooling processes of individual loops directly affect the measured time scales. From the comparison between the simulation and the observation, we conclude that the primary factors controlling the flare time scales are the duration of reconnection and the loop lengths.