2.5-DIMENSIONAL MAGNETOHYDRODYNAMIC SIMULATION OF A CORONAL MASS EJECTION AND A GIANT CUSP-SHAPED ARCADE FORMATION

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Coronal mass ejections (CMEs) are one of the most spectacular phenomena in the solar corona. Recent observations revealed that CMEs are associated with either solar flares or giant arcade formations, in which magnetic reconnection is thought to play an essential role. Considering these observations, Shibata (1996; 1999) suggest that CMEs, filament eruptions, flares/giant arcades can be understood in a unified view: mass ejection and magnetic energy release via magnetic reconnection.

In this study, in order to clarify the evolution process of CMEs and giant arcades, we performedmagnetohydrodynamic (MHD) simulations of CMEs and associated giant arcade formations. In the simulation 2.5-dimensional time-dependent resistive MHD equations wich include anisotropic heat conduction are solved.

Two cases of the simulation are studied: with and without heat conduction. Comparing between the results of the two cases, we found that the reconnection rate in the conductive case is a little higher than that in the adiabatic case and that the temperature of the loop top is consistent with the theoretical value predicted by the Yokoyama-Shibata scaling law. The dynamical properties such as velocity and magnetic field are similar in the two cases, whereas thermal properties such as temperature and density are very different. In both cases, slow shocks associated with magnetic reconnection propagate from the reconnection region along themagnetic field lines around the flux rope, and the shock fronts form spiral patterns. Just outside the slow shocks, the plasma density decreases greatly. The soft X-ray images synthesized from the numerical results are compared with the soft X-ray images of a giant arcade observed with the Soft X-Ray Telescope aboard Yohkoh; it is confirmed that the effect of heat conduction is significant for the detailed comparison between simulation and observation. The comparison between synthesized and observed soft X-ray images provides new interpretations of various features associated with CMEs and giant arcades.