M33a Data-driven MHD Simulation of Long-term Temporal Evolution of AR 11283

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Solar eruptive events such as flares are caused by the release of magnetic energy accumulated in the solar atmosphere. They occur in solar active regions (ARs) where strong magnetic field is present. It is empirically known that huge flares are more likely to occur in the delta-type ARs. However, the physical mechanism of energy build-up and release in the delta-type ARs have not been understood completely. The data-driven MHD simulation method introduced in Kaneko et al. (2021) used the time series photospheric magnetic field data as the bottom boundary condition, which can follow more realistic temporal evoultion of coronal magnetic field in response to the temporal change of observational magnetic field. In this study, we investigated a long-term temporal evolution of magnetic fields in AR 11283 which produced multiple M and X class flares. We conducted a data-driven MHD simulation using times series HMI vector magnetic field data from 2011 Sep. 4 19:48 UT to 2011 Sep. 6 05:48 UT which include the M5.3 flaring phase. As a result, we reproduced the flux rope formation and the growth of an MHD instability near the flaring region. The onset time of the instability in the simulation was close to the onset time of the M5.3 flare in the observation (2011 Sep. 6 01:48 UT). We also investigated the accumulation and release rates of magnetic energy and the structure of magnetic twist flux density over the flaring region.