

Data-driven MHD Simulation of Solar Active Region NOAA 11283

*康 永玖¹、金子 岳史¹、草野 完也¹

*Yeongmin Kang¹, Takafumi Kaneko¹, Kanya Kusano¹

1. 名古屋大学宇宙地球環境研究所

1. Institute for Space-Earth Environmental Research

Solar eruptive events such as flares or prominence eruptions are caused by the release of magnetic energy accumulated in the solar atmosphere. They occur in the solar active regions (ARs) where the strong magnetic fields are present. Focusing on flare events, not all of the energy accumulated in AR is released with a single flare. It is still difficult to predict the exact value of released energy. Moreover, the physical mechanism to determine the ratio between the released energy and the stored magnetic energy is unclear because the coronal magnetic field cannot be observed directly. MHD simulation is a powerful method to investigate and understand the evolution of the coronal magnetic fields. In this study, we conducted an MHD simulation on AR11283 where multiple M and X class flares have occurred. The objective of this study is to know about the energy release rate of these two flares and the physical mechanism to determine the rate. We applied a newly developed data-driven simulation method in which the time series observational photospheric magnetic field data are introduced as the bottom boundary condition to the MHD simulation. The SDO/HMI vector magnetic data of AR11283 were used. As a result, the dynamic evolution of the coronal magnetic fields was reproduced. We investigated the energy build-up and evolution of trigger magnetic fields leading to the sudden energy releases.

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