Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PEM021-25 Room: Function Room A Time: May 25 09:00-09:15

Review of modeling study on the solar flare of 2006 December 13

Kanya Kusano[1*]

[1]STEL, Nagoya Univ.

The GOES X-class solar flare occurred on 2006 December 13 was a spectacular event and gave us a great opportunity to investigate the physical processes of space weather. In particular, the data observed by Hinode satellite is so accurate that it is applicable even as the boundary condition of numerical simulation. Here, in this paper, we will review what the modeling studies on this event revealed particularly for the onset mechanism of solar flare and coronal mass ejection (CME) on the following three different topics. First, we argue about the reliability and the validity of nonlinear force-free field extrapolation using the Hinode data. Although the methodology is not yet established to derive the equilibrium magnetic field in the solar corona, the nonlinear force-free extrapolation is an efficient way to analyze the three-dimensional structure of coronal magnetic field. Second, we will represent the results of magnetohydrodynamic (MHD) simulation driven by the data, and demonstrate how useful is the data-driven simulation is for the study of flare trigger problem. In fact, we will discuss on the hypothesis that a small flux emerging might work as the trigger of flare onset, based on our three-dimensional MHD simulations. Third, we will quantitatively analyze the liberation of magnetic energy in the active region and the propagation of magnetic helicity out of it. The simulation clearly indicated that not only the plasmoid ejection but also the wind-off motion of ejected flux tube substantially contributed to the transmission of free energy from the flaring site to a large-scale loop, which is a candidate of the origin of CME ejector. All the results exemplify that the numerical modeling driven by the data is powerful tool for the study of solar eruption.

Keywords: solar flare, modeling, MHD, simulation