Interlocked Modeling of Solar Terrestrial System toward the Basic Study of Space Weather Prediction

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The numerical modeling of solar flares and coronal mass ejections (CME) is crucially important for the understanding of solar terrestrial system as well as for the forecasting of space weather influence. Based on the Creative Scientific Research, *The Basic Study of Space Weather Prediction*, we are aiming to develop a holistic modeling framework of space weather phenomena as a multi-institution collaboration in Japan.

Our numerical model is constituted by the several models, each of which are specialized to different region of the solar terrestrial system. The solar active region model simulates the onset of flare and the launching of CME based on photospheric magnetic field data observed by HINODE Solar Optical Telescope (SOT). The global corona model simulates the acceleration and formation process of CME, and the inter-planetary space model can track an interplanetary CME (ICME) to the orbit of the earth. Finally, the magnetospheric model is used to evaluate the impact on Earth's magnetic field.

In this paper, we will present the basic algorithm of our model as well as show the first result of the modeling experiment, in which we have chosen the X-class flare occurred in the active region NOAA10930 on Dec. 13, 2006 as a target event, and tried to numerically reproduce the solar terrestrial phenomena caused by that.

First, we can successfully performed the first-ever data-driven simulation of CME launching using the vector magnetogram observed by HINODE/SOT as the boundary condition of the active region model. Second, the global corona model and the interplanetary model can well track the formation and the propagation of ICME to the orbit of the earth. Finally, based on the results, we will discuss about the predictability of CME onset as well as about the mechanism of structural evolution of CME during the propagation through the solar corona and the interplanetary space.