

Validation of EUV dynamic spectra and their impact on the ionosphere

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Solar flares suddenly emit strong multi-wavelength electromagnetic emissions. Among these emissions, soft X-ray and extreme ultraviolet (EUV) emissions cause the sudden ionospheric disturbance (SID) and effect on radio communication (Dellinger 1937). We need soft X-ray and EUV flare spectra for predicting SID, however, EUV flare spectra observation with high spectral and temporal resolution are very limited, the numerical model for predicting EUV emissions is needed. One of them is the Flare Irradiance Spectral Model (FISM; Chamberlin et al., 2008). Although FISM is the most widely used model now, this model has some problems such as uncertain physical processes due to empirical model.

Hence, we are trying to construct new prediction model of flare EUV dynamic spectra which can explain simple physical models in flare loop (Imada et al., 2015; Kawai et al., under review). In this model, we use the hydrodynamic simulation of the solar flare model given in the CANS (Coordinated Astronomical Numerical Software) 1D package and the CHIANTI atomic database (Del Zanna et al., 2015). First, by using CANS1D, we calculate the time evolution of density and temperature of a single flare loop whose loop length is estimated from observed flare ribbon distance. Then we obtain the flare (X-ray and EUV) spectra of the simulated coronal loop by using the CHIANTI atomic database. Using this model, we reproduced EUV dynamic spectra for some flare events, and compared with observed EUV spectra by SDO/EVE. As a result, we found that our calculation results clearly reproduced most of the EUV lines on short wavelength during flare. Moreover, we found that our model well reproduce the total EUV flare energy especially at wavelengths shorter than 14 nm.

Furthermore, in order to examine the effect of flare EUV emission on the Earth's ionosphere, we input our calculated flare EUV spectra to the Earth's atmospheric model GAIA (Ground-to-Topside Model of Atmosphere and Ionosphere for Aeronomy; Jin et al., 2011), and reproduced the ionospheric response.

In this presentation, we will discuss the physical parameters that affect flare EUV spectra and the effects of flare emissions on the Earth's ionosphere.

Keywords: Solar Flare, UV emission, X-ray emission