Space Weather Modeling From Interplanetary Space to Earth on the Solar Flare Event in December 2006

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One of the important issues on space weather study is to make a physical model and to simulate a series of phenomena from origins of disturbances in the sun to the responses of magnetosphere and ionosphere in earth. Under the Creative Scientific Research, The Basic Study of Space Weather Prediction, we have firstly tried such a series of modeling on the solar flare event in December 13-16 2006 and the geomagnetic storms. Following the space weather modeling (1) from the sun to solar wind, we present the space weather modeling (2) from the solar wind to the magnetosphere-ionosphere response in the earth. Large interplanetary disturbances were generated in association with the strong solar activity of X-class flare. Characteristic features of the event are two X-class flares on 12/13 and 12/14 in the interval of rather quiet solar activity, north-south fluctuation of IMF and a long duration of southward IMF from 12/14, arrival of a high speed solar wind during the time for southward IMF. Propagation of the disturbances from the sun to the earth is simulated by using 3D global solar wind model following evolution of solar disturbances. A 3D global MHD simulation of interaction between the solar wind and earth's magnetosphere is carried out by using the output of the 3D solar wind simulation. Moreover, magnetosphere-ionosphere coupling, ionosphere convection in the polar region, energetic particles in radiation belts and precipitation of energetic particles due to wave-particle interaction are discussed in association with geomagnetic storms generated by the solar flare event.