

## New perspectives of space weather forecast

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The study of space weather forecast has a great importance since numerous satellites are orbiting around the earth providing necessary infrastructure to our society, and also the international space station cruises around the earth carrying astronauts who conduct various observations and experiments in the space. To prevent accidents caused by such as spacecraft discharge, destruction of electronic devices by high-energy particles, radiation exposure of the astronauts, the study of the space weather forecast is quite significant.

In order to achieve this goal, it is necessary to conduct researches on explosive events such as CMEs or solar flares on the sun, the nonlinear evolution of the solar wind and a resultant shock formation, the interaction between the solar wind and the magnetosphere, the driving mechanisms of substorms and magnetic storms, production of high-energy particles in the inner magnetosphere. Also, various elementary processes associated with those phenomena, such as the magnetic reconnection, Kelvin-Helmholtz instability, the cyclotron instability, other various plasma instabilities, and interactions between waves and particles should be studied.

Currently, we are promoting the development of Geospace Environment Modeling System for Integrated Studies (GEMSIS) aiming at realizing an accurate space weather forecast at our division of STE laboratory as one of the flagship projects of the laboratory.

However, to make the forecast of the space weather far more accurate, it is necessary to accelerate the studies on the predictions of the solar wind evolution, the fluxes of the solar proton and cosmic rays, the auroral activity, the ring current intensity, the flux of radiation belt particles, and more fundamentally the solar dynamo, appropriately employing advanced technologies in statistical mathematics as well as super computing.

In the new division for integrated studies which will be constructed at the time of newly organizing the laboratory, we will try not only to establish firm and universal methods of space weather forecast, but also to make innovative findings and establish a new guiding principle in the field of space and earth environmental study.

Keywords: space weather forecast, sun, magnetosphere, geospace, elementary plasma process