Development of WASAVIES: WArning System of AVIation Exposure to Solar energetic particles

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We report our latest research activities for a challenging space weather forecast system, as a product of a solar energetic particles (SEP) prediction workshop held on 29 June 2010 at Tokyo Tech. The prediction of SEP is very important to mitigate the space weather hazard toward increasing solar activities, and is also an ultimate problem for physics-based modelers because of the hybrid nature of MHD fluid and particles. We are developing a two-step forecast system called Warning System of AVIation Exposure to SEP (WASAVIES) as follows: 1) Detect ground level enhancement (GLE) onset by multiple ground-based neutron monitors [Kuwabara et al., Space Weather, 2006] and obtain the GLE, solar wind, and flare parameters to publish the preliminary forecast within one hour after X-ray flare detection. At this stage we have only a small number of necessary parameters, and available forecast may be limited about the anisotropic GLE dose map and the maximum level of SEP fluence during coming 7 days. 2) Within 6 hours after the flare onset, automatically obtain the CME parameters such as speed and direction parameter to predict the CME driven SEP profiles during the 7 days in the energy range from 10 MeV to 10 GeV. The modified MHD Cube model [Kataoka et al., J. Geophys. Res., 2009] calculates the time-varying CME shock strength and the magnetic field connectivity to Earth for a particle model to estimate the SEP spectra, and also estimate the weekly profiles of solar wind parameters which are necessary inputs for T05 storm model to estimate the cutoff latitudes. Using the SEP energy spectra and cutoff latitudes, the aviation dose map are evaluated by modified PARMA model [Sato et al., Radiat. Res., 2008]. The real-time data of SEP, solar wind, and geomagnetic activities are also utilized properly. In the presentation, we further discuss some other possible utilization of real-time observations of SEP electrons, Type II and Type III burst, and EIT waves etc in possible collaboration with other institutes.