Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

PEM27-P01 Room:Convention Hall Time:May 21 17:15-18:30

Cosmic-ray exposure during aircraft operation

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Effects of exposure to cosmic-ray during aircraft operation, are divided into the exposure of the crew and operational impact.

International Commision on Radiological Protection(ICRP) issued a recommendation to include occupational exposure of aircrew with a jet operated exposure from natural radiation source in 1990.

Radiation Council consists of the Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Health,Labour and Welfare, the Ministry of Land, Infrastructure,Transport and Tourism estabilised "Guidelines for management of aircrew exposure to cosmic radiation" in 2006.

In response to this, airlines manage doses on each aircrew using Japanese Internet System for Calculation of Aviation Route Doses(JISCARD) developed by National Institute of Radiological Sciences(NIRS).

Examples of operational impacts are, communication difficulty on short wave due to Dellinger Phenomenon during international flight, and rewrite the data in memory known as soft error on electronic equipment onboard aircrafts.

Use of Space Weather forecast for major solar flare, how to provide the information to aircrew and how to make decisions are urgent consideration.

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PEM27-P02 Room:Convention Hall Time:May 21 17:15-18:30

Particle acceleration in solar flares and propagation of high energy particles to the Earth (II)

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Large amount of particles can be accelerated to relativistic energy in association with solar flares, and sometimes these penetrate to the Earth's atmosphere. These particles are observed by ground-based detectors (e.g., neutron monitor). Such phenomena are called Ground Level Enhancements (GLEs).

Solar flares are observed by detecting their electromagnetic radiations. Hard X-ray, and radio and line gamma-ray observations give information of accelerated electrons and ions, respectively. High energy particles which reach the Earth and penetrate to the ground are observed by neutron monitors. We can predict the energy spectrum of high energy particles penetrating the Earth's atmosphere by comparing neutron monitor measurements with electromagnetic radiations. This is beneficial for the quantitative prediction of radiation dose.

There are two possible candidates for high energy particle production: the solar flare itself; and/or the CME-driven shocks, where by the flare-produced "seed" particles are re-accelerated by the CME-driven shocks. However, detailed acceleration mechanisms are still not understood, and should be modeled. For predicting the energy spectrum of energetic particles at the Earth, it is important to understand quantitatively the population of accelerated particles during the flare.

In this paper, we discuss the population of accelerated particles produced in solar flares, and the prediction of the energy spectrum of high energy particles (especially solar neutrons) in the Earth's atmosphere during GLE events. We also inspect an M8.7-class flare of 23 Jan 2011 using solar data; this event was the source region of a large SEP event.

Keywords: solar flare, particle acceleration

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PEM27-P03 Room:Convention Hall Time:May 21 17:15-18:30

Simulations of Diffusive Shock Acceleration with AMR Scheme and SDE Method

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It is believed that coronal mass ejection driven shock waves can produce energetic particles by diffusive shock acceleration. We model this mechanism by the following 2 steps: a study of the shock propagation and a study of acceleration at the shock. The shock wave is realized by a hydrodynamic simulation with an Adaptive Mesh Refinement(AMR) scheme. The acceleration of particles is simulated by Stochastic Differential Equation (SDE) method. We showed, in COSPAR-2008, that the treatment was technically established. However, the region used in the hydrodynamic simulation was only upto the Earth orbit. Therefore, the component of energetic particles reflected at the shock propagating out of the Earth orbit was not taken into account and the flux of energetic particles was less than expected.

In this report, we show the spectra of particles obtained by using the results for the simulation in which the simulation box covers the orbit of 2.3AU and discuss contribution of the shock wave which has passed.

Keywords: shock acceleration, high energy particle, Adapted Mesh Refinement, Stochastic Differential Equation

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PEM27-P04 Room:Convention Hall Time:May 21 17:15-18:30

Effects of 2012 solar energetic particle events measured near multiple planets in the inner solar system

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The solar energetic particles (SEPs) observed at the Earth exceed 6000 PFU at >10 MeV protons in January 23 and March 7 associated with M8 and X5 flares and associated coronal mass ejections, respectively. The SEP flux is the largest in the last 8 years. Mercury, Venus, and Mars are on the same side of the Sun, making particularly the March event very unique to understand the radiation effect at multiple planets and to understand the SEP distribution itself via the comparison of the observations and models at different positions. Indeed, there are operating spacecrafts, not only near the Earth, but near Mercury, Venus, and Mars in addition to Stereo spacecrafts which provide information on the environment of interplanetary space. In this presentation, we overview the 2012 solar flare events and report the observations by spacecrafts (Mars Express, Venus Express and others) at multiple planets.

Keywords: Solar Flare, Energetic particle event, Inner solar system