

44th SYMPOSIUM ON SAFETY AND QUALITY IN SPACE ACTIVITIES (D5)  
Space Weather Prediction and Protection of Space Missions from Its Effects (3)

Author: Prof. Mengu Cho  
Kyushu Institute of Technology, Japan, cho@ele.kyutech.ac.jp

Mr. Koya Saito  
Kyushu Institute of Technology, Japan, i349521k@tobata.isc.kyutech.ac.jp

DATA ANALYSIS OF THE POLAR PLASMA ENVIRONMENT FOR SPACECRAFT CHARGING  
ANALYSIS

**Abstract**

Polar Earth orbit (PEO) is a peculiar orbit where energetic auroral electrons and low-temperature ionospheric plasma coexist. There is a risk of charging and subsequent arcing in PEO. The plasma environment, namely its density and energy, is the crucial parameter for the spacecraft charging analysis. We statistically analyzed the environmental condition in PEO using the data of auroral electrons and thermal ions measured by DMSP (Defense Meteorological Satellite Program) satellites. The energy spectrum of energetic electrons were fitted by double Maxwellian using Genetic algorithm. Using the derived distribution function, the aurora current density and the average energy were derived. Probability of a given combination of current densities of auroral electrons and thermal ions was derived. The correlation between the energy of the auroral electrons and the thermal ion density is also classified. Combinations of the plasma parameters used by a spacecraft charging simulation software was identified and database regarding the probability of occurrence of each combination was formulated. Spacecraft charging analysis was carried out to derive a number of electrostatic discharge events expected for one year in polar orbit using the statistical database.