Analysis of spacecraft surface charging events in MEO

Tsuyoshi Teraoka[1]; Masao Nakamura[2]; Iku Shinohara[3]; Yoshizumi Miyoshi[4]; Kazushi Asamura[5]; Satoshi Kasahara[6]; Shoichiro Yokota[7]; S.-Y. Wang[8]
[1] Osaka Prefecture Univ.; [2] Dept. of Aerospace Eng., Osaka Prefect. Univ.; [3] ISAS/JAXA; [4] ISEE, Nagoya Univ.; [5] ISAS/JAXA; [6] The University of Tokyo; [7] ISAS; [8] ASIAA, Taiwan

Analysis of spacecraft surface charging in the medium earth orbit (MEO) is important for spacecraft designs and operations, because surface charging sometimes cause spacecraft anomalies due to discharging arcs. However, the plasma environment which induces the spacecraft surface charging in MEO was not so well studied, since it was difficult to measure the ambient plasma accurately due to contamination by high energy particles of the radiation belts. Therefore, we use the data of the Van Allen Probe (VAP) and the ARASE satellite, which are designed for scientific missions to measure wide energy range plasma and radiation environment accurately. Since their almost all surfaces are conductive and electrically tied together with their chassis, their surface charging potential equals their absolute charging potential. We study the surface charging events using the proton flux data of the Helium Oxygen Proton Electron (HOPE) onboard VAP. We find ion flux peaks accelerated by spacecraft potential in the spin averaged differential proton flux data and estimate the spacecraft potential. The results show that most of the surface charging events (spacecraft potential < -50 V) occur in the midnight-to-dawn sectors and intense charging events (spacecraft potential < -1,000 V) occur mainly in the Earth’s shadow. We also survey spin averaged differential proton flux data of the Low energy Experiments (LEP) data of the ARASE satellite and find surface charging events. We will discuss the environment which induces these charging events in MEO.