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#中村 雅夫¹⁾, 長澤 恒聖¹⁾

⁽¹⁾ 大阪公大・工・航空宇宙

Surface charging plasma environment modeling in the medium earth orbit

#Masao Nakamura¹⁾, Kosei Nagasawa¹⁾

⁽¹⁾Dept. of Aerospace Eng., Osaka Met. Univ.

The spacecraft surface charging sometimes causes spacecraft anomalies due to electrostatic discharging (ESD). It is important to develop an empirical surface charging plasma environment model in medium earth orbit (MEO). We use electron and proton fluxes from a few eV up to 50 keV measured by the Helium Oxygen Proton Electron (HOPE) and spacecraft potential measured by the Electric Field and Wave instruments (EFW) on the Van Allen Probes from 2012 to 2019. Since the Van Allen Probes are well-designed scientific satellites, their severe charging events are only observed in the eclipse region because of the lack of the photoelectron emission. Therefore we evaluate charging plasma environment features for typical satellites in the daylight and eclipse regions and statistically model their distribution as a function of MLT and L value. The distribution models make it possible to estimate the charging occurrence rate in MEO.