Spatial distribution of radiation belt protons deduced from solar cell degradation of the Arase satellite

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Solar cells mounted on any satellites are susceptible to effect of abundant space radiations. Solar cells on the Arase satellite orbiting in the inner magnetosphere degrade due to trapped protons with energies of more than 6 MeV. In the current study, we try to deduce spatial distribution of the radiation belt protons from analysis of output variation of the SAP (Solar-cell Array Panel) of the Arase satellite.

Analysis of the SAP data from launch (20 December, 2016) to 2017 year-end showed a clear degradation that could be attributed to trapped protons. Radiation dosage was determined from Voc (Open circuit voltage) variation of the solar cells and we made comparison with those expected from various distribution models (AP8MAX, AP9MEAN and CRRESPRO quiet) of trapped protons. We found a general agreement with degradation expected from the distribution models, which demonstrates that the trapped protons are major cause of the degradation. However, there remains a little difference in expected radiation dosage from the model calculations. The Voc is also sensitive to temperature. We modify the models, including temperature variation, to minimize the difference and discuss the spatial distribution of trapped MeV protons.

Keywords: The Arase satellite, Proton radiation belt, Solar cell degradation

