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Multispacecraft observation of solar particle events contribution in the space radiation exposure on electronic equipment at different orbits

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In the paper we present processing results of flight data from different spacecrafts and different orbits during different solar proton events in 2012. We use data from the elements of Roscosmos space radiation exposure on electronic components (dose sensors developed by Institute of Space Device Engineering and placed onboard of more than 20 spacecraft on navigation orbit), from dose sensors developed by Skobeltsyn Institute of Nuclear Physics Lomonosov Moscow State University and placed onboard International Space Station (ISS), and from spectrometers placed onboard Electro-L and Meteor-M spacecrafts, functioning at geostationary and polar orbits correspondingly (the data are been supplying in the Roscosmos Monitoring System by Fedorov Applied Geophysics Institute).

We determined solar proton fluxes for different events at geostationary orbit according to measurements of Electro-L and GOES spacecrafts as well as at navigation and ISS orbits with taking into account geomagnetic cutoff rigidity for these orbits. Also we determined solar proton flux at polar orbit according to measurements of Meteor-M using algorithm, described in the previous paper.

We calculated absorbed dose values from solar proton exposure for different events in different orbits using real sensors shielding configurations and compared with experimental ones during these events. We show that in some cases solar proton dose exposure exceed average value in several times as for low-Earth orbit ISS as for navigation orbit (and consequently electronic equipment failure if accumulated dose is close to its failure level). But if solar proton event is accompanied by high-energy electron flux increasing event, the latter gives more contribution in absorbed dose than the former. We also calculated of single events rate values for different events in different orbits using measured and model solar proton spectra.

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