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FLIGHT EXPERIENCE IN SPACE WEATHER MONITORING USING CUBESATS

Abstract

Bauman Moscow State Technical University, in collaboration with the Orbital Systems company and the Institute of Applied Geophysics of Roshydromet, developed two 6U-XL CubeSat type satellites Hors 1 and Hors 2. These satellites were launched into orbit on June 27, 2023 under the "UniverSat" program. The satellites are equipped with miniature heliogeophysical equipment GAMVEKI - charged particle detectors. These instruments are designed for monitoring space weather, specifically obtaining data on the electron and proton fluxes spatial structures (density) within the radiation belts using Geiger-Müller tubes. The nanosatellites were launched piggyback with the spacecraft Meteor-M 2-3 into a circular polar orbit with 550 km altitude. Charged particles monitoring under various heliogeophysical conditions at this orbit is necessary for real-time radiation conditions prediction at manned flights altitudes, as well as for assessing the solar activity impact and refining the low Earth orbit satellites' active lifetime forecast. Data obtained from GAMVEKI complement information from target meteorological satellites at

orbits around 800 km. Special scientific interest lies in information about particle flux over the Brazilian anomaly. To obtain reliable data, we calibrated the detectors. The calibration method is based on the results of calibrating similar detectors used on federal meteorological spacecraft. Based on the collected data, we made a daily dose accumulation onboard the spacecraft graph. The measured parameters were compared to the numerical model and showed a slight deviation from the model. For instance, during monitoring, GAMVEKI instruments recorded proton events on January 29, 2024, February 10, 2024 and others. The satellites confirmed the validity of their use in researching heliogeophysical conditions in near-Earth space. This is a practical outcome of the university's interaction with the Institute of Applied Geophysics of Roshydromet - the data-consuming organization interested in this field. Currently, the satellites are in continuous operational monitoring mode.