GC2024-STP072

Dynamics of the Earth's high-latitude magnetosphere during a magnetic storm on 02.27.2023

Alina S. Manina[1] , Vladimir V. Kalegaev[1] , Vera D. Nikolaeva , Roman E. Sarajev[1] , Alexandra R. Ivanova[1] , Natalya A. Vlasova

[1] Московский государственный университет им. М.В. Ломоносова

alinmanina73@yandex.ru

The Earth's magnetosphere is exposed to the effects of the interplanetary medium. Changes in the parameters of the solar wind and the interplanetary magnetic field lead to geomagnetic disturbances, as a result of which the structure of the magnetic field lines and the dynamics of charged particle fluxes change. The most striking manifestations can be observed in the high-latitude magnetosphere. Charged particle fluxes can serve as a tool for studying the topology of the magnetic field.

24.02 - 25.02.2023 a series of explosive processes were observed on the Sun, as a result of which two solar proton events were recorded in near-Earth space. The coronal mass ejection from 24.02 arrived in near-Earth space on 26.02, the shock wave preceding it was registered at ~18 UT. A strong magnetic storm with |Dst|max~140 nT occurred in the magnetosphere.

The simultaneous presence of different populations of charged particles (solar energetic particles [2], energetic electrons of the outer radiation belt and auroral particles precipitating in the area of the auroral oval [1]) create a unique opportunity to study the structure and dynamics of the high-latitude magnetosphere during a magnetic storm. The results of a study during a magnetic storm on 02.27.2023 of the dynamics of the high-latitude boundaries of the main magnetospheric structures: the penetration regions of solar protons with energies of 1-100 MeV and 3-10 MeV are presented; areas of precipitation of auroral electrons and ions with energies ~30 eV to 30 keV; positions of the capture boundaries and maximum electron fluxes with energies >300 keV and >700 keV of the Earth's outer radiation belt. The work was performed on the basis of experimental data on charged particle fluxes obtained on the low-orbit polar satellites Meteor-M2 and DMSP in the evening and morning sectors local time.

It is found that during the main phase of the magnetic storm, the boundaries of all magnetospheric structures shift to lower latitudes, while a strong morning-evening asymmetry is observed [3]. A stronger boundary shift in the evening sector compared to the morning hours is associated with the development of an asymmetric ring current in the main phase of the storm. During the recovery phase of the magnetic storm, the position of the maxima of the electron fluxes of the outer radiation belt shifts to lower latitudes, and the electron capture boundary of the outer radiation belts shifts to higher latitudes.

The research was carried out within the framework of the scientific program of the National Center for Physics and Mathematics (project "Nuclear and Radiation Physics").

We thank all the researchers who provide their data on proton fluxes and solar wind parameters via the Internet. Experimental data obtained at NASA's Goddard Space Flight Center: on solar wind and interplanetary magnetic in OmniWeb: High Resolution OMNI [http://omniweb.gsfc.nasa.gov/form/omni_min.html]; on solar proton fluxes in CDAWeb: the Coordinated Data Analysis Web.

[1] Ivanova A. R., Kalegaev V. V. Dynamics of the night boundaries of the auroral oval during a magnetic storm 27-29.V.2017 // Space Research.— 2022. — vol. 60, № 5. — pp. 357–367.

[2]Tverskoy B.A., Darchieva L.A., Ivanova T.A., Panasyuk M.I. Penetration of solar cosmic rays into the Earth's magnetosphere // V Leningrad International Seminar, 1973, Proceedings, pp. 365-385, 1974

[3]M., & Reistad, J. P. (2023). Auroral oval morphology: Dawn-dusk asymmetry partially induced by Earth's rotation. // Journal of Geophysical Research: Space Physics, 128, e2023JA031345.