Multi-satellite observations of the high-latitude ionosphere structure on March 22, 1979 storm

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Structure variations of the high-latitude ionosphere during March 22, 1979 geomagnetic storm were examined. Data of electron density Ne and temperature Te from the Cosmos-900 satellite (altitude 450 km), NmF2, Ne and He+ from the ISS-b satellite (altitudes 1100 – 1200 km), precipitations of the soft energy near 1 KeV electrons from the Intercosmos -19 satellite (altitude 502 – 995 km), global picture of the auroral electron precipitations from the DMSP, TIROS and P78 satellites were used. These multi-satellite data let us investigate the position variations: of the day-time cusp, of the equatorial boundary of the diffuse auroral precipitations (DPB), of the main ionospheric trough (MIT), of the day-time and ring ionospheric trough (RIT) and of light ions trough (LIT) during the different geomagnetic storm phases. The high-latitude variations of NmF2, Ne, He+ and Te data for all local time sectors were analyzed also. It is shown, that the westward auroral electrojet during the main phase of the geomagnetic storm is located in the morning sector near the equatorial boundary of the auroral diffusion precipitations (DPB). The main ionospheric trough is located about 2° below that DPB, but during the main phase of the geomagnetic storm the MIT position became more polarward than DPB. As result of electron precipitations to its minimum, the MIT was ill-defined this time. In spite of these distinctions, positions of the minimum MIT and minimum DPB can be closely approximated by DR-index ($r \sim 0.94$). Dst-index is the best to estimate the cusp daytime position ($r \sim 0.84$). Positions of the RIT attributed to the magnetospheric ring current and MIT can be well separated during the geomagnetic storm recovery phase. The RIT is very deep and narrow in the morning ionospheric sector but during equinox it can be weakly seen on the residual ring current latitudes during daylight hours. Nighttime electron temperature peak at about 6000° is related to the RIT also. Relatively strong daytime ionization trough and peak of Te located equatorward of the cusp are formed during the storm recovery phase. It is shown that the light ions trough is restored more slowly in the daytime than in the nighttime. The problems of the daytime ionospheric trough formation and the peak of electron temperature Te relation to the RIT and to the residual ring current, the plasmapause dynamics and structure position of high-latitude ionosphere relationships with different geomagnetic indices are discussed.

References

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