The influence of geomagnetic disturbances on the growth of GNSS signal scintillations at auroral latitudes

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The paper analyzes the impact of various types of geomagnetic disturbances on a sharp increase in phase and amplitude scintillations of signals from global navigation satellite systems (GNSS) GPS, GLONASS using geophysical observations in Scandinavia and the Kola Peninsula.

Geomagnetic disturbances associated with the arrival of an interplanetary shock wave, a substorm, and Pc5 pulsations are considered. To register GNSS signals, data from the Septentrio PolaRx5 receiver in the city of Apatity, data from the NovAtel GPS receiver at the Skibotn station (Skibotn, Norway) were used. Observation data for 2018-2021 were analyzed. To register ionospheric disturbances in the E and F regions, data from VHF and UHF EISCAT radars in Tromso were used. Registration of ionospheric convection was carried out using the SuperDARN radar in Hankasalmi. Optical observations of auroras in the 557.7 and 630.0 nm emissions are also used to record various ionospheric disturbances. To register ionospheric disturbances on the Kola Peninsula, the data of the PGI LFM ionosonde operating in the quasi-vertical mode were used.

The analysis shows that in most cases a noticeable increase in phase scintillations ($\sigma\phi$ >1) occurs during night or evening substorms. But during magnetic storms, phase GPS scintillations on the dayside have quite comparable values. No increase in amplitude GPS scintillations was found during the considered events. The mechanisms of the appearance of GPS scintillations during various types of ionospheric disturbances at auroral latitudes are discussed.

The study was supported by a grant from the Russian Science Foundation No. 18-77-10018 (Belakhovsky V.B.).