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On the influence of the long-term history of magnetospheric activity on the precipitation of energetic electron fluxes into the D layer of the auroral ionosphere

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Previously the authors have shown that energetic electron fluxes in outer radiation belt (RB) is influenced by solar wind parameters and magnetospheric activity indexes with large delays (up to 24 hours for 31 keV and up to 8 days for 719 keV according to THEMIS observations). In the present work the authors try to estimate the effect of long memory of magnetospheric activity on the electron density in the D region of auroral ionosphere where accelerated electrons are precipitated from RB. For this purpose the geomagnetic indexes (SML, Ap, etc) integrated over time intervals of different length (up to 5 days) were correlated with ionospheric electron concentration at different altitudes observed by EISCAT UHF radar during the daylight conditions in the prenoon sector of auroral ionosphere, where most intense energetic electron precipitation is observed. Ionospheric electron concentration was studied separately at different altitudes between 105 and 75 km, which correspond to precipitated electron fluxes with energies between 30 keV and 200 keV. The effective length of time windows for integration are ~1 hrs for 105 km and up to 24 hrs for 75 km for SML index. This is consistent with the results presented in Hua et al., 2022, who found progressive increase of memory with the energy of electrons in the radiation belt. Similar delay pattern obtained for energetic fluxes in the outer radiation belt, implying that long memory manifests itself in the ionospheric electron density. Obtained results allow to estimate the time to energize electron fluxes to energies sufficient to produce ionization at given altitudes during magnetospheric activity.