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Features of development of geomagnetic activity and night sky airglow at mid-latitudes during the 20 Dec 2015 storm

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The study considers a number of different geomagnetic events: disturbances caused by pulses of the solar wind dynamic pressure, a super substorm, and the localized at middle latitudes geomagnetic and optic disturbance. All these events were observed during the main phase of a strong magnetospheric storm on 20 December 2015. We analyze the development of geomagnetic activity in these events using a wide range of instruments located at mid- and high-latitudes, which allowed us to describe them in detail. Particular attention in the analysis we address to geomagnetic pulsations (in particular Pi1B type) and night sky airglow (on the 557.7 and 630.0 nm lines) at mid-latitudes near Irkutsk, as well as to the development of ionospheric and field-aligned electric currents using the ISTP SB RAS magnetogram inversion technique.

We have shown that the observed solar wind dynamic pressure pulses were accompanied by an increase in substorm activity and the intensity of burst pulsations at the southward IMF.

By analysing the super substorm, we show that the observed change in the sign of the two components of the geomagnetic field variations along the IMAGE station chain near 18 MLT is caused by the formation of an additional westward electrojet north of the eastward electrojet.

After the super substorm, we also revealed in the near-midnight sector a localized geomagnetic event during which the magnitudes of variations in the H geomagnetic component, PiB/PiC pulsations, and intensity increase of oxygen emissions at mid latitudes were more than twice greater than during the super substorm. We present the features of the geomagnetic pulsation development from middle latitudes to high latitudes during the event.