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Impact of the Wintertime Meteor Showers on the Sporadic E Layer Activity at Midlatitudes

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The impact of meteor showers and individual meteors on the ionosphere has been investigated during wintertime meteor showers using synchronised measurements of two DPS-4D Digisondes installed at Pruhonice (50°, 14.5°) and at Sopron (47.63°, 16.72°). Rather short distance between Pruhonice and Sopron allow us to perform special joint campaigns of vertical and oblique sounding under the high sampling rate to detect fine structures within ionospheric plasma.

High cadence campaigns have been performed to observe behavior of sporadic E layer (Es) during the Leonids, Geminids and Quadrantids meteor showers in 2018 and 2019. The time resolution of the ionograms have been set to approximately 0.5 - 2 ionograms per minute. We used vertical and oblique reflections to investigate the fine structure and the movement of Es layer. Based on the first results the oblique sounding is a good technique to detect the Es activity between two stations, however there were periods (typically 10 to 40 minutes of duration) when the Es was observed using oblique trace but there was no observation of Es layer in vertical ionograms. Furthermore, double Es structures have been detected more times for tens of minutes during the observation nights.

Beside the regular behavior of Es we concentrated on observation of intervals of increased plasma frequency in the Es region presumably directly induced by the meteors. In the framework of GINOP-2.3.2-15-2016-00003 ("Kozmikus hatások és kockázatok") an optical camera has been installed at the MTA Széchenyi István Geophysical Observatory (Sopron) in September 2019 with the cooperation of the Konkoly Observatory to monitor the meteors. Therefore, we were able to compare the ionograms measured during meteor showers with the optical data to determine the plasma trails of individual meteors. In the 20-25% of the observed meteors a faint Es layers were detected on the ionograms during and after (< 1 min) the optical record. The direction of the detected plasma traces determined by the SAO Explorer was in good agreement with the direction of the optically observed meteors in most of the cases. Consequently, the plasma trace of individual meteors could be detected on the high time resolution ionograms.

