# GNSS-TEC と SuperDARN レーダー観測に見られる SED の時間・空間発展について

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# Temporal and spatial evolutions of storm enhanced density (SED) as seen in the GNSS-TEC and SuperDARN radar observations

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Temporal and spatial evolutions of storm enhanced density (SED) in the low and midlatitudes during a geomagnetic storm that occurred on 27-28 September 2017 have been investigated using GNSS (Global Navigation Satellite System)-TEC (Total Electron Content) and midlatitude SuperDARN radar data. The GNSS-TEC data analysis results show that the TEC enhancement related to the storm enhanced density (SED) first occurs in the American sectors (11:00-15:00 MLT: magnetic local time) at high latitudes within one hour after the southward turning of interplanetary magnetic field (IMF). The enhanced TEC region moves to the mid- and low-latitude regions extending into both the latitudinal and longitudinal directions as the geomagnetic storm develops. The midlatitude trough with a latitudinally narrow structure is also observed in the higher latitude of the TEC enhancement. The signature of the TEC enhancement is not only observed in the American sector but also in the, European, Japanese, and Australian sectors. During the late main phase of the geomagnetic storm, another TEC enhancement related to the equatorial ionization anomaly (EIA) occurs in equatorial and low latitudes and extends to higher latitudes. The two prominent TEC enhancements due to the SED and EIA finally meet each other at low latitudes. On the other hand, the midlatitude ionospheric plasma flow observations taken by the SuperDARN radars at Adak Island East (ADE), Adak Island West (ADW), Blackstone (BKS), Christmas Valley East (CVE), Christmas Valley West (CVW), Fort Hays East (FHE), Fort Hays West (FHW), Hokkaido West (HKW), and Hokkaido East (HOK) show that large poleward and westward flows with a speed of more than 1000 m/s appear in the noon to evening sectors (12:00-23:00 MLT) after the southward turning of IMF. The intense ionospheric plasma flows exist near the high-latitude boundary of SED and inside the midlatitude trough. The location of the plasma flows moves equatorward together with the SED and midlatitude trough as the geomagnetic storm develops. Sometimes, the large westward flow is observable in the TEC enhancement related to SED. From these analysis results of the GNSS-TEC and SuperDARN radar data, it can be considered that the mid-latitude TEC enhancement related to SED is not generated by the high-latitude expansion of the EIA, but by the uplifting and westward transportation of ionospheric plasma in the sunlit region due to localized intense electric field drifts associated with storm-time enhanced ionospheric convection.