

SuperDARN Hokkaido radar observations of nighttime medium-scale traveling ionospheric disturbances and E region echoes

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We report on HF radar echoes associated with nighttime medium-scale traveling ionospheric disturbances (MSTIDs) and sporadic E (Es) layers over the Sea of Okhotsk, which were observed by the SuperDARN Hokkaido radar at Rikubetsu (43.5N; 36.5N geomagnetic). Echo data are analyzed together with data from GEONET (TEC) and an all-sky imager at Rikubetsu. Main results are as follows: 1) Echoes associated with daytime and nighttime MSTIDs are due to ground (sea) scatter and F region field-aligned irregularities (FAIs), respectively. 2) MSTID echoes are largely accompanied by Es-FAI echoes. 3) Spatial structures of nighttime MSTIDs observed by GEONET and the imager are well coincident with Es-FAI echo regions, and MSTID-FAI echo regions are connected with Es-FAI echo regions through the geomagnetic field, both suggesting the existence of an electrical coupling between the E and F regions. 4) We found quasi-periodic echoes (QPE) from nighttime Es for the first time by this radar. The QPE characteristics are very similar to previous QPE observations by the MU radar at Shigaraki (34.9N; 25.0N geomagnetic).