

Displacements of midlatitude intense sporadic E-layer

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The azimuthal distribution of directions of movements (“wind rose”) of intense sporadic E layers is calculated on the observations by enough close (<2000 km) located ionosondes. The following stations have been used: Slough (51.5°N, 0.6°W), Dourbes (50.1°N, 4.6°E), Poitiers (46.6°N, 0.3°E), Lannion (48.8°N, 3.4°W), Lisbonne (38.7°N, 9.3°W), South Uist (57.4°N, 7.3°E), Rome (41.8°N, 12.5°E) and Gibilmanna (37.6°N, 14°E). In the analysis the summer observations for 20 years (1970–1989) were processed. Sporadic E layer is considered as intense when its limiting frequencies exceed median values of critical frequency of layer E in 2.5 times and more. Low-intense sporadic E layers were not considered, as they are controlled by atmospheric tides to a greater extent than intense one.

Additional set of stations Moscow (55.5°N, 37.3°E), Gorky (56.1°N, 44.3°E), Sverdlovsk (56.4°N, 58.6°E) has been used for analysis of zonal movements of intense sporadic E layers .

According to Applton’s effect at first the metal ions ascend from E to F-area, then drift in the direction of poles along force geomagnetic lines whereupon again will return in the E-area spatially limited in latitudes 15°–30° to the north and to the south of equator. Acting at the moment of descent of ions in E area the tidal southward wind returns ions in equatorial latitudes. The performed analysis of movements is based on Mathews’s hypothesis about circulation of metal ions in near-equatorial areas. We have assumed that at distortions of the mentioned circulation in middle latitudes the occurrence of intensive Es-layers should become more frequent.

As a result of the performed calculations it is established, that for the majority of years a primary direction of the intensive sporadic E layer movements is north-eastward. Eastward component is seen to be consequence of zonal carry in lower thermosphere and Sq currents. Northern component can indirectly confirm a hypothesis about ingress of metal atoms (ions) in middle latitudes from tropical one.

The analysis of interannual variability of a wind rose has shown, the more occurrence of intense sporadic E (in concrete year), the more probability of their movement in northern direction.