A case study on multiple self-interactions of MSTID bands: New insights

Sumanta Sarkhel¹, Dipjyoti Patgiri¹, Rahul Rathi¹, Virendra Yadav², Dibyendu Chakrabarty³, Subarna Mondal³, Mallepulla Venkata Sunil Krishna¹, Arun K. Upadhyaya⁶, Chiranjeevi G. Vivek⁵, Suresh Kannaujiya⁶, and Surendra Sunda⁷

¹Department of Physics, Indian Institute of Technology Roorkee, Roorkee-247667, India
²Aryabhatta Research Institute of Observational Sciences, Nainital – 263001, Uttarakhand, India
³Space and Atmospheric Sciences Division, Physical Research Laboratory, Ahmedabad, 380009, Gujarat, India
⁴Environmental Sciences and Biomedical Metrology Division, CSIR National Physical Laboratory, New Delhi, India
⁵CSIR Fourth Paradigm Institute (Formerly CSIR-CMMACS), Wind Tunnel Road, Bengaluru, India.
⁶Indian Institute of Remote Sensing, ISRO, Dehradun - 248001, India
⁷GNSS Research Center for Ionospheric Studies & Navigation Application, Airports Authority of India, Ahmedabad, India

In this study, we report a special event of nighttime southwestward propagating medium scale traveling ionospheric disturbances (MSTIDs) observed in O(¹D) 630.0 nm airglow images from an all-sky imager at Hanle (32.7°N, 78.9°E; Mlat. ~24.1°N), Ladakh, India on a geomagnetically quiet (Ap = 7) night of 15 September 2018. The time sequence of airglow images unveiled two dynamic interactions between multiple dark bands of MSTID. Following the first interaction, one of the interacting bands decayed possibly due to the entrance of plasma from the ambient higher plasma density region. Shortly after this interaction, the other interacting dark band was involved in the second interaction with a third dark band which resulted in the co-alignment of the two interacting bands. Following this co-alignment, one of the bands started rotating prominently that led to further separation of these two co-aligned bands. These changes in the MSTID phase fronts (bands) are explained based on the development of the polarization electric fields arising out of the interactions. This investigation combines the all-sky 630.0 nm airglow imaging observations with TEC maps constructed, for the first time over the Indian sector, from 67 Global Navigation Satellite System (GNSS) measurements to capture the MSTID over this region. The investigation reveals a few important features of self-interactions of MSTID bands over the geomagnetic low-mid latitude transition region which is important to assess their impact over low latitudes. The highlights of these results will be discussed in the meeting.