

Evidence of daytime 150-km echoes associated with the upper E region density gradient over Sanya

Baiqi Ning ^{*1}, Guozhu Li²

¹ Key Laboratory of Ionospheric Environment, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China. (nbq@mail.iggcas.ac.cn)

² Key Laboratory of Ionospheric Environment, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China. (gzlee@mail.iggcas.ac.cn)

Abstract

The daytime 150-km echoes, indicating the existence of the upper E-region field-aligned irregularities (FAIs), have been observed around the equatorial electrojet (EEJ) region but never before at magnetic latitudes near the northern anomaly crest region, for example with the Chung-Li VHF radar and the MU radar. In view of their relative rarity, the observations of the 150 km echoes by the Sanya VHF radar (18.4°N, 109.6°E, dip latitude 13°N), which is located at ~6° lower in magnetic latitude than Chung-Li, but at ~2° higher than that of Kototabang, would provide vital information on the latitudinal extent of their occurrence in the same longitude sector of the northern hemisphere and would be valuable for the investigation of possible mechanism involved in the excitation of these irregularities. In this study, we present the observations of daytime 150-km echo over Sanya, China. A layer of weak radar echoes with spectral width less than 10 ms⁻¹ was seen in the height range from 145 km at 12:15 LT to 152 km at 13:45 LT on 21 July 2010 [1]. The interesting aspect is that the rare observation of daytime 150-km echoes with the Sanya VHF radar was preceded by the occurrence of an unusual intermediate layer, which is identified as abnormal traces at the upper E-region in corresponding ionograms. The abnormal intermediate layer associated with possible gravity wave (GW) activity (that implicates the presence of upper E-region density gradients) could make a significant contribution to the growth of irregularities responsible for the rarely detected daytime 150-km echoes over Sanya. Further, to verify how frequent is the occurrence of abnormal intermediate layer, we checked all ionograms recorded by the Sanya DPS-4D Digisonde during May 2011-December 2013 and could identify some intermediate layer events that presented similar abnormal traces but no 150 km echoes detected by the Sanya VHF radar. This could suggest that the critical conditions favouring the 150-km irregularity growth might not only be linked with the upper E region density gradients but also some other factors. Possible causes responsible for the difference are discussed.

References

1. Li, G., B. Ning, A. K. Patra, M. A. Abdu, J. Chen, L. Liu, and L. Hu, On the linkage of daytime 150 km echoes and abnormal intermediate layer traces over Sanya, *J. Geophys. Res. Space Physics*, 118, 7262–7267, doi:10.1002/2013JA019462, 2013.