Prediction of occurrence of sporadic E layers using GAIA

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Sporadic E layer (Es) occasionally appears in a narrow-altitude region between about 90 km and 120 km. Es has significant influences on radio communications and broadcast, and therefore, the prediction of occurrence of Es is one of the most important phenomena in space weather forecast. Although it is generally accepted that Es is formed by combination of neutral wind shear and metallic ions originated from meteor ionization in the lower thermosphere and in the upper mesosphere, the mechanisms of formation and variation of Es have not been quantitatively understood. Previous observations have indicated that Es has clear seasonal and local time variations and geographic location dependences. Our group has been developing GAIA (Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy), which self-consistently includes the whole atmosphere and the ionosphere with meteorological reanalysis data introduced in the lower atmosphere. Present version of GAIA has a horizontal resolution of one degree. Although the resolution of GAIA is still not enough to directly reproduce Es, it is expected that the model can give at least a clue to estimating occurrence conditions of Es. Previous studies using GAIA show that seasonal and geographical dependence of vertical wind shear in the lower thermosphere region agrees with seasonal and geographical dependence of the Es occurrence rate [Shinagawa et al., 2017]. We will report the result of prediction study of daily variations in the Es occurrence, and discuss the possibility of predicting the Es occurrence.

Reference

Shinagawa, H., Y. Miyoshi, H. Jin, and H. Fujiwara (2017), Global distribution of neutral wind shear associated with sporadic E layers derived from GAIA, J. Geophys. Res. Space Physics, 122, doi:10.1002/2016JA023778.

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