國立中央大學地球系統科學
國際研究生博士學位學程
International Ph.D. Graduate Program for Earth System Science, National Central University

專題演講

Interferometry Observation Of The Dynamic Behavior Of Midlatitude Field Aligned Sporadic E Layer Irregularities Using Chung-Li VHF Radar System

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Place： 健雄館(科四館) S4-807 教室

摘 要/Abstract：

Based on multiple baseline interferometry analysis, we investigated the spatial structures and dynamic characteristics of the 3-m field aligned sporadic E (Es) layer irregularities at midlatitude by using Chung-Li VHF radar (25.0o N, 121.1o E). Interferometry measurement demonstrates that the meridional, zonal and vertical extents of the field aligned sporadic E layer plasma structures were approximately in the spans 6 – 14 km, 10 - 28 km, and 4 - 12 km, respectively. The vertical, zonal and true meridional drift velocity of sporadic E plasma structures estimated from the displacement of the plasma patterns projection on three mutually normal surfaces were, respectively, in ranges between -15 and 16 m/s, between -91 and 50 m/s, and between -13 and 26 m/s, in which the positive (negative) sign indicates upward, eastward and northward (downward, westward and southward) drifts. Analysis of the dispersion relation of gravity waves of the trace velocity components of Es layer suggests the presence of majorly westward with slightly northward propagating gravity waves that modulated the Es layer. The wave period is about 46.3 min and the vertical, zonal and meridional wavelengths are approximately in the ranges 4 - 12 km, 10 - 28 km, and 6 -14 km, respectively. In addition, the theoretical polarized electric fields of Es layer are calculated from ionospheric current system such that the zonal (i.e., eastward) polarized electric field was much larger than the meridional polarized electric field. Then, the corresponding drift velocity of eastward polarized electric field is estimated to compare with the radar-observed radial velocity of Es FAI in the environment of gravity wave breaking. The observed radial velocity agrees with drift velocity of eastward polarized electric field. Therefore, the Es instability was most likely the physical mechanism governing the dynamic behavior of the plasma structures. Furthermore, interferometry observation indicates that the plasma structures associated with gravity wave propagation were in clumpy or plume-like structures, while those not disturbed by the gravity waves were in a thin layer structure that descended over time at a rate of about 2.17 km/hr. The observation demonstrates that the height of a thin Es layer with a thickness of about 2-4 km can be significantly altered by a gravity wave with a height of 10 km or more.

Key words： Interferometry, Sporadic E layer, Drift velocities, Wind shear theory, Gravity waves, Gravity wave breaking, Ionospheric dynamo current, Polarized electric field.

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