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顶部电离层电子密度和温度的统计背景及其地磁活动变化

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Statistical backgrounds of topside-ionospheric electron density and temperature and their variations during geomagnetic activity

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摘要 通过对DEMETER卫星从2004年11月7日至2005年11月30日期间探测到的710 km高度顶部电离层的电子数据进行网格化(纬度2°×经度4°)统计平均,本文分析了不同地磁条件下顶部电离层电子密度和温度的全球分布情况.不论是在地磁宁静还是地磁活动期间,顶部电离层电子密度的分布都存在着一个巨大的威德尔海异常(夜间电子密度高于白天的)区域(30°W~180°W和30°S~75°S)、夜间中纬槽(35°N~60°N和35°S~60°S)和夜间南大西洋地磁负异常区域的低密度结构,而且电子密度在磁倾(dip)赤道附近最大,说明710 km高度的顶部电离层并不存在赤道异常.和电子密度的分布相反,电子温度在磁倾赤道附近最小,在等离子体层顶附近最大.在地磁活动期间,顶部电离层电子的密度普遍增加,同时电子密度的赤道峰值向中纬区扩宽.但是,地磁活动并没有明显地改变威德尔海异常区和夜间中纬槽的空间范围.另外,地磁活动对电子温度的影响并不明显,它仅造成了等离子体层顶附近的电子温度增大.

关键词: 顶部电离层 电子密度 威德尔海异常 中纬槽 电子温度

Abstract: Electron density and temperature measured by DEMETER satellite at 710 km altitude from 17 November 2004 to 30 November 2005 are collected, and their statistical averages are calculated in each geographic cells of 2° (lat) ×4° (lon) under different geomagnetic conditions. The statistical results indicate that whenever the geomagnetically quiet or active times the electron density distribution has a large Wedell Sea Anomaly (WSA) region (30° W~180° W and 30° S~75° S, where the nighttime density of plasma is larger than the daytime) and the low-density nighttime midlatitude trough (MIT) regions (35° N~60° N and 35° S~60° S) in the topside ionosphere, and the electron density is maximum near the magnetic dip equator (±20°), indicating that Equatorial Ionization Anomaly (EIA) does not exist in the topside ionosphere of 710 km altitude. Though the geomagnetic activity causes the global increase of electron density and the latitude expanding of equatorial density peak, it does not obviously change the spatial ranges of the WSA and MIT regions. In contrast to the electron density distribution, the electron temperature is the minimum near the magnetic dip equator, whereas it is the maximum near the plasmapause, and the geomagnetic activity merely leads to the increase of electron temperature near the plasmapause.

Keywords: Topside ionosphere Electron density Wedell Sea Anomaly Midlatitude trough Electron temperature

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