

引用本文:

宋茜, 丁锋, 万卫星, 刘立波, 宁百齐. 北美地区夜间中尺度电离层行进式扰动的GPS台网监测研究[J]. 地球物理学报, 2011, V54(4): 935-941, DOI: 10.3969/j.issn.0001-5733.2011.04.007

SONG Qian, DING Feng, WAN Wei-Xing, LIU Li-Bo, NING Bai-Qi. Monitoring nighttime medium-scale traveling ionospheric disturbances using the GPS network over North America. Chinese J. Geophys. (in Chinese), 2011, V54(4): 935-941, DOI: 10.3969/j.issn.0001-5733.2011.04.007

北美地区夜间中尺度电离层行进式扰动的GPS台网监测研究

宋茜^{1,2}, 丁锋¹, 万卫星¹, 刘立波¹, 宁百齐^{1*}

1. 中国科学院地质与地球物理研究所, 北京 100029;
2. 中国科学院研究生院, 北京 100049

Monitoring nighttime medium-scale traveling ionospheric disturbances using the GPS network over North America

SONG Qian^{1,2}, DING Feng¹, WAN Wei-Xing¹, LIU Li-Bo¹, NING Bai-Qi^{1*}

1. Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing 100029, China;
2. Graduate University, Chinese Academy of Sciences, Beijing 100049, China

摘要

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摘要 本文利用2007年6月~2008年5月期间北美GPS台站密集地区的TEC观测资料,对夜间中尺度电离层行进式扰动(MSTIDs)的传播特性进行了分析研究.结果表明:北美地区的夜间电离层行进式扰动一般发生在美国西部时间21:00~02:00LT(05:00~10:00UT)时段,表现在TEC中的最大扰动幅度为0.45~0.6TECU.扰动以20~40 min的周期,100~200 m/s的水平相速度朝西南方向传播,覆盖磁纬24° N到44° N,经度130° W到70° W的广大范围.统计结果显示,夜间电离层行进式扰动呈现明显的半年变化特征,扰动振幅的峰值在春秋分前后达到最大,在至日前后最小;扰动传播的水平相速度在夏季比冬季约大20%.进一步分析表明,夜间电离层扰动振幅的半年变化是由电离层背景电子浓度的半年变化引起的,而扰动速度的季节变化则与高层风场的季节变化密切相关.

关键词: GPS TEC 夜间中尺度电离层行进式扰动

Abstract: Using the total electron content (TEC) data observed from a dense GPS network in North America from June 2007 to May 2008, we analyzed the propagation characteristics of the nighttime medium-scale traveling ionospheric disturbances (MSTIDs) over North America. The results show that, the nighttime MSTIDs occur frequently between the local time of 21:00LT (05:00UT) and 02:00LT (10:00UT), which can be characterized by the maximum amplitude of 0.45~0.6TECU and the average period of 20~40 minutes in the TEC perturbation series. The nighttime MSTIDs tend to propagate southwestward at the horizontal velocities of 100~200 m/s covering large area in the range of magnetic latitude (24° N~44° N) and longitude (130° W~70° W). The statistical results indicate that, the nighttime MSTIDs have a clear semiannual variation, with the maximum amplitudes around equinox and the smallest ones around solstice; the horizontal velocities in summer are about 20% larger than that in winter. Further studies have revealed that, the semiannual variation of nighttime MSTIDs is caused by the semiannual variation of background TEC, while the seasonal variation of the horizontal velocity is closely related with the seasonal variation of the thermospheric wind.

Keywords: GPS TEC Nighttime medium-scale traveling ionospheric disturbances

Received 2010-02-01;

Fund:

国家自然科学基金项目(40974089,40774090)和国家重点基础研究发展计划项目(2006CB806306,2011CB811405)资助.

Corresponding Authors: 丁 锋,男,1972年生,副研究员,主要从事电离层物理研究.E-mail: dingf@mail.iggcas.ac.cn
Email: dingf@mail.iggcas.ac.cn

About author: 宋 茜,女,1986年生,在读硕士研究生,主要从事电离层物理研究.E-mail: songqq198641@163.com

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