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论文

利用GPS监测电离层不均匀结构探讨

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摘要: 利用上海地区GPS综合应用网提供的高时空分辨率的双频GPS观测资料, 研究了该区域内一电离层不均匀体的产生、消亡过程.首先, 采用Kalman滤波的方法改善双频伪距之差的观测精度, 并利用参数估计的方法计算该时段内相应的硬件延迟.再根据电离层单层模型, 利用GPS双频观测量、测站位置和GPS精密星历, 求出GPS信号穿刺点的坐标和垂直方向电离层的电子含量; 然后内插并获取其等值线图.等值线图随时间的变化表明, 受等离子体湍流的影响, 2003年9月8日北京时间9时40分左右在38°N、118°E左右产生了一电离层不均匀体, 其尺度大约在50km左右, 生存时间大约为5min.受地球重力场和高空风场的影响, 该不均匀体向东北方向扩散.然后, 利用大气扩散模型, 按扩散方程计算分析了该不均匀体可能发生的电离层层区.理论计算表明, 该不均匀体发生在电离层扩展F区, 高度在350km左右.

关键词: GPS 总电子含量 扩散方程 电离层不均匀体

Monitoring of small scale ionospheric heterogeneities using local GPS network

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扩展功能

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Abstract: Based on the high spatio-temporal resolution GPS dual-frequency data provided by Shanghai GPS Comprehensive Application Network, an ionospheric heterogeneity and its process of arising and disappearing were monitored and studied. First, Kalman Filter is used to improve the accuracy of $\Delta P_2 - P_1$, and the hardware delay of GPS system is estimated by the least square method. Then according to the single layer model (SLM) of the ionosphere and the altitude of the SLM shell, the accurate positions of GPS satellites and receivers, and the observations of dual frequency, the ionosphere pierce points' (IPPs') location and their Total Electron Content(TEC) are obtained, then the contour maps of TEC are derived using the interpolating technique. The variations of TEC reflected by these maps as time goes indicate that due to the turbulent flow of the atmosphere, an ionospheric heterogeneity, whose scale is about 50 km and existence time 5 minutes, located at 38°N and 118°E came to being at 2003-09-08-01:40 UTC. It diffused northeastward, which was caused by the upper air winds and geomagnetic field. After analysis with diffusion equation under 1976 U. S. standard atmosphere, we find that the heterogeneity appeared at the height of 350km above the ground.

Keywords: GPS Total Electron Content(TEC) Diffusion equation Ionospheric heterogeneity.

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