

地球物理学报 » 2011, Vol. 54 » Issue (7) : 1718-1726

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王虎, 王解先, 白贵霞, 王潜心, 李浩军, 朱卫东. 基于GPS技术实时监测2009年7月22日日全食期间长三角区域电离层TEC变化[J] 地球物理学报, 2011, V54(7): 1718-1726, DOI: 10.3969/j.issn.0001-5733.2011.07.004

WANG Hu, WANG Jie-Xian, BAI Gui-Xia, WANG Qian-Xin, LI Hao-Jun, ZHU Wei-Dong. Real-time monitoring of ionosphere changes in the Yangtze River Delta region based on GPS technology during the total solar eclipse of 22 July 2009. Chinese J. Geophys. (in Chinese), 2011, V54(7): 1718-1726, DOI: 10.3969/j.issn.0001-5733.2011.07.004

## 基于GPS技术实时监测2009年7月22日日全食期间长三角区域电离层TEC变化

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Real-time monitoring of ionosphere changes in the Yangtze River Delta region based on GPS technology during the total solar eclipse of 22 July 2009

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摘要

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**摘要** 2009年7月22日上午发生的日全食是21世纪持续时间最长的日全食,其全食带覆盖了中国中部的长江流域,为研究日全食对电离层的影响提供了一次难得的机会.为此本文通过卡尔曼滤波算法实现了实时求解TEC和GPS系统硬件延迟,为实时监测日全食期间电离层变化提供了绝对的电离层TEC.采用上海和浙江区域内GPS网的观测数据,建立了实时区域电离层延迟模型,进而计算出了实时的VTEC和TEC变化率.同时考虑太阳和地磁活动参数,综合上述方法详细分析和讨论了长三角区域在此次日全食期间的TEC变化的电离层异常现象.

**关键词:** 日全食 电离层 TEC VTEC GPS 卡尔曼滤波 GPS系统硬件延迟

**Abstract:** The longest total solar eclipse during the 21st century occurred in the morning of 22 July 2009. The Yangtze River Valley of Central China is located on the central line of the total eclipse belt. It will provide a unique opportunity to investigate the influence of the total solar eclipse on the ionosphere. This paper describes a method of real-time solving TEC and GPS instrumental bias using Kalman filtering, so this can be used to provide absolute amount of ionospheric TEC for real-time monitoring of ionosphere changes during the total solar eclipse. For validation of this method, the data of Shanghai and Zhejiang regional GPS network are used and a real-time regional ionosphere model is created, then real-time VTEC and TEC ratio are also calculated. Meanwhile, with consideration of the solar and geomagnetic parameter, the ionospheric anomalies with phenomenon of TEC changes in the Yangtze River Delta region during the total solar eclipse are analyzed in detail and discussed by adopting the numerical computations.

**Keywords:** Total solar eclipse Ionosphere Total electron content (TEC) Vertical total electron content (VTEC) Global Position System Kalman filter GPS instrumental biases

Received 2010-09-17;

Fund:

国家自然科学基金项目"GNSS实时精密单点定位的若干问题的研究"(40974018),中国地震局陆态网络工程资助项目(CMONOC II - RJ-2008-005)和上海市科学技术委员会资助项目(06DZ22101)资助.

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