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Abel电离层掩星反演方法及误差分析

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Abel ionospheric inversion technique and its error analysis

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摘要

GNSS-LEO电离层无线电掩星技术是近年来发展的电离层探测新技术.为消除LEO轨道以上的电离层影响,改正TEC反演方法采用非掩星侧的观测数据进行电离层掩星反演.本文首次提出了一种新方法——基于历元差分的电离层反演方法;并将改正TEC与历元差分两种反演方法应用于模拟掩星观测数据反演,随后基于反演结果及误差分析得到一些有益的结论:历元差分反演精度较改正TEC反演精度均有所提高;不管是哪种方法,高轨(约800 km)反演结果要优于低轨(约500 km)的反演结果;随着剖面高度的降低,反演精度随之下降;反演误差主要集中在8至18时(当地时),主要分布在磁纬-30°至30°之间.

关键词 GPS无线电掩星, 改正TEC反演, 历元差分反演, 国际电离层参考2007

Abstract:

Currently, GNSS-LEO ionospheric radio occultation (IRO) is a new and powerful technique in probing ionosphere. In order to eliminate the effect from the topside ionosphere above LEO, the Calibrated TEC inversion technique retrieves electron density profiles utilizing non-occultation side measurements. In this paper, a new technique is firstly proposed based on the Epoch Difference, and then the two techniques are applied in the inversion of simulated data, subsequently some conclusions can be drawn from the inversion results and its error analysis: the inversion results derived from the Epoch Difference inversion technique show better performance than those derived from the Calibrated TEC inversion technique; no matter which inversion technique is used, the inversion results at the higher orbits (~800 km) are better than those at the lower orbits (~500 km). The lower the profile altitudes, the lower the precision of inversion; the inversion errors are significant during 8-18 (local time), and are mainly located between -30° and 30° (magnetic latitude).

Keywords GPS radio occultation, Calibrated TEC inversion, Epoch Difference inversion, International Reference Ionosphere 2007

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