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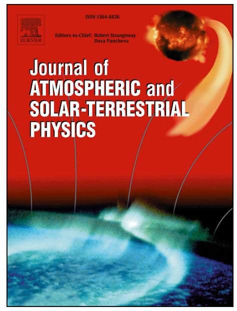

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PII: S1364-6826(16)30342-X

DOI: 10.1016/j.jastp.2018.03.017

Reference: ATP 4820

To appear in: *Journal of Atmospheric and Solar-Terrestrial Physics*

Received Date: 25 October 2016

Revised Date: 6 March 2018

Accepted Date: 22 March 2018

Please cite this article as: Li, M., Yuan, Y., Wang, N., Li, Z., Liu, X., Zhang, X., Statistical comparison of various interpolation algorithms for reconstructing regional grid ionospheric maps over China, *Journal of Atmospheric and Solar-Terrestrial Physics* (2018), doi: 10.1016/j.jastp.2018.03.017.

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Statistical comparison of various interpolation algorithms for reconstructing regional grid ionospheric maps over China

Min Li[12](✉), Yunbin Yuan[1](✉), Ningbo Wang[3], Zishen Li[3], Xifeng Liu[4], Xiao Zhang[12]

Abstract

This paper presents a quantitative comparison of several widely used interpolation algorithms, i.e., Ordinary Kriging (OrK), Universal Kriging (UnK), planar fit and Inverse Distance Weighting (IDW), based on a grid-based single-shell ionosphere model over China. The experimental data were collected from the Crustal Movement Observation Network of China (CMONOC) and the International GNSS Service (IGS), covering the days of year 60–90 in 2015. The quality of these interpolation algorithms was assessed by cross-validation in terms of both the ionospheric correction performance and Single-Frequency (SF) Precise Point Positioning (PPP) accuracy on an epoch-by-epoch basis. The results indicate that the interpolation models perform better at mid-latitudes than low latitudes. For the China region, the performance of OrK and UnK is relatively better than the planar fit and IDW model for estimating ionospheric delay and positioning. In addition, the computational efficiencies of the IDW and planar fit models are better than those of OrK and UnK.

Keywords

Total Electron Content (TEC); Regional Grid Ionospheric Map; Interpolation Algorithms; Ionospheric

1. Introduction

Ionospheric delay is one of the main sources of error in Global Navigation Satellite System (GNSS) positioning and navigation. It is usually caused by the disturbing influence of the temporally and spatially varying ionization of the ionosphere, and it can reach more than 100 meters during severe ionosphere storms. Therefore, to achieve the highest possible location accuracies, one must correct the delay imposed on the signals by the ionosphere. Fortunately, thanks to the dispersive nature of the ionosphere, the Total Electron Content (TEC) with high temporal-spatial resolution can be continuously extracted using dual-frequency GNSS observations. This is of great importance in many scientific studies, such as space weather monitoring, research and applications or Earth observation

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