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## 120° E赤道电离异常区电子浓度总含量分析与预测

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Analysis and prediction of ionospheric total electron content of the Equatorial Ionization Anomaly around 120° E longitude

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摘要

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**摘要** 基于国际全球定位服务中心(International GPS Service, IGS)提供的120° E上空1999-2009年IONEX格式电离层电子浓度总含量(TEC)资料,分析赤道电离异常驼峰区TEC峰值Inc和Isc的年变化和季节变化以及与太阳、地磁活动的相关性.在11年时间尺度上,Inc和Isc与太阳辐射P指数的日均值有较好的相关性( $r=0.90$ 和 $r=0.84$ ),而与地磁活动指数Dst、Kp和Ap日均值的相关性均不好.驼峰区TEC峰值Inc和Isc都是在北半球春、秋季出现极大值,而且冬季值大于夏季值,即Inc呈现"半年异常"和"冬季异常"现象,我们认为Inc和Isc相似的半年变化特征是与赤道上空电离层电急流相关的东向电场半年变化导致的.利用支持向量回归方法构建了EIA指数的预报模型,预报试验结果表明,该预报模型能较准确地描述Inc和Isc的变化,对南北驼峰TEC峰值预报的平均相对误差分别为22.96%和10.2%.基于支持向量机回归的预测方法为赤道电离异常特征指数预报的实现提供一条有效方法途径和好的应用前景.

**关键词** 电离层赤道异常, 电子浓度总含量(TEC), 赤道电急流, 支持向量机(SVM)

**Abstract:** Based on the 1999-2009 IONEX total electron content (TEC) data over 120° E from IGS, we studied annual and seasonal variations of the TEC at the daily northern anomaly crest (Inc) and southern anomaly crest (Isc) as well as solar and geomagnetic effects on the equatorial ionization anomaly (EIA). The variation of Inc and Isc is correlated well with solar P index but poorly correlated with geomagnetic Dst, Kp and Ap index. It is found that the Inc and Isc are almost highest in equinoctial season on northern hemisphere and the values in winter are greater than the summer values which showed the semiannual anomaly and winter anomaly in Inc. We attributed this to the semi-annual variation of the eastward electrojet-associated electric field. The method of support vector regression based on support vector machines (SVM) is used to establish the prediction model of EIA index. The results of the forecasting experiments with the model showed that this model can describe the variation of EIA index Inc and Isc and the mean relative error of Inc and Isc is about 10.2% and 22.96% respectively. The prediction effect of Inc is better than the Inc. This method provides a new approach and idea for the prediction of characteristic index of EIA and shows a good application perspective.

**Keywords** Equatorial ionization anomaly (EIA), TEC, Equatorial electrojet, Support Vector Machine

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