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赤道-低纬电离层不规则结构和闪烁活动出现率的理论模型构建

罗伟华[1,2], 徐继生[2], 朱正平[1]*

1. 中南民族大学电子信息工程学院, 武汉 430074;
2. 武汉大学电子信息学院, 武汉 430072

Theoretical modeling of the occurrence of equatorial and low-latitude ionospheric irregularity and scintillation

LUO Wei-Hua[1,2], XU Ji-Sheng[2], ZHU Zheng-Ping[1]*

1. College of the Electronic Information and Engineering, South-Central University for Nationalities, Wuhan 430074, China;
2. School of Electronic Information, Wuhan University, Wuhan 430072, China

摘要

为构建赤道-低纬电离层不规则结构和闪烁活动出现率的理论模型,本文根据分析赤道-低纬电离层的广义Rayleigh-Taylor(R-T)不稳定性得到的三维线性增长率的表达式,计算分析了线性增长率随地方时的变化特征.并选取计算得到的每日增长率的极大值表征每日的线性增长率,分析增长率随季节、太阳活动和地理经度的变化特征以及逐日变化特征,建立三维广义R-T不稳定性线性增长率的理论统计特征模型,发现增长率表现出显著的随地方时、季节、太阳活动和地理经度以及逐日变化特征.通过比较分析增长率的变化特征与不规则结构和闪烁活动的变化特征,发现三维广义R-T不稳定性的线性增长率能较好地反映不规则结构和闪烁活动随季节、太阳活动、地理经度以及逐日变化规律.本文建立的R-T不稳定性的三维线性增长率的统计特征模型可用于构建赤道-低纬电离层不规则结构和闪烁出现率的理论形态特征模型.

关键词 电离层, 不规则结构, Rayleigh-Taylor(R-T)不稳定性, 线性增长率, 电离层闪烁

Abstract:

In this paper, the three-dimensional linear growth rate of Rayleigh-Taylor(R-T) instability depending on the local time is investigated based on the analysis of the generalized three dimensional R-T instability. The maximum of the growth rate in a day is taken as the signature of that day. The characteristics of three-dimensional linear growth rate varying with the seasons, solar activities, geographic longitudes and day-to-day variations are studied and modelled. The variations of growth rate significantly rely on the local times, seasons, solar activities, longitudes and also day-to-day. Comparing the characteristics of the growth rate with the characteristics of the irregularities and scintillations in equatorial and low-latitude ionosphere, it is found that three-dimensional linear growth rates of the R-T instability display similar characteristics with that of the irregularities and scintillations, the growth rate can be used in modeling the theoretical characteristic of the occurrence of the ionospheric irregularity and scintillation.

Keywords Ionosphere, Irregularity, R-T instability, Linear growth rate, Ionospheric scintillation

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