地球物理学报 » 2012, Vol. 55 » Issue (1) :29-35 doi:10.6038/j.issn.0001-5733.2012.01.003

引用本文(Citation):
何飞, 张效信, 陈波, FOK Mei-Ching.遗传算法反演地球等离子体层离子密度分布. 地球物理学报, 2012,55(1): 29-35,doi: 10.6038/j.issn.0001-5733.2012.01.003

HE Fei, ZHANG Xiao-Xin, CHEN Bo, FOK Mei-Ching.Inversion of the Earth's plasmaspheric density distribution from EUV images with genetic algorithm.Chinese J.Geophys. (in Chinese),2012,55(1): 29-35,doi: 10.6038/j.issn.0001-5733.2012.01.003

遗传算法反演地球等离子体层离子密度分布

何飞[1], 张效信[2], 陈波[1], FOK Mei-Ching[3]*

1. 中国科学院长春光学精密机械与物理研究所, 长春 130033;
2. 中国气象局国家空间天气监测与预警中心, 北京 100081;
3. NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

Inversion of the Earth's plasmaspheric density distribution from EUV images with genetic algorithm

HE Fei[1], ZHANG Xiao-Xin[2], CHEN Bo[1], FOK Mei-Ching[3]*

1. Changchun Institution of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, Changchun 130033, China;
2. National Center for Space Weather, China Meteorological Administration, Beijing 100081, China;
3. NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA

摘要 参考文献 相关文章

Download: PDF (524KB) HTML 1KB Export: BibTeX or EndNote (RIS) Supporting Info

摘要 本文介绍了采用一维遗传算法从地球等离子体层极紫外图像反演地球等离子体层He^+密度的原理.首先采用通量管近似和磁偶极近似将三维问题转化为一维问题.通过引入权矩阵,将极紫外光强积分离散为求和函数,再采用一维实数编码遗传算法反演得到磁赤道面等离子体层He^+密度,最后通过磁力线追迹得到三维密度分布.算法采用动态全球核心等离子体模式模拟的密度和光强分布作为初始输入参数,并通过遗传算法得到相应密度分布.反演结果表明,等离子体层密度相对误差在8%以内,光强相对误差趋于0,算法有效可行.本文研究为中国探月二期工程中月基极紫外图像反演奠定了基础.

关键词 地球等离子体层, 密度分布, 遗传算法, 反演

Abstract: The principles for inversion of plasmaspheric He^+ density from the extreme ultraviolet images of the Earth's plasmasphere with one-dimensional genetic algorithm are introduced. The three-dimensional problem is transformed to one-dimensional case through flux tube approximation and dipole magnetic field approximation. With the weight matrix, the extreme ultraviolet intensity integration equation is discretized into linear equation systems, then the one-dimensional real-coded genetic algorithm is used to calculate the equatorial plane plasmaspheric He^+ density, and finally the three-dimensional density is obtained by magnetic field line tracing. The density and intensity simulated by the dynamic global core plasma model are used as the primary input parameters, and the corresponding density distribution is determined through genetic iterations. The results show that the relative density error is less than 8% and the relative intensity error tends to be zero, which proves that our algorithm is effective and feasible. Investigations in this work will provide basis for the inversion of the moon-based EUV images in the Second Phase of Chinese Lunar Exploration Program.

Keywords Earth's plasmasphere, Density distribution, Genetic algorithm, Inversion

Received 2011-05-09;

Fund:

国家自然科学基金(40890160,10878004,40974093),国家重点基础研究发展计划"973计划"(2011CB811400)和公益性行业专项(GYHY200806024)联合资助.

Corresponding Authors: 张效信,研究员,E-mail:xxzhang@cma.gov.cn. Email: xxzhang@cma.gov.cn

About author: 何飞,男,1984年生,助理研究员,2011年在中国科学院长春光学精密机械与物理研究所获得博士学位,主要从事空间物理学和空间短波段光学成像技术研究.E-mail:hef@ciomp.ac.cn.

Service
把本文推荐给朋友
加入我的书架
加入引用管理器
Email Alert
RSS
作者相关文章

链接本文:
http://118.145.16.227/geophy/CN/10.6038/j.issn.0001-5733.2012.01.003 或 http://118.145.16.227/geophy/CN/Y2012/V55/I1/29
查看全文 下载PDF阅读器