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# 高频返回散射扫频电离图的反演

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## Inversion of HF sweep-frequency backscatter ionograms

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**摘要** 斜向返回探测可以对遥远地区的电离层进行连续监测,是探测电离层的主要手段之一,一般得到返回功率、群路径或时延与频率之间的关系,称为高频返回散射电离图.由于电离图包含了探测路径上电离层状态信息,可以通过对其反演获得电离层结构参数.本文提出了一种新的反演算法,使用模拟退火方法对返回散射扫频电离图前沿进行了反演,并用实际探测数据进行了验证及统计,最后给出二维电子密度剖面图.结果显示,62.97%的反演结果与垂测结果吻合情况良好.该方法很好地克服了传统反演算法的不稳定性,且计算速度快,能获得准确的反演结果,表明了该算法在实时处理实际探测的返回散射扫频电离图中的应用价值.

**关键词:** 斜向返回 电离图 反演 模拟退火 超视距雷达

Abstract: The oblique backscatter sounding is a powerful tool for detecting and monitoring the ionosphere continuously at a remote distance. HF backscatter ionograms showing the backscatter amplitude and group path or time delay against operating frequency can be obtained in this way. A backscatter ionogram contains useful information regarding the state of the ionosphere along the propagation paths which can be acquired by inversion algorithm. A new inversion algorithm using simulated annealing is proposed to inverse the leading edge of sweep-frequency ionogram. This algorithm is validated by real data and a two-dimension electron density profile is shown. Statistical result is also presented, and 62.97% of the inversion results accord with the vertical data. The results present that this algorithm can give accurate inversion results rapidly, and instability of traditional algorithm is conquered. The algorithm is practicable in dealing with real data.

Keywords: Backscatter Ionogram Inversion Simulated annealing Over-the-horizon radar

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