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## COSMIC大气掩星开环数据反演方法

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### Inversion of COSMIC atmospheric open-loop radio occultation data

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摘要

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**摘要** COSMIC星座GPS无线电掩星探测利用GPS开环接收技术提高低层大气观测数据的质量和对上升掩星事件的跟踪能力. 开环掩星观测数据受到GPS导航数据调制的影响, 在其数据后处理中必须消除该影响以获得高质量的科学反演结果. 利用GPS导航数据调制码数据和利用开环数据本身内在的关系等两种方法可以消除该影响. 将上述方法应用于COSMIC的掩星事件个例反演, 获得了修复的大气附加相位数据; 并利用几何光学近似反演方法和全谱反演方法, 获得了射线弯曲角. 全谱反演方法获得的弯曲角及其温度反演结果与COSMIC数据中心的的结果一致, 说明我们的算法是有效的.

**关键词** GPS掩星反演, 开环数据处理, 电波弯曲角, 导航数据调制影响

**Abstract:** The GPS open-loop receiver has been used in COSMIC GPS radio occultation to improve the data quality of the troposphere occultation and the ability of tracking the rising occultation events. The open-loop data are affected by the navigation data modulations. This effect must be removed in the post-data processing to get the high quality scientific inversion results. Two methods for removing the effect, one using the external navigation data modulation bit information and the other method using the internal relationship of the atmospheric excess phase data between adjacent epochs, were investigated. For a case study, the above methods were applied in the data processing of one COSMIC radio occultation event's atmospheric excess phase data to remove the navigation data modulation effect and to output the corrected atmospheric excess phase data. By using the corrected atmospheric excess phase data, the ray bending angles were estimated with the geometric optics approximation method and the full spectrum inversion method. The estimated bending angles with the full spectrum inversion method and the corresponding retrieved temperatures agree excellently with those provided by the COSMIC data center. The agreement suggests that our algorithms for open-loop data processing work efficiently.

**Keywords** Inversion of GPS radio occultation, Open-loop data processing, Ray bending angle, Navigation data modulation effects

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