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## 利用COSMIC掩星弯曲角数据分析中国区域对流层顶结构变化

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Structure and variation of the tropopause over China with COSMIC radio occultation bending angles

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摘要

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### 摘要

对流层顶是地球大气的一个最基本的结构特征,对流层与平流层通过对流层顶交换气团、水汽、微量气体、能量等.对流层顶结构变化与气候变化密切相连.本文采用掩星弯曲角自然对数协方差变换法确定对流层顶,利用气象、电离层与气候星座观测系统(Constellation Observing System for Meteorology, Ionosphere and Climate, COSMIC)2007年1月至2011年12月共5年的掩星观测数据分析了中国区域对流层顶高度、温度、气压等参数随经度、纬度、时间变化的特征.采用 $2^{\circ} \times 2^{\circ}$ 网格法,把包括中国在内的 $16^{\circ} \text{N}—54^{\circ} \text{N}$ 、 $72^{\circ} \text{E}—136^{\circ} \text{E}$ 区域共分成 $19 \times 32$ 个格网单元,然后计算每个格网单元内对流层顶高度、温度、气压的平均值,结果表明对流层顶参数呈明显的纬度分带分布特征.计算每个格网单元内对流层顶参数季节平均值,结果显示对流层顶高度和气压具有明显的季节性变化特征.采用中位数斜率回归法分析对流层顶参数年平均值,发现在研究时段内中国区域对流层顶高度平均每年降低8 m.

关键词 对流层顶, COSMIC, GPS无线电掩星, 弯曲角

### Abstract:

The tropopause is the most basic structural feature of the earth atmosphere. The exchange of air mass, water vapour, trace gas and energy between the troposphere and the stratosphere occurs in the tropopause. The variation of tropopause structure is closely linked to climate change. The natural logarithm objective covariance transform method is used in this paper to identify the tropopause altitude from GPS occultation bending angle profiles. With GPS occultation observation data from the Constellation Observing System for Meteorology, Ionosphere and Climate (COSMIC) mission over the period from Jan 2007 to Dec 2011, the spatial and temporal variations of the tropopause parameters including height, temperature and pressure are analyzed over China. The area of  $16^{\circ} \text{N}—54^{\circ} \text{N}$ ,  $72^{\circ} \text{E}—136^{\circ} \text{E}$  is divided into  $19 \times 32$  lattices using  $2^{\circ} \times 2^{\circ}$  grids. The average value of height, temperature and pressure of the tropopause in each grid is calculated. The results show that the latitudinal distributions of tropopause parameter are distinct. The monthly and seasonal average value of tropopause parameters in each grid shows that the tropopause altitude and pressure have obvious seasonal variation characteristics. By using median of pairwise slopes regression method to analyze the annual average value of the tropopause parameters, it is found that the tropopause height decreases 8 m on average annually during the five years period.

Keywords Tropopause, COSMIC, GPS radio occultation, Bending angle

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