

论文

利用瑞利激光雷达和无线电探空仪观测数据对武汉上空重力波特性的研究

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摘要 本文利用武汉大学的瑞利激光雷达的瑞利散射回波数据(30~65 km)来研究武汉地区上空(30° 5' N, 114° 4' E)〔JP〕重力波的活动规律和统计特性.通过对2003年12月到2005年3月观测的200 h数据反演的密度进行处理分析,得到了重力波的一些个例特征,并提取垂直波长为2 km以上的重力波进行统计分析.结果表明,最可几的垂直波长是3~4 km和17~20 km,重力波振幅的月平均值在冬季有较大值,夏季值较小.与武汉2004年无线电探空仪的密度扰动提取到的重力波做比较,发现与瑞利激光雷达得到的重力波振幅的月平均值有很强的相关性,也是冬季值比较大,夏季值比较小.通过无线电探空仪的风场数据,本文还得到了急流的季节变化规律、最大风剪切年变化规律,发现急流和最大风剪切与激光雷达的重力波统计结果有很强的相关性.

关键词 [瑞利激光雷达](#) [无线电探空仪](#) [中层大气重力波](#) [统计特性](#)

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On the asymmetry of the storm time current system in the ionosphere between southern and northern hemispheres

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Abstract The parameters of the upper atmosphere and ionosphere, such as the neutral wind and conductance, deduced from widely accepted empirical models are used to calculate the distribution of the electric field and current between geomagnetic latitudes $\pm 72^\circ$ and 00:00~24:00 MLT on June and December solstices during strong storms in terms of the ionospheric current continuity equation. The deviation of geomagnetic and rotation axes of the earth is considered in the calculation. Except the dynamo effect induced by the neutral wind, the driving electric field across the polar cap and the region 2 field aligned current, caused by the magnetospheric coupling, are also taken into account. The results show that on the June solstice the penetration of magnetospheric disturbances from the auroral zone to mid and low latitude areas is similar between the southern and northern hemispheres, but is a bit little stronger in the northern one. On the December solstice, however, obvious asymmetry appeared. The penetration of disturbed current is much stronger in the southern hemisphere than that in the northern one, meanwhile the penetration of the electric field is stronger in the northern one. Independent of the southern or northern hemisphere, in the moderate high latitude areas the existence of a eastward electric field in the midnight dawn region is an expected mechanism, which can be used to explain phenomena found many times in our previous works, due to its [WTHX]E×B[WTBZ] upper ward drift effect.

Key words [Disturbance current system](#); [Ionospheric dynamo](#); [Thermospheric wind](#); [Electric conductivity](#); [Magnetic storm](#); [Magnetospheric coupling](#); [Driving electric field at the polar cap boundary](#); [Field aligned current](#)

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