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中层大气重力波的全球分布特征

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Analysis on the global morphology of middle atmospheric gravity waves

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摘要 从2002年1月到2009年12月的SABER温度剖面数据提取了可以反映重力波活动的垂直尺度2~10 km的中尺度温度扰动,分析了全球中层大气重力波的分布.重力波扰动在夏季和冬季明显强于春季和秋季,而冬季与夏季相比,在70 km以下的高度夏季弱于冬季,在70 km以上夏季比冬季要强.从全球重力波分布来看,较大值分布在冬季半球和25° N到25° S的热带范围,其中热带范围重力波的峰值随着高度向北移动,而在南半球高纬度地区重力波扰动较大值位于极区涡流的边缘.热带范围的扰动沿着经度方向有明显的变化,这是由风过滤、地形和波动等因素共同作用的结果.重力波扰动强度随高度变化,在25~30 km处呈现下降趋势,而超过42 km后又逐渐递增.对比8年平均的重力波在不同高度的强弱分布,可以看到,在较低高度,重力波的强弱明显与地形有关,而在较高高度,重力波的分布与地形的关系变得不明显.这说明重力波的形成与地形有显著相关性,但在传播过程中重力波的分布会随高度出现明显的变化.

关键词: 重力波 中层大气 SABER / TIMED 温度波动

Abstract: Using the temperature profiles obtained by the SABER/TIMED experiment from January 2002 to December 2009, we have extracted mesoscale temperature perturbations with vertical wavelengths ranging from 2 to 10 km. Global distribution of middle atmospheric gravity wave activity is revealed by observing the temperature perturbations. Gravity wave fluctuations in summer and winter are stronger than those in spring and autumn. Comparing with the values in winter, the disturbances' intensity in summer is weaker below 70 km, but it becomes stronger above 70 km. The larger gravity waves appear in winter hemisphere and in the tropics between 25° N and 25° S. Meanwhile,the perturbation peak points in the tropics move northward as the altitudes become larger. Furthermore, the wave is slightly larger at the edge of the Antarctic polar vortex. They also appear to vary with longitude at tropical latitudes, which may be resulted from wind filtering, topography, planetary wave modulations and other factors together. Moreover, gravity wave disturbance intensity changes with height. It indicates a decrease at 25~30 km and an increase above 42 km. Comparing the average distribution of gravity waves of eight years at different heights, we can see that the strength of gravity waves is related to topography obviously at lower altitudes, but the relationship is not significant at higher altitudes. It indicates that the formation of gravity waves is closely correlated with topography, but in the process of propagation the distribution of gravity waves significantly changes with altitudes.

Keywords: Gravity wave Middle atmosphere SABER / TIMED Temperature perturbation

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