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Inertia-gravity Waves in troposphere and lower stratosphere observed with the Beijing MST radar

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It is well known that gravity waves play an important role in determining the atmospheric circulation. The breaking of the gravity wave also contributes to the production of turbulence. Atmospheric gravity waves are also believed to have a significant impact on climate. Among the variety of techniques, MST (Mesosphere-Stratosphere-Troposphere) radar is a great tool for studying atmospheric dynamics, and it plays a unique role in gravity wave investigations. Since 2011, the Beijing MST radar (one of the only two domestic MST in China, within the Chinese Meridian Project) has been in continuous operation observing the vertical distribution of three-dimensional winds and turbulence in the troposphere-lower stratosphere and mesosphere-lower thermosphere regions with high spatial and temporal resolutions. Using one year's data from the Beijing MST radar observed in 2012, a statistical analysis is made to investigate inertia-gravity waves (IGWs) characteristics in troposphere and lower stratosphere. A combination of the Lomb-Scargle spectral analysis, the quasi-monochromatic gravity waves model, and the hodograph method were used to investigate wave characteristics including intrinsic frequencies, vertical wavelengths, horizontal wavelengths and period. The characteristics of IGWs show difference in troposphere and lower stratosphere. The gravity waves energy is consistent with the variation of the horizontal wind disturbance intensity. In addition, the monthly averaged IGWs occurrence rate indicates that the IGWs occur mostly in summer, which is related to the dynamic instability excitation; while in the lower stratosphere the occurrence is large in winter, which is closely related to the vertical shear of the horizontal wind.