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Atmospheric Gravity Waves: MST Radars and Sondes
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MST radars have proved to be extremely useful in monitoring atmospheric gravity waves and understanding their role in the middle and upper atmosphere dynamics. However, there are only a few such radars around the world, making routine monitoring of gravity waves in the global atmosphere impossible. Using sondes to extract wave information such as the momentum flux would help monitor and study gravity waves in the troposphere and the lower stratosphere, provided the method can be demonstrated to yield realistic results. As a sonde ascends, its vertical velocity is modulated by gravity waves so that, in principle, it should be possible to extract wave properties such as the energy density and momentum flux. However, the aerodynamics of the flow around the balloon complicates the sonde vertical motion. The Reynolds number of the flow is around the transitional value so that transition of the boundary layer on the forward hemisphere from laminar to turbulent can change the wake size and hence the drag in an unpredictable fashion, affecting the vertical velocity. We have modeled the behavior of the balloon assuming it to be elastic so that the sonde vertical velocity can be modeled and the transition from low drag to high drag assessed. The extensive sonde dataset collected during the 2005 CPEA II campaign at the Koto Tabang Equatorial Radar facility has been used to explore the technique. The vertical velocity fluctuations resulting from the model have been used to estimate atmospheric gravity wave properties at the radar site during the month-long campaign.

Proper validation of sonde-extracted gravity wave properties requires comparison with another independent, reliable and simultaneous set of measurements. MST radars, being the gold standard for gravity wave studies, provide such an opportunity. At the NARL MST radar facility in Gadanki, India, there exist radar data obtained during some sonde launches. We have used these data to compare wave properties extracted from sondes with those extracted from radar horizontal and vertical wind velocity measurements. We find the sonde provides results consistent with radar measurements, thus providing more confidence in the utility of the technique for studying gravity waves in the global stratosphere. We will present results of these comparisons and discuss their potential utility and some unresolved issues.

キーワード: MST radar, Radiosonde, Atmospheric gravity waves
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