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TITLE: Lidar and radar investigation of gravity wave characteristics, propagation and dissipation from the stratosphere to the lower thermosphere over McMurdo, Antarctica

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ABSTRACT BODY: In the middle atmosphere, dissipating gravity wave is one of the major forcing in driving the mean meridional circulations, which greatly affects the thermal structure and constituent transport in this region. Gravity waves also play a crucial role in the coupling process from the lower to the upper atmosphere. Therefore, in order to constrain gravity wave parameterizations in general circulation models, long-duration, large-altitude-range and high-resolution measurements of gravity waves are essential to provide real observations. In particular, the long-standing "cold pole" problems in many models can be attributed in large part to missing wave drag which can be estimated based on the gravity wave measurements around polar regions. However, at high latitudes, such measurements are rare in Antarctica. Simultaneous lidar and radar observations at McMurdo (77.8°S, 166.7°E) provide such an opportunity to study gravity waves in details. Besides, located just east to a vigorous gravity wave source, the Trans-Antarctic Mountain (ridge), McMurdo has been highlighted as a gravity wave 'hotspot'. In this paper, we perform a combined study of Fe Boltzmann lidar and MF radar observations of gravity waves events in the polar winter. We use Fe and Rayleigh temperature lidar data collected from early June to late July to extract the gravity wave perturbations. For each dataset, one or two dominant wave modes are identified from stratosphere to lower thermosphere (~30 km to ~110 km). The wave properties, such as apparent period, vertical wavelength, and phase speed, are characterized. Our preliminary analysis indicates dissipation of gravity waves, some in stratosphere and some even in the mesosphere and lower thermosphere. We will further characterize the wave dissipation via investigating vertical wavenumber power spectra. Hodograph analysis of MF radar wind data measured at the same location will be used to study characteristics of horizontal propagation directions and intrinsic properties of these waves.

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INDEX TERMS: [0342] ATMOSPHERIC COMPOSITION AND STRUCTURE / Middle atmosphere: energy deposition, [3363] ATMOSPHERIC PROCESSES / Stratospheric dynamics, [3332] ATMOSPHERIC PROCESSES / Mesospheric dynamics.

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