1 Gravity Waves and Momentum Fluxes in the MLT Using 430 MHz Dual-Beam Measurements at Arecibo

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We report on a new use of the UHF radar at the Arecibo Observatory in Puerto Rico. We have employed the 430 MHz radar for incoherent scatter measurements of radial wind spectra at altitudes from $\sim$71 to 95 km using the Gregorian and line-feed antennas to define two beams inclined 15^o to the east and west of zenith. We find that the two beams define radial velocities with sufficient accuracy to characterize both the gravity waves (GWs) and the momentum fluxes due to these waves over the majority of the observed altitude range during daylight hours. The characteristics of the GWs inferred from these measurements include 1) vertical scales ranging from $\sim$2 to 20 km, 2) downward phase progression of the dominant GWs up to $\sim$5 ms^{-1}, and 3) vertical wavenumber spectra having slopes near the value

expected for saturated GWs. The coplanar, dual-beam experiment was specifically designed to test the ability to measure GW momentum fluxes and their frequency distributions. Radial velocity variances reveal preferential eastward propagation for most intervals and altitudes. The momentum fluxes observed during this experiment had $\sim$1-hr averages that were often near zero, occasionally achieved amplitudes of $\sim$20 to 50 m^2s^{-2}, displayed significant consistency in altitude, and exhibited an approximate anti-correlation with the zonal wind field in cases with significant momentum fluxes. Frequency spectra defined the major contributions to the momentum fluxes, while S transforms were employed to examine the temporal variability of the GWs and momentum fluxes in greater detail.