Analysis of VHF coherent scatter observations of E-region irregularities in Puerto Rico and North Carolina

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The University of Illinois 50 MHz radar interferometer was installed near Fort Macon, Atlantic Beach, North Carolina (76°W, 34°N), to make observations of meter-scale E-region plasma density irregularities in support of two NASA rocket campaigns conducted in June-July period of 1999 and 2001. The radar was pointed perpendicular to the magnetic field at E-region heights over Wallops Island. E-region echoing layers were observed between 65 and 150 km altitude, centered around 100 km. The median vertical distance between sampled layers is about 3 km. The median layer duration is 9 min. Over 90% of the sampled layers show a mean altitude descent rate of 22 m/s while the average ascent rate for the remaining layers is 11 m/s. In contrast to results from Puerto Rico, no events with sustained vertical stationary layers were observed (tidal ion layers) (Urbina et al. Geophys. Res. Lett 27, 2853-2856, 2000). We analyze the general characteristics of the E-region radar echoes detected during these periods and compare them with E-region events obtained in Puerto Rico with a radar of similar sensitivity. We also discuss why the characteristics of QP echoes from Puerto Rico are very different from QP echoes observed at other geographic mid-latitude radar stations by inspecting those parameters that might influence these QP layers. We speculate that perhaps the lack of strong orography near Puerto Rico is influencing the climatology of gravity waves at E-regions heights compared to other sites to suppress frequent QP events. If this conjecture proves to be right, it would strengthen the case for the involvement of gravity wave motions in QP generations.