First results from the St. Croix Coherent Scatter Radar Imager

D. L. Hysell[1]*, E. Nossa[1], M. F. Larsen[2], J. Munro[3], N. Aponte[4], S. A. Gonzalez[4], J. Friedman [4], M. P. Sulzer[4], and S. M. Smith[5]

(1) Earth and Atmospheric Sciences, Cornell University, Ithaca, NY, USA
(2) Physics and Astronomy, Clemson University, Clemson, SC, USA
(3) University of the Virgin Islands, St. Croix, USVI, USA
(4) Arecibo Radio Observatory, Arecibo, Puerto Rico, USA
(5) Center for Space Physics, Boston University, Boston, MA, USA

ABSTRACT

A 30-MHz coherent scatter radar imager has been deployed on St. Croix, U. S. Virgin Islands, for studying field-aligned plasma irregularities associated with midlatitude sporadic *E* and spread *F* ionospheric instabilities. The radar shares a common volume with the Arecibo Radio Observatory. Using spaced receiver aperture synthesis methods, the coherent scatter radar can produce images of the plasma density irregularities with spatial and temporal resolution of the order of kilometers and seconds, respectively. Previous results indicate that the E-region irregularities in question are frequently organized along wavefronts that are also visible in neutral optical emissions. Those resilts were obtained mainly in 2002 during solar maximum conditions.

A number of joint experiments have been carried out in the summer of 2008 involving the 30-MHz radar, the Arecibo incoherent scatter radar, the Boston University all-sky imager, and the Arecibo resonance lidar aimed at elucidating the relationship between the stability of the neutral atmosphere in the MLT region, the sporadic *E* layers that form there, and the plasma density irregularities that form subsequently. Preliminary results from the campaigns, including one conducted in late September and October and well outside the normal season for observing quasiperiodic (QP) echoes and during solar minimum conditions, will be presented and discussed. Arecibo was operated in dual-beam coded long-pulse mode for these experiments, permitting the estimate of wind and temperature profiles in the *E* region. Features in the Arecibo data can be collocated precisely with those in the coherent scatter radar imagery. Such experiments make the causality chain leading to QP echoes clear.