MIDLATITUDE RADAR OBSERVATIONS OF THE JULY 2004 GEOMAGNETIC STORM

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We operate a coherent radar at sub-auroral latitude in Washington State. This "passive radar" takes advantage of existing illumination by commercial FM transmitters, so we are able to observe plasma density irregularities in the E region ionosphere at multiple frequencies (in the FM band) simultaneously. During the geomagnetic storms occurring from 17 July until 27 July 2004, we observed many of these irregularities for long continuous periods (up to 2.5 minutes) every 4 minutes, thus sampling the "storm evolution" completely on both long time scales (several hours) as well as short ones (seconds). Furthermore, we were able to make these observations with two different transmitters simultaneously (at 96.5 MHz and 97.3 MHz), allowing us to study the E region effects of the storms from diverse frequencies, look angles, and waveforms.

Our radar is also capable of fine spatial resolution: 1.5 km in range and approximately 2 km in transverse resolution at a distance of 1000 km (achieved with interferometry). We are able to form rudimentary images and discern velocity shears within scattering volumes with interferometric techniques; we can use antenna pattern, range, and the magnetic aspect angle criterion to roughly locate scatterers in our field of view.

We have found many interesting features in our July 2004 data, including a large-scale wavelike structure with a period that suggests a gravity wave, or TID, and irregularities whose speed sharply increases over a few kilometers in range. We will present some of these storm-time observations, along with any analyses we are able to perform on the data, and corroborating observations from other instruments (satellite and GPS data). We will discuss our observations with respect to storm-time magnetosphere-ionosphere coupling, storm evolution at midlatitude, and the plasma physics of E region density irregularities.

Abstract Submission Form

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