A statistical comparison of auroral electrojet- and SAPS-induced irregularity scatter

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Many observations of E-region field aligned irregularities have been collected using the Manastash Ridge Radar (MRR), a passive, multistatic system operating in the FM spectrum. These irregularities arise from at least two distinct phenomena: the auroral electrojet and the sub-auroral polarization stream (SAPS). Depending on geomagnetic conditions, the MRR (with a field of view limited to sub-auroral regions) may detect scatter due to one or more of these processes. We show evidence that the radar data can be associated with these generation mechanisms by use of DMSP and TIMED/GUVI satellite data. The data sets can be categorized as containing auroral targets, SAPS targets, or both by comparing range and time characteristics to the satellite data.

Passive remote sensing is well suited for these types of measurements due to the ability to continuously receive scatter over long periods of time. This is a necessity for developing meaningful statistics about the irregularities. We have analyzed over 100,000 spectra from the MRR containing signatures of the radar aurora and compiled various statistics for the entire set of data. These statistics will be used to quantitatively determine the Doppler moment characteristics of electrojet- and SAPS-induced irregularities and to infer characteristics of the processes causing the scatter. We will comment on any differences between SAPS and auroral targets with respect to their instantaneous range-Doppler information as well as their respective evolutions over time and space. By comparing statistics for the two types of targets, we will develop an automated method for classifying targets.

Finally, we will compare the Doppler statistics derived from three different algorithms for automatic identification and characterization of irregularity echoes. Based on this comparison, we will comment on the significance of the choice of spectral moment estimator in phenomenological studies of the radar aurora.