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The Impact of Solar and Magnetospheric Conditions on High-Latitude Irregularity Spatial-Scales as Observed Using Advanced Radar Techniques

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To provide new insights into the relationship between geomagnetic conditions and plasma irregularity scale-sizes, high-latitude irregularity spectra are developed using a novel Incoherent Scatter Radar (ISR) technique. This new technique leverages: 1) the ability of phased array Advanced Modular ISR (AMISR) technology to collect volumetric measurements of plasma density, 2) the slow F-region cross-field plasma diffusion at scales greater than 10 km, and 3) that high-latitude geomagnetic field lines are nearly vertical. The resulting irregularity spectra are of a higher spatial-temporal resolution than has been previously possible with ISRs, capable of resolving approximately 20 km structures in less than two minutes (depending on the radar mode). By comparing irregularity spectra from high-latitude Resolute Bay ISR data to solar and magnetospheric conditions, we have found that although structures 100s of km wide can be prevalent for a variety of geomagnetic conditions, polar cap structures 10s of km will become more prevalent during quiet geomagnetic conditions. Furthermore, structures that are 10s of km wide will also become more dominant near midnight, reflecting the role of polar cap convection in breaking down structures as they travel from the dayside ionosphere to the nightside. This presentation will expand on these and other findings, as well as discuss the future goals of this work.