An Examination of the Source of Decameter-Scale Irregularities in the Geomagnetically Disturbed Mid-Latitude Ionosphere

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We present first results from a study of the relationship between small-scale ionospheric irregularities observed by Super Dual Auroral Radar Network (SuperDARN) radars and large-scale density structures, such as the mid-latitude trough associated with subauroral polarization stream (SAPS) events. A focus is placed on mid-latitudes over North America where recent expansion of the SuperDARN network allows for comparison with total electron content (TEC) measurements from a dense network of ground-based GPS receivers. Numerical models show that gradients associated with the mid-latitude trough walls can produce small scale structures due to both the ion temperature gradient instability and gradient drift instability. However, previous studies of the gradient drift instability using high-latitude SuperDARN radars suggest that only sunward directed plasma density gradients at the duskside and dawnside ends of the trough present favorable conditions for the growth of decameter-scale field-aligned irregularities (FAIs). Recent campaigns by the Millstone Hill Incoherent Scatter Radar in support of the NASA Van Allen Probes mission provide crucial ion/electron velocity, temperature, and density measurements for the study of these instability processes. Specifically, we re-examine the gradient drift instability as a source of the small-scale FAIs regularly observed by SuperDARN radars in the mid-latitude ionosphere during geomagnetically disturbed conditions.