

STUDYING MID-LATITUDE DENSITY IRREGULARITIES
WITH DISTRIBUTED INSTRUMENT NETWORKS

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Studies have shown an association between scintillation and mid-latitude ionospheric irregularities which are generated by instabilities associated with electron density gradients and strong electric fields [Foster and Aarons, 1998]. To fully understand this association, it is necessary to make observations over wide regions during a variety of geomagnetic activity levels. These investigations can be best accomplished using distributed arrays of instrumentation which have coverage that far exceeds that of any individual instrument. We will describe how data both from the Global Positioning System (GPS) receiver network and from the recently funded Intercepted Signals for Ionospheric Science (ISIS) array has been, and will be, used to study mid-latitude scintillation. For example, the global network of GPS receivers provides near real-time TEC information from many locations around the world. By combining the TEC data from this network, phenomena such as the development of storm enhanced density (SED) can be monitored. A recent study has observed a correlation between SED, which is associated with large gradients in the TEC, and scintillation activity in Canada [Skone, et al. 2003]. In this study, phase scintillation parameters were measured by specially equipped GPS receivers at different sites in Canada. Scintillations were clearly observed in Calgary and other sites during time periods that correspond to presence of SED in Canada. Additional experimental observations are needed to help understand the association of scintillation with SED and the plasmasphere boundary layer (PBL) phenomena.

The ISIS array is based on high performance coherent software radio receivers which can intercept a wide range of signals with extremely precise time and frequency synchronization. The intercepted signals can be used for propagation studies, spectrum monitoring, scintillation observations, passive radar, and multistatic active radar. By using real time data from the ISIS array in the context of GPS TEC maps targeted incoherent scatter observations can be made in regions of the ionosphere where scintillation is observed to occur. This kind of detailed study is needed to fully understand mid-latitude scintillations and their evolution with the development of SED structures. This talk will review our current scintillation observations in the presence of SED and discuss our plans for future measurements.

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