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Sensing Ionospheric Disturbances Using a Large GNSS Network

Traveling Ionospheric Disturbances (TIDs) can be observed following surface or underground nuclear weapons tests. The availability of large, dense networks of GNSS receivers enables the detection of these disturbances and mapping of their speed and direction of propagation over large geographical areas. Our previously published results have shown the detection of disturbances from the 2006 and 2009 DPRK events. Many other types of sources, however, can produce similar disturbances, and consequently TIDs are ubiquitous in the ionosphere, often with a seasonal and directional dependence. We have applied the wavelet transform to isolate individual traveling wave packets and are studying pattern classification methods for distinguishing different sources from their unique signatures in the time series of the Total Electron Content (TEC). In addition, we are applying a high fidelity coupled atmosphere-ionosphere model to study the sensitivity of TEC variations to source strength and environmental variables. We will present results from application of our array processing techniques to assess the detectability of signatures in data collected during the 2013 and 2016 DPRK tests

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