

Panels (P)

Preparation for a New Ionospheric Space Weather Scale for Trans-ionospheric Radio wave Propagation (PSW.3)

Consider for oral presentation.

PROGRESS ON THE NEED FOR AN IONOSPHERIC T-SCALE TARGETING TRANS-IONOSPHERIC RADIO WAVE USERS

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The existing NOAA Space Weather Scale for Geomagnetic Storms (G), Radio Blackouts (R), and Solar Radiation Storms (S) serve a number of user groups affected by space weather. However, user surveys show the GNSS navigation and satellite communication communities are still not well served. The latter user group relies on trans-ionospheric radio wave propagation that is impacted by the plasma density content (e.g., line-of-sight total electron content; TEC) and structure or irregularities in the plasma. Plasma density structure can cause amplitude and phase scintillation in the radio wave signals from refraction, or bending, of the waves around ionospheric structure and subsequent interference effects. The existing G, R, and S Scales are driven, respectively, by real-time observations from ground-based magnetometers for the Kp index, X-ray flux from the GOES satellite, and the solar energetic proton flux also from the GOES satellite. The need for a reliable consistent data source is fundamental to the operation of a Scale. For trans-ionospheric radio waves, a reliable, widely available, repeatable, global data source is from dual-frequency GNSS data, either from ground or space-based platforms. These measurements from either platform can provide estimates of TEC, and indices related to ionospheric irregularities, such as the rate of change of TEC (ROTI), amplitude scintillation (S4), and phase scintillations (σ_{ϕ}), for example. Recently, significant effort has been devoted to determining the relationships between these different indices and combining observations from ground-based and space-based platforms at all latitudes. Note that the physical processes

driving the ionospheric irregularities are likely to be very different in different latitude domains, and during varying levels of geomagnetic activity from quiet to storm. Only with this concerted observational effort will sufficient data be available in real-time to drive a T-Scale. As the observational capability matures at all latitudes to characterize the global ionospheric “state”, some effort is also being devoted to the possible design of a scale, in terms of defining the index that will determine the scale levels, what those levels will be and their occurrence frequency, the Scale cadence, and how the scale levels will relate to the various trans-ionospheric radio wave user groups.