HamSCI Personal Space Weather Station: A New Tool for Citizen Science Geospace Research

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Recent advances in geospace remote sensing have shown that large-scale distributed networks of ground-based sensors pay large dividends by providing a big picture view of phenomena that were previously observed only by point-measurements. Notable examples include the improved understanding of traveling ionospheric disturbance (TID) sources based on observations from the high frequency (HF) Super Dual Auroral Radar Network (SuperDARN) radars and GNSS-based total electron content remote sensing networks. While these existing networks provide excellent insight into TID science, the system remains undersampled (especially at HF) and more observations are needed to advance understanding. Additionally, previous measurements have revealed that characteristics of medium scale traveling ionospheric disturbances (MSTIDs) observed on the bottomside ionosphere using oblique HF sounding by SuperDARN differ from integrated ionospheric measurements of MSTIDs made using GNSS-TEC. These differences have yet to be accounted for, and additional observations could aid in understanding the propagation of MSTIDs from the bottom to the top of the ionosphere.

In an effort to generate these additional measurements, the Ham Radio Science Citizen Investigation (HamSCI, hamsci.org) is working with the Tucson Amateur Packet Radio Corporation (TAPR, tapr.org), an engineering organization comprising of volunteer amateur radio operators and engineers, to develop a network of Personal Space Weather Stations that will provide scientific-grade observations of signals-of-opportunity across the HF bands from volunteer citizen observers. These measurements will play a key role in the characterization of ionospheric variability across the geographic regions in which these stations are deployed. We will describe concepts, key software patterns for radio science, and proposed timelines for the Personal Space Weather Station project. A particular focus will be assembling the proper metadata for science grade observations, and strategies for lightweight calibration of radio sensors. Initial project efforts concentrate on a wideband receiving station and backing software data distribution system.