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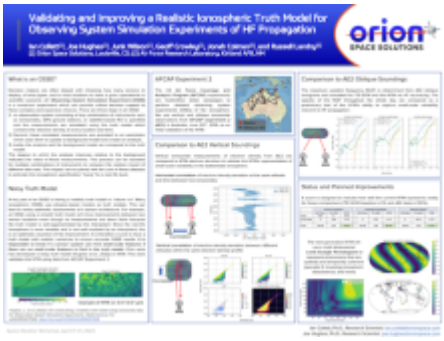
The US Air Force Coverage and Analysis Program (AFCAP) experiments 1, 2, and 3 have all been multimillion dollar campaigns to perform detailed Observing System Experiments (OSEs) of the ionosphere. Much of that expense has been dedicated to collecting enough observations of the ionosphere to be capable of post processing a “truth” ionosphere. Even after such great expense, significant limitations exist in the breadth of available truth data. The ability to conduct an OSE without having to deploy sensors and personnel would vastly expand research opportunities. Such “virtual” OSEs are called Observing System Simulation Experiments (OSSEs) and require a synthetic truth model. For the HF propagation environment relevant to AFCAP, the synthetic truth model must accurately represent small-scale structures not present in smooth climatological or physics-based models. We present a synthetic truth model and a path of further development which we believe will achieve this objective.

Our synthetic truth model is constructed from the smooth physics-based TIE-GCM model by incorporating spatial and temporal electron density variations informed by two years of ionosonde measurements at mid-latitudes. Recently, using data from AFCAP experiment 2, we have performed validation of the truth model’s representation of the HF propagation environment (E, F1, and F2 layers). Improvements to the truth model are also being explored. For example, using a N-dimensional Lomb-Scargle Periodogram is a more consistent treatment among spatial and temporal correlations, allowing the truth model to capture phenomena that are coherent in space and time, such as traveling ionospheric disturbances and sporadic E.



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