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LSTIDs and their impacts on the Topside Ionosphere

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Large Scale Traveling Ionospheric Disturbances (LSTIDs) have been observed extensively in GPS TEC and other datasets, but their mechanism for formation, progression, and their global impacts are still not well understood. One interesting question is how the wave signatures from LSTIDs propagate to the topside ionosphere. Wave-like variations have been seen in many observations of the topside ionosphere, but it is not clear how the density variations reach these altitudes. Around the peak of the F-region, we typically assume that LSTIDs are driven directly by their neutral counterparts: Large Scale Traveling Atmospheric Disturbances (LSTADs). In the topside ionosphere, however, the ion and neutral densities are much lower, so the neutrals cannot effectively impart a wave signature to the plasma. This study examines the origin of LSTIDs in the topside ionosphere using a two-way coupled ionosphere-thermosphere model, developed by combining WACCM-X (Whole Atmosphere Community Climate Model, Extended version) with the three-dimensional ionospheric model SAMI3 (SAMI is Another Model of Ionosphere), to simulate LSTIDs. We analyzed the model output and compared it to observations of topside LSTID signatures. Then we performed model experiments to examine the role of various physical processes in the generation of LSTID signatures in the topside ionosphere.