Simulation of Ionospheric Irregularities for the 2008 C/NOFS ALTAIR Campaign

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One of the vital elements of the C/NOFS (Communication and Navigation Outage Forecast System) program is the modeling and forecasting of low-latitude structures that can produce radio scintillation, using physics-based forecast codes. To describe the extent and structure of the turbulent plasma plumes caused by interchange instabilities in the low-latitude ionosphere, a three-dimensional model of the plumes has been developed. To better reflect the day-to-day variability of the occurrence of the plumes, the plume model is closely coupled to a time-dependent model of the ambient ionosphere which is designed to be initialized by assimilation of data from the C/NOFS satellite. The system of models has been implemented in the C/NOFS Data Center to provide operational scintillation forecasts. After describing the models, I will use them to present a detailed study of the ionosphere over the Pacific during the 2008 C/NOFS ALTAIR campaign (days 271-273, 2008), addressing the structure of the ambient plasma density as well as the presence and form of plasma plume structures.

Based on preliminary runs calculated using climatological drivers (prior to the arrival of the satellite data for analysis), we find that plasma plumes containing irregularities form regularly every evening; this is consistent with the period of the campaign being within the usual scintillation season for this longitude. Consistent with the ALTAIR radar observations and with the expectations for solar minimum conditions, we find that the plumes rise no further than about 400 km in altitude. We expect that the day-to-day variability of the conditions in the ionosphere will be reflected in the variability of the plasma drifts measured by instruments on the C/NOFS satellite, which, when incorporated into the models, will enable us to better describe the variability of these phenomena.