Statistics of Ion Density Irregularities Within Low-Latitude Ionospheric Plasma Bubbles and Their Gradients Based on C/NOFS Planar Langmuir Probe Data

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The Planar Langmuir Probe (PLP) onboard the Communication/Navigation Outage Forecasting System (C/NOFS) satellite monitored ionospheric plasma bubbles and relatively small scale irregularity densities with high resolution (512 Hz) almost seamlessly for approximately five years since May 2008. These structures severely affect the performance and availability of satellite navigation and communication systems. PLP C/NOFS data are immediately available in individual daily files with 1-Hz resolution. Each 1-s record, corresponding to approximately 7.5 km, associates the Universal Time (s) to the corresponding average ion density N_i (cm^{-3}), standard deviation of the ion density ΔN_i (cm^{-3}), ratio $\Delta N_i/N_i$, as well as satellite latitude (degrees), longitude (degrees), and altitude (km).

This contribution will present statistical analyses of ΔN_i, $\Delta N_i/N_i$, and time gradients of N_i (that is, $\delta N_i/\delta t$, for different time baselines δt, such as $\delta t = 1$ s and $\delta t = 10$ s). Time series of these parameters are displayed in Figures 1 and 2. Additionally, it will analyze simultaneous occurrences of standard deviations ion density ΔN_i and time gradients $\delta N_i/\delta t$. These studies will be limited to evening-time sections of the C/NOFS orbits and will classify results according to different combinations of: (i) solar activity; (ii) altitude range; (iii) longitude sector; (iv) local-time interval, when applicable.

The results from the proposed work will quantitatively characterize the gradients and internal small-scale structuring involved in their evolutions. The present characterization provides information that could be useful for a description of scintillation dynamics and in the design of countermeasures of their effects on the systems referenced above.

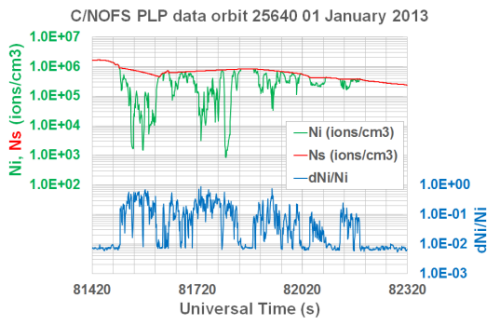

Figure 1. Time series of N_i (green) and $\Delta N_i/N_i$ (blue) for 15 minutes C/NOFS PLP data.

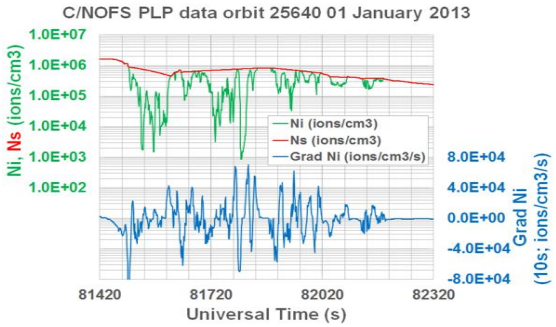

Figure 2. Time series of N_i (green) and $\delta N_i/\delta t$ (blue, with $\delta t = 10$ s) for 15 minutes of C/NOFS PLP data.