AN EXAMINATION OF THE VARIABILITY AND CORRELATIONS IN THE TOPSIDE IONOSPHERE

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In order to understand the global response of the ionosphere to space weather events, it is important to examine the inherent variability of the ionosphere and the correlations associated with this variability. This paper examines both the variability of the topside ionosphere and the correlations between the different distributions of the observations. For this study, the existing database of electron density observations from the Defense Meteorological Satellite Program (DMSP) is used. These observations have been taken for nearly a complete solar cycle from 1995 to 2005 with some earlier observations. The measurements are taken over all geographic latitudes and longitudes every four seconds along the satellite orbit. However, the data exist in four local time regions at mid and low latitudes. In total, over eighty million data points are included in this statistical study.

The topside electron densities, when binned by F10.7 cm solar radio flux and geomagnetic latitude, obey a lognormal distribution. These distributions can be characterized by three parameters: a scale parameter related to the median density, a location parameter related to the minimum observable density, and a shape parameter related to the width of the tail of the distribution. These parameters are calculated from the data and are presented. Finally, linear correlation coefficients can be constructed from these distribution functions, which represent the overall correlation in the variability of different ionospheric regions. Since each data bin has a different number of data points, sample distributions using the statistical parameters are constructed for a 20000 point distribution. During geomagnetic storms, these correlations provide insight into the ionospheric response in data sparse regions.

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