THEORETICALLY MODELING THE IONOSPHERIC RESPONSE AT LOW LATITUDES TO LARGE GEOMAGNETIC STORMS

Anderson, D.[1], Anghel, A.[1], Araujo, E.[1]
, Eccles, V.[2], Valladares, C.[3], Lin, C.[4]
[1]CIRES/Univ of Colorado; NOAA/SEC, 325 Broadway, Boulder, CO 80303
[2]Space Environment Corp., 221 N. Spring Creek Pky, Suite A, Providence, UT 84332
[3]Institute for Space Research/Boston College, 140 Commonwealth Ave., Chestnut Hill, MA 02467
[4]NCAR/HAO, 3450 Mitchell Lane, Boulder, CO 80301

In the low latitude, ionospheric F region, the primary transport mechanism that determines the electron and ion density distributions is the magnitude of the daytime, upward ExB drift velocity. During large geomagnetic storms, penetration of high latitude electric fields to low latitudes can often produce daytime, vertical ExB drift velocities in excess of 50 m/sec. Employing a recently-developed technique, we can infer these daytime, upward ExB drift velocities from ground-based magnetometer observations at Jicamarca and Piura, Peru as a function of local time (0700 1700LT). We study the ionospheric response in the Peruvian longitude sector to these large upward drifts by theoretically-calculating electron and ion densities as a function of altitude, latitude and local time using the time-dependent Low-Latitude Ionospheric Sector model (LLIONS). This is a single sector ionosphere model capable of incorporating data-determined drivers, such as ExB drift velocities. For this study, we choose 4 large storms in 2003 May 29, October 29 and 30 and November 20- when daytime ExB drift velocities approached or exceeded 50 m/sec. Initial results indicate that the large, upward ExB drift velocities on Oct. 29 produce equatorial anomaly crests in ionization at +/- 20 dip latitude rather than the usual +/- 16 dip latitude. In addition, crests in electron density at 840 km are observed on either side of the magnetic equator by the DMSP F13 SSIES sensor at 1800 LT for each of the four storm periods. We compare the theoretically-calculated results with a variety of ground-based and satellite observations for these four periods and discuss the implications of these comparisons as they relate to the capabilities of current theoretical models and our ability to infer ionospheric drivers such as ExB drifts.

Abstract Submission Form

2004 National Radio Science Meeting

Abstract: anderson8665

Date Received: September 23, 2004

1. (a)
David Anderson
NOAA/SEC
325 Broadway
Boulder, CO
80303 USA
david.anderson@noaa.gov
   (b) 303-497-7754
   (c) 303-497-3645
2. G - Ionospheric Radio and Propagation
3. (a) Data Assimilation
4. C - Contributed Paper
5. No special instructions