

1 On the vertical electrodynamic drift velocity at nighttime equatorial F-region ionosphere

Oyedemi S. Oyekola (1), Akinremi Ojo (2) and Jolasun Akinrimisi (3)

1.1 (1,2) Department of Physics, University of Ibadan, Ibadan, Nigeria

e-mail: osoyekola@yahoo.com;

1.1.1 (3) Department of Physics, University of Lagos, Lagos, Nigeria

email: akinjibs@yahoo.com

Abstract: Low-latitude nighttime ionospheric F-region phenomena are relatively less investigated in the equatorial region of African continent compared with American and Indian sectors. However, the lack of extensive studies in the African zone is a major deficiency in global modeling of ionospheric and thermospheric system. F-region vertical plasma drifts at the magnetic equatorial station, Ibadan (7.4°N , 3.9°E ; 6°S dip) are inferred from the time variation of the hourly-recorded ionosonde virtual height of F-layer ($h'F$) data obtained during 1957/58 International Geophysical Year, IGY period (corresponding to a year of solar cycle maximum epoch) under geomagnetic quiet and disturbed nights. Prominent nocturnal vertical drifts characteristics are presented. Seasonal effects appeared to be pronounced during undisturbed and disturbed nighttime periods. The values of maximum prereversal enhancement velocities during quiet and disturbed periods are poorly correlated. Also, prereversal peak velocity noticeably varies with season. The magnitudes during quiet winter, summer, and equinox periods are estimated as 26, 29.5, and 36.4 m/s respectively; while the values are 26, 27.7, and 32.6 m/s during disturbed summer, winter, and equinox periods in that order. In addition, prereversal peak velocity exhibits considerable variability with 10.7 cm Solar Flux Index and average Zurich monthly sunspot numbers. Furthermore, based on our analysis, we conclude that, at Ibadan, an African zone, the threshold parameters, such as, $E \times B$ vertical drifts and virtual height ($h'F$) required causing spread-F irregularities are determined to be approximately 30 m/s and 400 km respectively. The results are in accord with earlier quantitative investigations for the equatorial region in the American and India sectors. Nonetheless, the results in this work must help to advance equatorial ionospheric modeling studies by providing data from a station near the southern magnetic equator, a region of the African ionospheric station with rela-

tively hardly any observations. There are several possible processes responsible for the quite and disturbed times plasma drift variability in the night hours at equatorial regions.

Keywords: Equatorial-ionosphere; Prereversal-velocity; Solar-parameter