Equatorial nighttime vertical F-region plasma drifts during disturbed-time in the African sector

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The terrestrial ionosphere deals with the basic structure and variability of plasma within the upper atmosphere of the Earth. Furthermore, the ionosphere comprises less than one percent of the mass of the upper atmosphere, yet it has a significant influence on advanced communication and navigation systems; both have important economic consequences. As society beings to rely on more complex technologies, those systems become more susceptible to environmental effects. However, there is still considerable difficulty in the understanding of the equatorial ionospheric phenomena under different solar and geomagnetic conditions despite all extensive studies in the middle and high latitudes and in equatorial and low latitude American and Indian sectors. By contrast, there is a remarkably sparse database at equatorial African continent of the globe. Consequently, we infer F-region vertical plasma drifts at the magnetic equatorial station, Ibadan (7.4^{o}N, 3.9^{o}E; 6^{o}S dip) 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 high solar flux under geomagnetic disturbed night hours (1800-0600 LT). The results show a strong geomagnetic control of ionospheric plasma drifts velocities variability in month-to-month and at three different seasonal conditions. The largest random fluctuations are observed in June solstice months. The evening and morning reversal times are highly variable. The average magnitude of the downward nighttime F-region vertical plasma drifts are significantly smaller than usually reported value of about 10 m/s during quiet downward nighttime conditions. It is also found that the drifts are completely downward (negative) for about 8 hours during equinox and summer periods. An outstanding sudden sharp spike is observed at 0500 LT in the month of February which reaches a value as high as about 40 m/s. Prereversal enhancement of vertical velocity is maximum in equinoctial periods with a value nearly 27 m/s. Our data are essentially consistent with previous results from modeling, theoretical and observational studies in equatorial latitudes. The results here must provide additional data from the Southern magnetic equator for ionospheric and thermospheric models' representations. Possible sources of the disturbed-time variability in equatorial electrodynamic plasma drifts

can result from magnetospheric activity and meteorological control.

Keywords: Ionosphere variability, Equatorial F-region, Disturbed-nighttime