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Vertical drift velocity measurements at *F* region low latitude ionosphere

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The potential importance of the electrodynamic processes of the equatorial and low latitude ionosphere has been the subject of several extensive studies over the last few decades. Measurements of ionospheric parameters in the African longitude sector are comparatively sparse. Furthermore, it has been proposed that ionosondes can be used to measure vectorial nighttime ionospheric drifts at F region altitudes. These measurements have been validated at mid and high magnetic latitudes on campaign basis. Here we report nocturnal F region vertical plasma drift velocity measurements made at Ibadan (7.4^{o}N, 3.9^{o}E; 6^{o}S dip) using an hourly-recorded median values of ground-based ionosonde F peak height (*hmF2*) acquired from 1 year of data during 1957-1958 International Geophysical Year (IGY) that corresponds to a period of high solar flux under quiet geomagnetic condition. Vertical velocities during the three seasonal periods are compared with observations made by incoherent scatter radar (ISR) and AE-E satellite for low latitude F region vertical drifts. We show a good agreement between the three techniques mainly at periods when convection dominates other factors (e.g., around pre-reversal enhancement) in December solstice and equinox periods, respectively; while opposite is the case during June solstice. The vertical drifts are downward for about ten hours between 2000 and 0500 LT sector by the three methods, except ionosonde June solstice drifts, which are downward between 2200 and 0400 LT intervals. However, it is found that on the average, at Ibadan, during December solstice, ISR and AE-E results are higher in values by a factor of about two than the ionosonde derived drifts. The magnitudes of Jicamarca and satellite drifts are greater than the Ibadan drifts by a factor of about two and three, respectively, during equinoctial period. During June solstice, radar drifts is again a factor of about two higher in value than the ionosonde drift, but satellite and Ibadan ionosonde-derived vertical drifts are comparable. The average downward nighttime vertical drift is just less than 10 m/s. The prominent equinoctial average pre-reversal enhancements (PRE) measured by the three techniques are around 28 m/s, 30 m/s, and 35 m/s for radar, ionosonde and satellite, respectively, and occur at the same local time (1900 LT) for all the seasons. The evening reversal times are alike, apart from June solstice that exhibits significant variations. The morning reversal times are also in accord, except for the equinoctial Jicamarca data. In addition, the threshold parameters, such as **E**x**B** vertical drift and F layer peak height (*hmF2*) required to cause spread-F irregularities are determined to be $\sim$27 m/s and $\sim$550 km, in that order. Pre-reversal peak velocity shows strong variations with solar activity as represented by Zurich mean monthly sunspot numbers and $F10.7$cm solar flux. The slope relating vertical plasma drift velocity enhancement with sunspot number (*Rz*) is about 54 % greater in value than the slope connecting pre-reversal peak velocity with solar flux index ($F10.7$ cm). Conversely, the correlation coefficient value between PRE and Rz is about 23 % still greater than the correlation between PRE and $F10.7$ cm. However, our vertical drift measurements provide important information as to the global behavior of the equatorial ionosphere, and useful for global modeling of the equatorial and low latitude ionosphere.