Equatorial Electrojet Observations in the African Continent

E. Yizengaw[1], M. B. Moldwin[1], A. Mebrahtu[2], R. F. Pfaff[3], E. Zesta[4], and B. Damtie[5]

[1] Institute of Geophysics and Planetary Physics, University of California, Los Angeles, USA.
[2] Department of Physics, Mekelle University, Mekelle, Ethiopia
[3]NASA Goddard Space Flight Center, Greenbelt, Maryland, USA
[4]Air Force Research Laboratory, AFRL/VSBXP, Hanscom AFB, USA
[5]Washera Geospace and Radar Science Laboratory, Bahir Dar University, Bahir Dar, Ethiopia

Abstract: Although Satellite observations in the African sector show unique equatorial ionospheric structures that can severely impact navigation and communication systems, the study of ionospheric disturbances in this region is difficult due to the lack of ground-based instruments. This has created a gap in global understanding of the physics behind the evolution and formation of plasma irregularities in the equatorial region, which imposes limitations on ionospheric density modeling efforts. Therefore, in order to have a more complete global understanding of equatorial ionosphere motion, the international space science community has begun to develop an observational infrastructure in the African sector. This includes the deployment of a number of arrays of small instruments, including the AMBER magnetometer array, through the International Heliophysical Year (IHY) cooperative program with the United Nations Basic Space Science (UNBSS) program. Two AMBER magnetometers have been deployed successfully at Adigrat (~6°N magnetic) in Ethiopia and at Medea in Algeria (28° magnetic), and became fully operational on 03 August 2008. The remaining two AMBER magnetometers will be deployed soon in Cameroon and Namibia. One of the prime scientific objectives of AMBER is to understand the processes governing electrodynamics of the equatorial ionosphere as a function of latitude, local time, magnetic activity, and season in the African region. The most credible driving mechanism of ionospheric plasma ($\mathbf{E}\times\mathbf{B}$ drift) can be estimated using two magnetometers, one right at the equator and the other about 6° off the equator. Therefore, using the AMBER magnetometer at Adigrat and the INTERMAGNET magnetometer located at Addis Ababa (0.9°N magnetic) in Ethiopia, the equatorial electrojet ($\mathbf{E}\times\mathbf{B}$ drift) activities in that longitudinal sector of the African continent is estimated. The paper also presents the comparison between the estimated vertical drift and the $\mathbf{E}\times\mathbf{B}$ drift values obtained from the vector electric field instrument observation onboard the C/NOFS satellite. The evolution of equatorial ionospheric irregularities will also be presented using data from the growing number of ground- and space-based (on Low-Earth-Orbit (LEO) satellites) GPS receivers in the African region.