

Ground-based Instrumentations in African and their Scientific and Societal Benefits to the region

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Abstract: Much of what we know about equatorial physics is based on Jicamarca Incoherent Scattering Radar (ISR) observations. However, Jicamarca is in the American sector where the geomagnetic equator dips with a fairly large excursion between the geomagnetic and geodetic equator. On the other hand, in the African sector the geomagnetic equator is fairly well aligned with the geodetic equator. Satellites (e.g. ROCSAT, DMSP, C/NOFS) observations have also indicated that the equatorial ionosphere in the African sector responds differently than other sectors. However, these satellite observations have not been confirmed, validated or studied in detail by observations from the ground due to lack of suitable ground-based instrumentation in the region. Thus, the question of what causes or drives these unique density irregularities in the region is still not yet fully understood, leading the investigation of the physics behind each effect into speculative dead ends. During the past couple of years very few (compared to the land-mass that Africa covers) small instruments, like GPS receivers, magnetometers, and VLF have been either deployed in the region or in process. However, to understand the most dynamic region in terms of ionospheric irregularities, those few instruments are far from enough. Recently, significant progress has been emerging in securing more ground-based instrument into the region, and thus three ionosondes are either deployed or in process. In this paper, initial results from AMBER magnetometer network, ionosonde, and GPS receivers will be presented. By combining the multi instrument independent observations, this paper will show a cause and effect space weather impact in the region for the first time. While the magnetometer network, such as those operated under the umbrella of AMBER project, estimates the fundamental electrodynamic that governs equatorial ionospheric motion, the GPS receivers will track the structure and dynamics of the ionosphere. Finally, the paper will present the ongoing extensive activities on the possibilities of placing an equatorial ISR in Africa. In addition to the scientific importance, the ground-based instrumentations have also direct impact in advancing space science research by establishing and furthering sustainable research/training infrastructure within Africa so that more young scientists will be educated in their own country.