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Title: Variability parameters for *fof2* at equatorial latitudes

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This paper presents a study of the parameters implemented to characterize the variability of the equatorial ionosphere. It covers six years of high, moderate and low solar activity epoch at two equatorial stations that are next to the magnetic equator, Ouagadougou (dip +5.9) and Korhogo (dip -0.67). The result shows that the density function of foF2, the critical frequency of the F2 layer, is closed to a normal distribution that is some time flattened out with increased solar activity. The relative difference (mean-median/mean) of foF2 is lower and does not show a prominent seasonal effect. Regardless of the solar epoch, only few values are out of the range -4 to +4 percent mainly observed at nighttime. The lower deciles and lower quartiles to median ratios showed higher value during daytime and lower value at nighttime hours. The contrary is observed with the upper deciles and upper quartiles ratios to median. The deciles to median ratios agree well with the International Telecommunication Union (ITU) variability index model during daytime hours.

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Title: Establishing Cosmic Ray Station and other space research facilities in Ethiopia

Ethiopia (former Abyssinia) has been a first-class research field for geologists and especially seismologists from the early last century onwards. This is largely due to the Great Rift Valley, a great tear across the surface of Earth, extending nearly 6000 km from Syria, through the Red Sea, Ethiopia, and down to Mozambique. Its geographical (from about 35°E-45°E and 3°N-15°N) and magnetic location (the magnetic equator crosses Ethiopia) is perfect for investigations related to many topics of space physics.

Near Earth Space carries its specialty above Ethiopia in the sense of the Equatorial ElectroJet (EEJ), a narrowly north-south extended electric current flowing right across the country at an altitude of about 105 km. It comes, therefore, not as a surprise that pioneering work in the exploration of the EEJ was made at observation sites including Ethiopia (and other African countries located in the equatorial region). In the beginning of the seventies of last century, experiments in space physics were conducted in Ethiopia, thanks to the initiative and interest in coherent radar observations of a French team [1] and the Geophysical Observatory of the Addis Ababa University (AAU). The Geophysical Observatory in the campus of AAU is still operational and its present contribution to the scientific community is, among other activities, maintaining an INTERMAGNET station of the world-wide, real time, satellite-linked, magnetometer network (http://www.intermagnet.org/). A review paper that describes space research activities in Ethiopia and in neighboring African countries during the seventies of last century can be found in [2].

Although the facilities installed by French scientists have provided valuable data, the expansion and continuous operation of these facilities did not materialize in Ethiopia. This may be due to the fact that the involvement of Ethiopian scientists in research and development of these facilities was very limited. Moreover, there was no any space physics formal training at Ethiopian universities in that time.

Formal education in space physics has started in Ethiopia recently with the start of Space Physics Graduate Program jointly by Addis Ababa University and Bahir Dar University. In order to expand and strengthen this program, we are initiating a collaborative project in atmospheric research and educational programs with many national and international stake holders, including a commercial enterprizes such as Eigenor heading towards development and operation of weather radars (http://www.eigenor.com/BERCAB/index.php/Main Page). This paper presents an overview of the research and training activities in space physics in Ethiopia and also the descriptions of one successful collaborative project between Oulu University (Finland), Bahir Dar University (Ethiopia) and Addis Abeba University (Ethiopia). Moreover, a brief description of other forthcoming collaboration is presented with the intention of attracting the attention of potential collaborators and funding agencies.

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Title: Ionospheric Vertical Plasma Drifts at F-Region near the Magnetic Equator

The ionospheric plasma drift is one of the most essential parameters for understanding the dynamics of ionospheric F-region. Consequently, it has been the subject of numerous studies with variety of observational techniques over the last few decades, mostly, at equatorial and low-latitude regions. F-region electromagnetic drifts are calculated from ionosonde observations acquired during the Intentional Geophysical Year (1957/58) at Ibadan (7.4^{o}N, 3.9^{o}E, dip 6^{o}S), Nigeria. We investigate ionosonde drift variations with solar and geomagnetic activity under three seasonal conditions, and compared these drifts with vertical drifts obtained by incoherent scatter radar and AE-E satellite measurements under similar solar and geomagnetic conditions. We show that except for solar minimum equinoctial period, there is an excellent consistence in the magnitude (nearly 20 m/s) and occurrence pattern of upward daytime **E**x**B** drift velocity at low and high solar activity periods. A clear seasonal and geomagnetic effect is apparent. In the nighttime sector, from sunset to sunrise, we find comparable trends among the three techniques during the period of high F-layer heights at equinox and December solstice, while opposite behavior occurs during June solstice season. In addition, the equinoctial average evening upward drifts enhancements by the three methods are roughly comparable and occur at the same local time (19 LT) for all seasons. The evening reversal time from upward daytime to downward nighttime does not vary much except during the June solstice months and occurs earliest in December solstice and equinox, but least during June solstice. Furthermore, prereversal enhancement in **E**x**B** drift is found to be poorly correlated with solar activity as represented by F10.7 cm solar flux index and monthly average sunspot numbers during quiet period, but connected fairly well during disturbed time. The onset parameters required to trigger spread F irregularities at Ibadan longitude sector are estimated as 30 m/s and 400 km for prereversal peak **E**x**B** drift and virtual height of F-layer (h'F), respectively. Our observations are in good agreement with some results obtained for other equatorial and low latitude regions.

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I. Abstract

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Title: Diurnal Variation of Absorption of Trans-ionospheric Radio Waves in Equatorial Zone.

The investigation is primarily concerned with the hourly variation of the ionospheric absorption of high frequency radio waves propagated through the ionosphere in the equatorial zone. The monitoring system consisted of external dipole antennae, a radio receiver, a low-tension power supply, an amplifier, a rectifier, and a chart recorder. The ionospheric absorption obtained was strongest about noon and decreased toward the morning and evening hours. The O- and X- modes results were compared. The different results were discussed considering likely ionospheric region of reflection of the wave and spatial loss. Ionospheric absorption appears to have the major control on the hourly variation of the signal strength.

II. Abstract

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Title: International Heliophysical Year (IHY): participation and opportunities

International Heliophysical Year is an international cooperation programme organized to commemorate fifty years of International Geophysical Year, IGY. With a focus on Sun-Earth connection and the prevailing Physics in the helio-geosphere, IHY promises to be the greatest international cooperation of the recent time. The paper highlights the opportunities and the probable gains of the Nigerian scientific community in the programme. A strong call is made for participation in the activity.

III. Abstract

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Title: Characteristics of equatorial electrojet thickness

The diurnal variation of the thickness of equatorial electrojet over Indian sector have been evaluated from Onwumechili's thick current shell format of continuous current distribution model of equatorial electrojet for the first time. The thick current shell model, which takes into account the vertical ionospheric currents, permits both the width and the thickness of the jet to be determined simultaneously. The thick current shell model is shown to give better hourly representation of jet behaviour than thin shell format hitherto being used. The thin current shell model best fits only the near local noon jet observation, as the electrojet is thinnest at period of maximum intensity. The transient variation of the jet thickness is explained in terms of the wind shears in consistency with the electrodynamics of the dynamo region.

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Radiative transfer model in the atmosphere and experimental solar data of yaounde location

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ABSTRACT

Sun is the primary source of energy supplying the earth. This energy absorbed by the various components of the atmosphere, the oceans, the vegetation, earth surface, is at the origin of the forces which control the climatic changes, the general circulation of the atmosphere, the temperature of the atmosphere and that of the oceans, the ionization of atmospheric gases, etc.

The solar energy received on earth surface is also directly used in technological applications such as solar heaters, solar dryers and other solar distillers, the photovoltaic generators, etc. The calculation of the thermal performances of these apparatuses can be well made only if the spectral and even angular distribution of the solar irradiation arriving on the ground surface is well known. Moreover, the well known of the characteristics of the solar radiation arriving on the ground could inform about the atmospheric phenomena which influenced its crossing, and consequently provide a better correction of the sensors response while receiving a signal from outer space in its direction, or the correction to be made on the response of a sensor while receiving data from an terrestrial sender.

Just few measurements stations of solar radiation are running today and are not well managed, particularly in the developing countries where the maintenance of a park of pyranometers on the ground is difficult and expensive. Moreover where these measurements exist, they are rarely carried out for various wavelengths and/or angles.

Such data are on the other hand accessible by numerical calculation, by solving the radiative transfer equation (ETR) in the atmosphere. One of the mayor factors attenuating the solar radiation received on the ground is scattering by clouds. The non homogeneous nature of the clouds justifies the difficulty shown by the researchers to insert realistic profiles of clouds in radiative transfer models in a parallel stratified atmosphere [1,2]. Several recent studies showed that these non homogeneity have significant impacts on the transmitted radiation, calculated either for the thick and continuous clouds [3] or for dispersed clouds [4,5]. Such structures must be studied with a multidimensional radiative transfer model, as for example the one of Stephens [6] judiciously exploited recently by Evans [7] which breaks up the angular part of brightness into spherical harmonics while the space part is simply discretized by finite differences.

We intend here to make a comparison between results of this model and the experimental data collected on the Cameronian site of Yaounde[8-13]. This in order to detect its forces, weaknesses and the possible improvements which could be done to guarantee a prediction free from any significant variation with reality.

The first part is devoted to the description of the model. In the second, we have the results of the model as well as the values resulting from experimental measurements. The last part deal with the discussion of these results.

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IONOSPHERIC TEC MEASUREMENTS DURING THE 2003 OCTOBER/NOVEMBER MAGNETIC STORMS AT SCOTT BASE STATION ANTARCTICA

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ABSTRACT

This present the investigation on the characteristics of the 2003 October/November magnetic storms based on GPS TEC measurement at Scott Base station Antarctica (GC: 77.9°S, 166.8°E GCM: 79.9°S, 327.2°E). To support the investigation, the daily GPS-TEC and percentage of TEC deviation (%_TEC) at Scott Base Station are compared with the solar wind IMF data from MFI/SWE instruments and with the planetary magnetic and solar indices from WDC. Results show that, the November 2003 storm was more intense than the October 2003 storm, however it has a shorter duration of about 32 hrs than the October 2003 storm, which has three injections with storm duration of about 60 hours. For the October storm, VTEC peak equal 114 TECU with _TEC% equal 410% and the duration of the positive storm phase and negative storm phase are 23 hrs and 37 hrs respectively. For the November storm, VTEC peak equal 35 TECU with _TEC% equal 50% and the duration of the positive storm phase and negative storm phase are 2 hrs and 30 hrs respectively. In the October storm, the positive storm phase lagging of about 3 hours with respect to the onset of the southward IMF Bz and for the November storm, the short positive storm phase lagging of about 9 hours with respect to the onset of the southward IMF Bz. During the first SSC and second SSC of the October 2003 storm, the TEC response was flat with _TEC% of about 0%. The decreasing of Dst and the southward turning of the IMF Bz for October storm occurs at about the same time whereas for the November storm the decreasing of Dst was observed to lag by two hours. The TEC enhancement was observed to lag behind the southward IMF Bz by about 3 hours for the October storm and by about 9 hours for the November storm.

Keywords: Ionospheric TEC, Geomagnetic storm, IMF, GPS,