2014 African Geophysical Society Conference
Book of Abstract

2014-A001-O-001

Simulation of electric field and current during the June 11, 1993, disturbance dynamo event: comparison with the observations

K. Z. Zaka

Laboratoire de Physique de l'Atmosphère, UFR SSMT, Université F. H. B. Abidjan-Cocody,

22 BP 582 Abidjan 22, Cote D'Ivoire

komzach@yahoo.fr

The ionospheric disturbance dynamo signature in geomagnetic variations is investigated using the National Center for Atmospheric Research Thermosphere-Ionosphere ElectrodynamicsGeneral Circulation Model. The model results are tested against reference magnetically quiet time observations on June 21, 1993, and disturbance dynamo effects observed on June 11, 1993. The model qualitatively reproduces the observed diurnal and latitude variations of the geomagnetic horizontal intensity and declination for the reference quiet day in middle and low latitude regions, but underestimates their amplitudes. The patterns of the disturbance dynamo signature and its source "anti-Sq" current system are well reproduced in the northern hemisphere. However, the model significantly underestimates the amplitude of disturbance dynamo effects when compared with observations. Furthermore the amplitude maxima occur at different local times than the observations. The discrepancies suggest that the assumed high-latitude storm-time energy inputs in the model were underestimated.

2014 African Geophysical Society Conference
Book of Abstract

2014-A001-O-002

Impact Assessment of the equatorial ionosphere on GPS-based navigation using different pseudorange measurements

Adewale, A.O.[1*], *Oyeyemi, E.O.*[1], *Obafaye-Israel, A. A.*[2], *Rabiu, A.B.*[2]

[1]Department of Physics, University of Lagos, Lagos, Nigeria

[2]Centre for Atmospheric Research, National Space Research &Devt Agency, Anyigba, Nigeria

[1]Department of Physics, University of Lagos, Lagos, Nigeria

*olajide3000@yahoo.com

Assessment of the equatorial ionosphere on Global Positioning System (GPS) based navigation is important for the identification of the risks to Global Navigation Satellite System (GNSS) performance and operation. In this work, we present the impact of the ionosphere on positioning using different pseudorange measurements, namely: L1 C/A Code, L1 P Code, L2 P Code, Ionosphere-free L1/L2 combination (C/A on L1 and P on L2) and Ionosphere-free L1/L2 combination (P on L1 and P on L2). The results revealed the effects of geomagnetic storm on northing, easting and horizontal components of GPS positioning error, which were inferred from the measurements made from several dual frequency GPS receivers installed at equatorial latitudes. Means of mitigating adverse effects of space weather on GPS-based navigation are also discussed.

2014 African Geophysical Society Conference
Book of Abstract

2014-A001-O-004

Occurrence of Counter Equatorial Electrojet at African Longitudes

Folarin.O.O1 A.B Rabiu2

1. Federal University of Technology, Department of Physics, Akure, Ondo State, Nigeria

2. Centre for Atmospheric Research, National Space Research &Devt Agency, Anyigba, Nigeria

nykky4real@yahoo.co.uk

This study engaged one year data of the horizontal component of the Earth's magnetic field obtained from four geomagnetic observatories in the East and West African meridians to study the occurrence of counter electrojet along the African longitudes: Ilorin (Nigeria: 4.68°E, 8.50°N; dip latitude, 1.82°S) and Addis Ababa (Ethiopia: 38.77°E, 9.04°N; dip latitude, 0.18°N) in the year 2009. Data was obtained from the Magnetic Data Acquisition System (MAGDAS) installed and managed by the International Centre for Space Weather Science and Education

(ICSWSE), Japan. The diurnal as well as the seasonal distribution of the occurrence of CEJ was analysed. It was observed that the distribution of CEJ exhibits some characteristic features along the East and West African meridians respectively. The occurrence of morning CEJ is much prevalent along the East African longitude (90%) than the West African longitude (80.9%),while the evening CEJ is dominant along the West African longitude (82.9%) than the East African longitude (50%). The simultaneity in the occurrence of CEJ was also investigated in this study. It was found that most frequent and simultaneous occurrence of CEJ at both equatorial stations was in the morning (77%). Generally, the occurrence of the morning simultaneity is maximum in June solstice, while the occurrence of the evening CEJ is maximum in March equinox.

2014 African Geophysical Society Conference
Book of Abstract

2014-A001-O-007

Paul Baki

Signatures of Low-latitude Geomagnetically Induced Currents Effects on Transformers in Nairobi, Kenya

In this paper, we focus on the correlation between the calculated GICs and the behaviour of the power grid in Nairobi (a low latitude region) during a geomagnetic storm occurring in the low solar activity period of the year 2009. We also show that there is a correlation between the GICs and the post-sunset east-ward component of the ionospheric electric field enhancements that are usually responsible for plasma bubble development and occurrence of ionospheric scintillations.

2014 African Geophysical Society Conference
Book of Abstract

2014-A001-O-008

Three-dimensional non-tomographic imaging of the East-African Equatorial Ionosphere using GPS TEC

M. Nigusise, B. Damtie, E. Yizengaw, S.M. Radicella

WasheraGeospace and Radar Science Laboratory, Bahir Dar Unibersity, Ethiopia

melessewnigussie@yahoo.com

Different ionospheric tomography techniques, which include complicated algorithm, have been applied to reconstruct time dependent three-dimensional ionospheric electron density for different regions from a chain of GPS receiver measurements. However, the East-African ionosphere, which is very dynamic and complex medium, is the least imaged ionosphere due to lack of enough GPS receivers. In this study we have demonstrated new non-tomographic technique, which require GPS receiver data collected at an epoch, to reconstruct time dependent three dimensional electron density map for East-African region. The slant total electron content (sTEC) estimated from fifteen GPS receivers corresponding to the link between each receiver and visible GPS satellites has been used to adapted NeQuick 2 ionospheric model. The adaptation has been carried out by computing the effective ionization level, Az(the driver of NeQuick 2) which provides the minimum absolute difference between experimental and NeQuick 2 modeled sTEC corresponding to each GPS signal ray- path. Then after, first Az values are represented by deterministic and stochastic models, which can be obtained by applying the Generalized Least Square (GLS) and Kriging estimation techniques, respectively. The instantaneous Az map of the East- African region has been obtained by adding the outputs of these models (Universal Kriging) at any grid point continuously epoch by epoch. The Az map has been used to drive NeQuick 2 model to reproduce instantaneous time dependent three dimensional electron density maps for East-African region. We have shown that the reconstructed electron density maps are nicely mimic the small scale horizontal gradient of experimental TEC at the

ionospheric pierce points, which shows the reconstruction methods are well representing the spatiotemporal variability of the equatorial ionosphere. In addition, we will show different case studies for different days and demonstrate the Universal Kriging interpolation technique together with sTEC ingestion into NeQuick 2 are the best way to image the characteristics of the ionosphere of the regions that are devoid of ground based instrument, like East-Africa region.

2014 African Geophysical Society Conference
Book of Abstract

2014-A001-O-009

An Unsupervised Learning Algorithm for TEC Anomaly Detections using Diurnal TEC Profiles

Daniel Okoh

NASRDA Center for Atmospheric Research, Kogi State University, Anyigba 270109, Nigeria

okodan2003@gmail.com

The advent of dual-frequency GPS receivers and their proliferation even across the African continent is increasingly making the Total Electron Content (TEC) parameter of the ionosphere indispensible in space weather monitoring. The parameter has been known to be influenced in random pattern by space weather phenomena like geomagnetic storms and solar flares. Apart from these, the TEC value of a particular location is also known to be influenced mainly by the amount of solar radiation it receives; diurnally with the rotation of the Earth about its axis, seasonally with the Earth's revolution round the Sun, and over a Solar Cycle period with variations in the level of the solar activity.

In this work, an unsupervised machine learning algorithm is implemented to detect TEC anomalies in a given set of closely observed diurnal TEC profiles. A MATLAB program, called

TECAD (TEC Anomaly Detector), is developed and tested on GPS TEC data collected from the following four receiver stations in Nigeria: Lagos (6.45oN, 3.38oE), Nsukka (6.87oN, 7.38oE),

Ilorin (8.50oN, 4.55oE), and Akure (7.25oN, 5.20oE). Results from the work show that most of

the anomaly detections are associated with space weather phenomena like geomagnetic stormsand solar flares. The work however also reveals that not all storms and flares are captured as phenomena that lead to TEC anomalies. Interestingly, the algorithm is capable of capturing anomalies in the system irrespective of their causes, and so can be implemented on GPS receivers for real-time space weather warnings of rapid changes in observed TEC values.

2014 African Geophysical Society Conference
Book of Abstract

2014-A001-O-010

Yaw Poku-Gyamfi

(CSIR-BRRI, Ghana)

Space Science and Technology is becoming one of the critical and fundamental pillar of sustainable development in the world and Africa should not be left out in this all-important technology. One of the most important component of Space Technology is the Earth Observation System which includes the Equatorial and Near-Equatorial Orbit Earth Satellite System. Although this system has been spearheaded by Malaysia, Indonesia and Brazil, Africa stands to gain greatly from it as the footprints of NEqO covers about half of African countries, with the coverage land mass on the continent, more than these three put together. The potential resources that the continent has in contributing to NEqO has been outlined. This paper examines the trends in this technology and the need to maximize its potential gains in Africa and also discusses what has gone wrong with Africa's participation in Space activities. The role of NEPAD, African Governments, Academic and Research Institutions, National Mapping Organizations and others in making the utilization of NEqO in Africa a reality.

2014 African Geophysical Society Conference
Book of Abstract

2014-A001-P-002

Characterization of the equatorial anomaly in the Ethiopian sector

Tibebu Getachew, Tsegaye Kassa

Aksum University

Department of Physics, Aksum University Tigray, Aksum

tib2010get@gmail.com

Studying the distribution of electron density in the ionosphere is crucial to enhance the quality of space-based navigation and communication systems. In this paper we present and discuss the structure of ionospheric total electron content (TEC) in the Ethiopian sector as a function of universal time, season and magnetic activity. To show the diurnal structure of TEC, 4 GPS stations data from the Ethiopian region namely Bahirdar (11.6 °N, 37 °E), Robe (7.1 °N, 40 °E), Arbaminch (6.0 °N, 37.6 °E) and Nazreth (8.6 °N, 39.3 °E) of the year 2009 are used and to show the seasonal and magnetic activity dependence of TEC, we use the 2008 data from the above mentioned GPS stations of Ethiopia plus one station from Asmara (15.3 °N, 38.9 °E), Eritrea. Based on these data a biharmonic spline interpolation technique is used to construct the TEC map of the Ethiopian ionosphere. It is found that TEC shows diurnal and seasonal variations, the daily TEC is found to be maximum from 10:00-13:00UT attributed by solar intensity increase during these periods. Results reveal that equatorial ionization anomaly crests show seasonal variations; due to the sub solar point and meridional wind effects, the two crests move equator ward during solstice when compared to equinox crests. From all seasons the March equinox is found to have the maximum TEC value, this is because during this season the sun is overhead at the equator. Results also show that an asymmetry of the two crests of equatorial ionization anomaly during magnetic storm periods is occurred where relatively more electron content in the northern crest; the asymmetry is might be due to the ionosphere-magnetosphere coupling effect.

2014 African Geophysical Society Conference
Book of Abstract

2014-A001-P-004

Ionospheric investigation of the response time of peak EEJ and electron density

*1Adeniyi J.O., *2Adebesin, B.O., and 1I.A. Adimula.*

1Department of Physics, University of Ilorin, Ilorin, Nigeria.

Department of Physical Sciences, Landmark University, Omu-Aran, Kwara State, Nigeria.

*Corresponding author: f_adebesin@yahoo.co.uk, femiadebesin@gmail.com

Measurements of the ground-based Magnetic Data Acquisition System (MAGDAS) from two stations, an equatorial station Ilorin (8.50oN, 4.68 oE) and an off equatorial station Maputo (-25.57oN, 32.36oE) in the African sector are used to estimate the diurnal and seasonal EEJ strength and peak occurrence time. The data from the DPS 4.2 digisonde, located at Ilorin is used to infer the F2-layer peak electron density (NmF2). The study spans year 2010. The solar quiet (Sq) variation was higher at daytime than at nighttime. Seasonal daytime EEJ was higher during equinoxes than at solstices, peaking at different times with a time lag of ≈ 1-3h between the seasons. These seasonal time lags were linked to the combined electron density and E x B factors. The delay in time between the EEJ peak magnitude and the noon-period bite out of NmF2 are 2, 1 and 4h respectively for the March equinox, June solstice and September equinox. NmF2 was observed to depart away from a typical Chapman layer.

Keywords: MAGDAS; NmF2; equatorial station; EEJ; solar quiet.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A001-P-005

A COMPARATIVE STUDY OF *NIGNET*'S-GPS vTEC MEASUREMENTS WITH THE *IRI*-TEC PREDICTIONS OVER CALABAR, NIGERIA

Obu J.A, Okoh.D

Department Of Physics University Of Calabar

Nigeria Centre for Atmospheric Research Anyingba – Kogi State Nigeria

Since the installation of NIGNET (NIGerian GNSS Reference NETwork) GPS receiver in Calabar in 2011, no study has been carried out to evaluate its viability for the measurement of the vertical Total Electron Content (vTEC) over the Calabar region, Nigeria (Geographic coordinates: 4.95° N, 8.32 E; Geomagnetic coordinates: 6.39N, 81.81E). In this study, we have carried out a study of the vTEC values as measured by the NIGNET's GPS receiver in Calabar for the year 2013. The results obtained were then compared with the corresponding predictions of the International Reference Ionosphere (IRI) model (version 2012) over the Calabar region. The IRI model has been widely adopted as the international standard for specifying ionospheric parameters. Our preliminary results show that despite some gaps in the measured vTEC values by the GPS receiver in Calabar, there is a high diurnal correlation between it and the IRI-TEC predictions for the days examined, thus confirming the viability of the receiver as a vTEC measuring device.

KEYWORDS: NIGNET-GPS RECIEVER; vertical Total Electron Content; IRI-Model

2014 African Geophysical Society Conference
Book of Abstract

2014-A001-P-006

This study engaged the 2009 diurnal values of the horizontal component of the Earth's magnetic field (H), which were obtained from 14 geomagnetic observatories located along the African longitudes to examine and quantify the rates of rising and decay of the Solar Quiet daily variation Sq(H) during quiet conditions. The rising and decay rates of Sq(H) obtained from the dataset were further subjected to morphological and statistical analysis. The rising and decay rates exhibit day-to-day variability with a greater rising rates than decay rates at all stations. The rising and decay rates also display a significant response to solar activity, with the decay period being longer than rising period due to the longer acting solar-controlled conducting plasma of the upper atmosphere. Peak values of the rising and decay rates were obtained at Addis Ababa (Rising Rate = 17.85nT/hr; Decay Rate = 7.39nT/hr), while least values were obtained at Durban (Rising Rate = 3.19nT/hr; Decay Rate = 1.28nT/hr). Spatial analysis carried out show that the rising and decay rates of Sq(H) depend of the latitudinal position of the stations.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-O-002

Effects of Space Weather Conditions on the Upper Atmosphere and LEO Artificial Satellites

Victor U. J. Nwankwo1,3* and Sandip K. Chakrabarti1,2

1S. N. Bose National Centre For Basic Sciences, Kolkata 700098, India

2Indian Centre for Space Physics, Kolkata 700084, India

Dept. of Physics & Energy Studies, Salem University Lokoja, Kogi State, Nigeria

Influence of solar-forcing induced perturbations on the Earth's upper atmosphere and satellite's orbit has been studied. It is known that energetic ultraviolet, X-ray and particles emitted from the sun during solar events collectively heat up, expands the upper atmosphere and alters the density profile as a consequence. This condition increases drag on LEO satellites. The extent of impact, however, depends on the phase of the solar 11-year cycle. In this study, we perform a statistical analysis of the time distribution of space environmental parameters such as solar flux (F10.7), geomagnetic Ap indices and rate of coronal mass ejections (CMEs) due to solar activity during the past cycle. We compute plasma drag on a model artificial satellite during the events and predict, using solar cycle forecast, how Thermospheric density profile and the orbit of LEO satellites would be affected at different phases/stages of the solar cycle, and around the peak of current emerging maximum.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-O-003

Shetti Dadaso Jaypal

Simultaneous Observations of OI630 nm night airglow emission and GPS-TEC at low latitude Station, Kolhapur, India

Simultaneous observations of OI630 nm and TEC were carried out using a CCD based All-Sky Imaging system and GPS system at low latitude station Kolhapur (16.8˚N, 74.2˚E). The day-to-day variability in the occurrence of Equatorial Spread F (ESF) or Equatorial Plasma Bubble (EPB) is addressed using radio and optical observations from low latitude stations. We have found out the simultaneous occurrence of EPBs in both TEC and OI 630.0 nm emissions using both the techniques. In the present work we have also discussed the possible mechanism of day-to-day variability in the occurrence of EPBs. The ionosphere Total Electron Content (TEC), derived by analyzing dual frequency signals from the Global Positioning System (GPS) recorded from four stations in the Indian region is studied. We also present the mean diurnal, monthly, seasonal, and annual variation in the ionospheric TEC.

Keywords: Night Airglow, GPS-TEC, Plasma Bubbles, Low Latitude

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-O-004

Influence of solar activities on Rainfall in Nigeria

1Falayi, E.O and 2Usikalu, M.R

1Department of Physics, Tai Solarin University of Education, Ijagun, Ijebu Ode, Nigeria.

2Department of Physics, Covenant University, P.M.B 1023 Ota, Nigeria.

The study investigates the influence of the Sunspot Numbers, the solar radio flux, Total solar irradiance and Mg II core-to-wing ratio on rainfall in Nigeria. The positive signs of the correlation coefficients, for the period of 21 years, revealed that, rainfall variability is low during the high solar activity. The correlation indicates one-to-one correspondence between the rainfall and solar activity which strongly supports the variability of solar activity and may influence the yearly rainfall in Nigeria. The statistical indicators used are Root mean square error, Mean bias error and Mean percentage error to determine the accuracy of the models.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A002-O-005

The comparative study of chaoticity and dynamical complexity of the low latitude ionosphere, over Nigeria, during quiet and disturbed days

B. O. Ogunsua1, J. A. Laoye2, I. A. Fuwape1, and A. B. Rabiu1,3
Space Physics Laboratory, Department of Physics, Federal University of Technology, Akure, Nigeria
Statistical and Nonlinear Physics Research group, Department of Physics, OlabisiOnabanjoUniversity, Ago-Iwoye, Nigeria
National Space Research and Development Agency, Abuja, Nigeria
Correspondence to: B. O. Ogunsua
(iobogunsua@futa.edu.ng)

The deterministic chaotic behavior and dynamical complexity of the space plasma dynamical system over Nigeria were analyzed in this study and characterized. The study was carried out using GPS TEC time series, measured in the year 2011, at 3 GPS receiver stations within Nigeria which lies within the Equatorial Ionization Anomaly region. The TEC time series for 5 quietest and 5 most disturbed days of each month of the year were selected for the study. The nonlinear aspect of the TEC time series were obtained by detrending the data. The detrended TEC time series were subjected to various analyses for phase space reconstruction and to obtain the values of chaotic quantifiers like Lyapunov exponents, correlation dimension and also Tsallis entropy for the measurement of dynamical complexity. The observations made show positive Lyapunov exponents (LE) for both quiet and disturbed day which indicate chaoticity and for different days the chaoticity of the ionosphere exhibits no definite pattern for both quiet and disturbed days. However Values of LE were lower for the storm period compared to its nearest relative quiet periods for all the stations. The monthly averages of LE and entropy also show no definite pattern for the month of the year. The values of correlation dimension computed ranges from 2.8 to 3.5 with the lowest values recorded at the storm period of October 2011. The surrogate data test shows a significance of difference greater than 2 for all the quantifiers. The entropy values remain relatively close

with slight changes in these values during storm periods. The values of Tsallis entropy show similar variation pattern with that of Lyapunov Exponent with a lot of agreement in their comparison, with all computed values of Lyapunov exponent correlating with values of Tsallis entropy within the range of 0.79 to 0.81. These results show that both quantifiers can be used together as indices in the study of the variation of the dynamical complexity of the ionosphere. The results also show a strong play between determinism and stochasticity. The behavior of the ionosphere during these storm and quiet periods for the seasons of the year were discussed based on the results obtained from the chaotic quantifiers.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-O-006

ABSTRACT

Ogunmodimu Olugbenga
Lancaster University,UK

The occurrence of solar particle events energetic events are known to be sporadic, hence disrupting a number of terrestrial technologies among which is ionospheric communication.

To account for the control of SPE, we have utilized Radio Ionospheric Opacity Meter (RIOMETER) data to study the influence of interplanetary coronal mass ejections (ICMES) on cosmic noise absorption (CAN). The model was verified from Saucer-Wilkinson model of the global mapping of Ionospheric HF/VHF radio wave absorption due to solar energetic proton. The model was then evaluated by comparing its prediction with measured CNA.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-O-008

Understanding the Dynamics and Variability of the Equatorial Ionosphere over Africa with a SuperDARN Style Radar: A Scientific Agenda

H.A. Lawal, M. Lester, T.K. Yeoman, Steve Milan and Angeline G. Burrell

Equatorial plasma bubbles and other ionospheric irregularities have been observed to be more pronounced and occur more frequently over the African continent than at other longitudes. This may be a consequence of the symmetric shape of the equator over the continent and lack of variability in latitude. Such factors have been identified as possible reasons for the differences between ionospheric irregularities seen over Africa when compared with those seen over the American and Asian longitudinal sectors. The success of the Super Dual Auroral Radar Network (SuperDARN) in observing both the occurrence and important characteristics of ionospheric plasma irregularities in auroral latitudes, polar latitudes (PolarDARN) and mid-latitudes (StormDARN) indicates that such a system may also be successful in the equatorial region. In this work, we examine the science questions such as equatorial plasma bubbles and spread F formation that the deployment of a SuperDARN style radar in Africa would be able to address, both individually and in conjunction with other space-based and ground-based instrumentation.

Keywords: Equatorial ionosphere, SuperDARN, Instrumentation

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-O-010

A review of Space-Terrestrial Weather Coupling for Addressing Global Climate Change

Abraham A. Onugba1* and Victor U. J. Nwankwo1,2

1College of Natural & Applied Sciences, Salem University Lokoja, Nigeria

2S. N. Bose National Centre For Basic Sciences, Kolkata 700098, India

A substantial and evident change in global climate have been observed and studied for several years. The greater concern is principally on the enhanced greenhouse warming caused by man's recent activities rather than other attributive factors. Recent work has however revealed the existence of areas in which space weather might influence global climate change. In this paper, we present a review of solar-driven parameters and/or processes vis-à-vis terrestrial indicators, and their 'probable' connection to global climate change. We, also identify areas of space weather research that will be resourceful for the understanding and substantiation of solar-driven effects on terrestrial climate, and impact mitigation.

2014 African Geophysical Society Conference
Book of Abstract

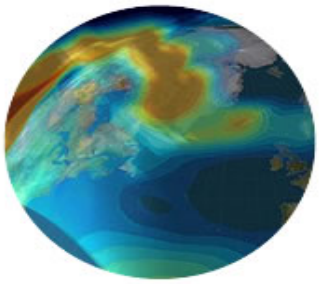
2014-A002-O-011

Ionosheric TEC variability during the ascending solar cycle 24, in Uganda

Oron S, Dujanga FM and Akoba
Department of Physics, Mbarara University of Science and Technology, P.O Box 1410, Mbarara, Uganda
soron@physics.mak.ac.ug

The total electron content (TEC) is a vital and most dominant ionospheric parameter that can cause Global Positioning System (GPS) signal delays, signal degradation and in extreme cases loss of lock. This results into inefficient operations of ground and space based Global Navigation Satellite System (GNSS) applications. The study of TEC variability is, therefore, useful for GNSS users in order to minimize errors where high levels of accuracy in measurements are required. This paper presents the diurnal, seasonal and solar activity dependence of TEC at the GPS-SCINDA (SCIntillation Network Decision Aid) station in Kampala, Uganda (geographic coordinates: latitude 0.3°N, longitude 32.6°S; and geomagnetic coordinates: latitude -9.3°, longitude 104.2°) for the years 2010 and 2011. The results obtained show that the diurnal variability in TEC at this station has a pre-dawn minimum followed by an early morning steady increase, an afternoon maximum and then a post sunset gradual reduction in TEC, with the equinoctial months depicting nighttime enhancements more prominently at around 2000 hrs UT (2300 hrs LT). Scintillation occurrence, a consequence of TEC fluctuations, was observed from about 1800 hrs UT (2100 hrs LT) to local midnight giving S_4 index values above 0.4, with the equinox months recording higher occurrences than other seasons. TEC variations were also seen to exhibit solar activity dependence. The sunspot numbers and the F10.7 solar flux exhibited a good correlation with TEC.

AGS
African Geophysical Society
www.afgps.org



2014 African Geophysical Society Conference
Book of Abstract

2014-A002-O-012

Day-To-Day Variability of Total Electron Content obtained from GPS over a terrestrial point within Equatorial Ionospheric Anomaly region

BabatundeRabiu* and AyorindeToyeseTunde**

***Centre for Atmospheric Research,National Space Research and Development Agency, Abuja.*

***Federal University of Technology, Akure, Ondo State, Nigeria*

E-mail: toye_tunde@yahoo.co.uk

The day-to-day variability of the total electron content (TEC) was examined using a fixed GPS receiver installed at Akure (7.3^0N, 5.3^0E, dip latitude -2.62^0), Nigeria, CBSS (Nsukka) (6.5^0N, 7.2^0E, and dip latitude -2.98^0), Nigeria and the IGS station in Ellesmere (79^0N, 82^0W, dip latitude 73.20^0) in Canada. This work investigates the diurnal and the seasonal variability of TEC over Akure, Nigeria, based on two years data (Jan 2010-Dec 2011) and also being a station within the equatorial ionospheric anomaly EIA region. The day to day variability was calculated by mapping the observed slant TEC value for every 1hr to the vertical using a single geometrical factor and the differencing (ΔTEC) with its corresponding value from the previous day. The result showed the mean monthly TEC value varies from the minimum at 0200hrs LT to a peak at about 1400hrs LT and then decreases. There is a clear daily variation which depicts the expected temporal variability. The values of the day-to-day variability at Akure are considerably higher than that of CBSS. There is a clear difference in the comparison with in the day-to-day variability between the stations under the EIA (>15 TECU in 2010 and >40 TECU in 2011) and that of the high latitude (<10 TECU in both 2010 and 2011). Seasonal variation of the day to day variability of TEC over Akure in both years maximize (> 13 TECU) during Equinoctial months and minimizes (< 8 TECU) during the Solstice months. During equinoxes the study shows that the day-to-day variability of TEC in autumnal equinox period is high compared to the vernal equinox period. Correlation of the day-to-day variability in Akure station with solar activity was also examined.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-O-013

Solar Wind Turbulence as a driver of Geomagnetic Activity

***Ugwu, E.B.I.[1, 2], Okeke, F.N.[1], Ugonabo, O.J.[1],**

[1]Dept. of Physics and Astronomy, University of Nigeria, Nsukka

[2]Natural Science Unit, Sch. of General Studies, Univ. of Nig., Nsukka

ernest.ugwu@unn.edu.ng

Simultaneous analyses of interplanetary and geomagnetic data sets for the period of least (2009) and maximum (2002) solar activity were carried out to determine the nature of solar wind turbulence on geomagnetic activity as monitored by AE, ASY-D, and ASY-H indices. We focused on the role played by Alfvénic fluctuations in the solar wind so as to determine the nature of the turbulence. Our analyses showed that solar wind turbulence play a role in geomagnetic processes at high latitudes during period of low and high solar activity but does not appear to have any effect at mid-low latitudes.

Keywords: - Solar wind, geomagnetic field, Alfvénic waves, cross-helicity, residual energy

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-001

ABSTRACT

GPS data for year 2012 recorded at various stations in Nigeria ranging from geomagnetic longitude 75.45oE to 84.31oE and geomagnetic latitude -4.33oN to 0.72oN was engaged for this study. Analysis of spatial and temporal variations which features diurnal, seasonal, daytime, latitudinal and longitudinal variations of TEC were performed within the period used and the result engaged to generate the local TEC map. The diurnal variation of TEC in all stations in Nigeria show many characteristics typical of low latitudes ionosphere. TEC exhibits consistent minimum diurnal variation during pre-sunrise hours 04:00 to 05:00hrs LT with (0 to 5 TECU), rises steeply during the sunrise period (07:00 to 09:00hrs LT) to an afternoon maximum around

12:00 to 16:00hrs LT and then falls to attain minimum just before sunset. The seasonal variation depicts higher values (~25-30 TECU) around equinoxes and minimum values (~20-25 TECU) in solstices. The spread of TEC is minimum during the nighttime and maximum during the daytime in all stations irrespective of the latitude indicating the effect due to the presence of strong latitudinal gradients even within Equatorial Ionization Anomaly (EIA). Also, TEC shows a predawn minimum, a steady early morning increase, followed by an afternoon maximum and a gradual fall after sunset in all the longitudes. At 07:00hrs, due to the relative position of the sun as the sun rises, TEC decreases westwards across all the latitudes and it's found to be weakest at this time because the intensity of solar radiation is quite low. Greater magnitude of TEC was observed at 12:00hrs LT while it decays gradually and smoothly at 17:00hr LT through the midnight until pre-sunrise hours and it is evident that the magnitude of TEC post-sunset variation is always greater than its pre-sunrise variation. Also, TEC decreases eastward across all latitudes as a result of reduction in the ionization at the east due to the relative position of the sun as the sun sets at 17:00hrs.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-002

Application Of Neural Network In Vertical Profile Of Radio Refractivity In Akure South-West Nigeria

IBEH GABRIEL FRIDAY

ibehgabrielfriday@gmail.com

The study of vertical radio refractivity profile variation in troposphere is very important as it influences the planning and design of microwave communication, the structure of the radio refractive index in the lower part of the atmospheric boundary layer, and long-distance terrestrial electromagnetic wave propagation. This study is aimed at calculating and estimating radio refractivity at Akure (7.15^{o}N, 5.12^{o}E), South Western Nigeria with tropospheric parameters of relative humidity, absolute temperature and atmospheric pressure using ITU-R and Artificial Neural Network models. The data were collected at 5-minute interval in the year 2010 and 2011 cover a time period of 5/6/2010 10.35am - 7/26/2011 15:25. Validation results are thus, absolute temperature = 0.4313 K, relative humidity = 0.9989 %, pressure = 0.0201 (hpa) respectively. The validation of the correlation coefficient results shows that all the tropospheric parameters have effects on radio refractivity, but relative humidity has more effect which is attributed to the large quantity of moisture at the troposphere. From the estimation results, it is clear that Artificial Neural Network has the capacity of estimating tropopheric refractivity since the estimated values has close agreement with the calculated values.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-003

Experimental verification of hybrid GNSS-UWB positioning algorithm

OFFIONG, EtimOkon

African Regional Center for Space Science and Technology Education in English (ARCSSTEE), Ile-Ife, Nigeria.

One of the major applications of the Global Navigation Satellite Systems (GNSS) is in positioning (localisation),and by extension Location Based Services. For accurate position estimation, a minimum of four satellites is required. This works very well in open-sky outdoor environments where signals from navigation satellites are not obstructed, but it does not work well in environements where the signals are obstructed eg. urban canyons, dense foliage and indoors. To improve localisation in GNSS-challenged environments, GNSS signals are often combined with available terrestrial technologies eg. RFID, GSM, UWB, etc.

Several hybrid positioning algorithms are currently available. This paper presents the results of the simulations and experiments on the hybrid algorithm developed by the IstitutoSuperiore Mario Boella (ISMB), Turin, Italy. The simulation tool was developed by ISMB and implemented in Matlab. The experiments were carried out for both outdoor and indoor. While GNSS-only signals were enough for outdoor localisation, a combination of GNSS and UWB were required as the scenario gradually changed to indoors. At some point deep indoors, GNSS signals could not be received at all; at this point, only UWB signals could be used for accurate positioning.

The results show that the combination of GNSS and Ultra-Wideband (UWB) improves localisation in GNSS challenged environments. It also ensures seamless navigation from outdoor to indoor.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-004

The relation between equatorial electrojet (EEJ) dependence on high energetic particle

*S.A. Bello1 and I.A. Adimula1

1Department of Physics, Faculty of Physical Science, University of Ilorin

*Email: bioyesaeed@gmail.com

The equatorial electrojet (EEJ) is a strong ionospheric current along the magnetic equator driven by the day side eastward electric field. We examined the dependence of equatorial electrojet with solar activity. For this analysis, we used magnetic field intensity of the horizontal component (H) data obtained from Ilorin (8.470 N, 680 E). The EEJ strength was calculated by finding the difference between the solar quiet daily variation Sq in H (Sq H) at Ilorin and a station outside the influence of EEJ. The linear relationship between equatorial electrojet and high energetic particles was then examined using power spectrum and correlation analyses. We found out that EEJ respond quickly to the enhanced high energetic particle from the sun during solar flares.

Keywords: Equatorial electojet, energetic electron, power spectrum

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-005

VARIATION OF SOLAR ACTIVITIES (SUNSPOT NUMBER AND F 10.7cm SOLAR RADIO FLUX) AND THE RESPONSE OF IONOSPHERIC ELECTRON CONTENT.

Babinisi Ayodeji.B

The Sun which is the principal source of the ionosphere's ionization however has several activities such as the coronal mass ejection (CME), the Extreme Ultraviolet Radiation, Sunspot Numbers, Solar Radio Flux. The Sun however, owes its high thermal energy to internal hydrogen-helium fusion reactions and it is a very stable radiator. The flux of the radiated energy increases slowly and steadily with time, by slightly less than 1% per 100 million years. For the purpose of this study, I will focus on F 10.7cm Solar Radio Flux and Sunspot Numbers. The sunspots are the regions with strong magnetic field on the surface of the Sun. The strong magnetic fields inhibit the convective motions that transport energy upward; consequently the sunspots are relatively dark and manifest as spots on the sun just as the name implies. The effective temperature is about 4500K, hence their darkness is only relative with regard to the surrounding solar photosphere. Another major manifestation of the variation in the solar activity is the Solar Radio Flux. Solar radio flux F10.7 cm, is the measure of the sun's radiation at a frequency of 2800MHz at a wavelength of 10.7cm. Total emission at 10.7cm originated in the vicinity of sunspots. Emission from the Sun at centimetric (radio) wavelength is due primarily to coronal plasma trapped in the magnetic fields overlying active regions, (TAPPING K.F 1987). The F10.7 index is a measure of the solar radio flux per unit frequency at a wavelength of 10.7cm, near the peak of the observed solar radio emission. F10.7 is often expressed in SFU or [solar flux units] (1 SFU = 10-22 W m-2 Hz-1. It represents a measure of diffuse, non radiative heating of the coronal plasma trapped by magnetic fields over active regions.

One of the parameters that can be used to study the ionosphere is the Total Electron Content (TEC). It is an important descriptive quantity for the ionosphere. TEC is the integral of electron number density along the line of sight path from the satellite to the receiver and can vary dramatically (RASTOGI; 2014-A002-P-008

KLOBUCHAR, 1990). The dual frequency SCINDA Novatel GSV 4004B GPS ground based receiver installed at Ile Ife Osun State (low latitude station) takes the data in RINEX format from the Space based GPS which is one of the Global Navigation Satellite System and a software designed by (Dr. Gopi Krishna Seemela of the Institute for Scientific Research, Boston College-Boston M.A,U.S.A) Would be employed to process the data in order to obtain the TEC both the daily plots with the bias inclusive and the TEC value as STD file.

2014 African Geophysical Society Conference
Book of Abstract

GEOMAGNETIC FIELD MEASUREMENT WITH INTERNATIONAL GEOMAGNETIC REFERENCE FIELD (IGRF) MODEL TO STUDY THE IONOSPHERE OVER AKURE

A.B Rabiu[1,2], J. O Oloketuyi[2], R.S Fayose[2,3], O. R Bello[2]

[1]National Space Research Development Agency, Abuja (NASRDA)
[2]Space Research Laboratory, Department of Physics, Federal University of Technology, Akure, Nigeria
[3]Dept of Physics Electronics, Adekunle Ajasin University, Akungba-Akoko, Nigeria

spacejacob@rocketmail.com

The ionosphere over Akure, southern Nigeria (7^{o} 15'N 5^{o} 12'E) was investigated for a period of two years (2005-2006) from direct observation and model. Ionosphere over Akure was monitored and measured using a locally produced magnetometer. The International Geomagnetic Reference Field (IGRF) model was used to evaluate the magnetic field over Akure at the same time epoch as the direct measurements. The measured values were compared with model values at every local time for discrepancies. Diurnal and Seasonal effects were investigated using the two means. The magnetic data generated from locally made magnetometer provided a comprehensive understanding of the geomagnetic variation over the region. The model when compared at every local time for discrepancies showed great deviation. The differences in the values were attributed to local sources captured in the direct measurements.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-008

Backscatter Occurrence Over the life time of SuperDARN

H.A. Lawal, M. Lester, T.K. Yeoman and S.Imber

This study is concerned with the statistical analysis of the occurrence of backscatter over two solar cycles. Data from 2 Super Dual Aurora Radar Network (SuperDARN) radars, at Hankasalmi, Finland, and Pykkvibaer, Iceland, spanning 18 years, from 1995 to 2012 were used in the study. Preliminary results for the occurrence of ionopsheric scatter and ground scatter are discussed. The percentage occurrence of backscatter for both Hankasalmi and Pykkvibaer radars has been analysed in the context of earlier work by Milan et al (1997) where only one year of observations were available. Variation in ionospheric irregularities in solar cycles is observed. Diurnal and seasonal variations seen in Milan et al (1997) vary according to solar cycle. Scatter occurrence at Pykkvibaer and Hankasalmi radars varies over the solar cycles. We also observed that occurrence of ionospheric scatter is more prominent at far ranges during solar cycle 23 at local day in winter months while ground scatter is prominent at near ranges.

KEYWORDS: Backscatter, Solar Cycle, SuperDARN

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-009

Ionospheric TEC variability during the ascending solar cycle 24, in Uganda

Oron S, Dujanga FM and Akoba R
Mbarara University of Science and Technology
Department of Physics, Mbarara University of Science and Technology
Mbarara, Uganda
soron@cns.mak.ac.ug, sulaoron@yahoo.co.uk

The total electron content (TEC) is a vital and most dominant ionospheric parameter that can cause Global Positioning System (GPS) signal delays, signal degradation and in extreme cases loss of lock. This results into inefficient operations of ground and space based Global Navigation Satellite System (GNSS) applications. The study of TEC variability is, therefore, useful for GNSS users in order to minimize errors where high levels of accuracy in measurements are required. This paper presents the diurnal, seasonal and solar activity dependence of TEC at the GPS-SCINDA (SCIntillation Network Decision Aid) station in Kampala, Uganda (geographic coordinates: latitude 0.3°N, longitude 32.6°S; and geomagnetic coordinates: latitude -9.3°, longitude 104.2°) for the years 2010 and 2011. The results obtained show that the diurnal variability in TEC at this station has a pre-dawn minimum followed by an early morning steady increase, an afternoon maximum and then a post sunset gradual reduction in TEC, with the equinoctial months depicting nighttime enhancements more prominently at around 2000 hrs UT (2300 hrs LT). Scintillation occurrence, a consequence of TEC fluctuations, was observed from about 1800 hrs UT (2100 hrs LT) to local midnight giving S_4 index values above 0.4, with the equinox months recording higher occurrences than other seasons. TEC variations were also seen to exhibit solar activity dependence. The sunspot numbers and the F10.7 solar flux exhibited a good correlation with TEC.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-010

Diurnal Variation of TEC and S4 Index during the Period of Low Geomagnetic Activity at Ile-Ife, Nigeria

Emmanuel Ariyibi

Obafemi Awolowo University,Ile-Ife,Osun State

Ile-Ife lies on the equatorial anomaly regionwhere the ionospheric current is greatly influenced bythe existence of the equatorial electrojet. The dual frequencySCINDANovAtelGSV4004BGPSreceiver recentlyinstalled at Ile-Ife [on geographical latitude 7_33_N and longitude4_33_E and geomagnetic dipole (coordinate) of latitude9.84_N and longitude 77.25_E] is currently operationaland recording data from the available global positioning systemsatellites. The receiver provides the data on total electroncontent (TEC) and the scintillation index (*S*4*)*. This paperpresents the first sets of results from this station. Data recordsfor the month of February 2010 were analyzed using theWinTec-P software program and these were interpreted todiscuss the diurnal variation of the TEC and *S*4 index duringthe period considered, as having low geomagnetic activity.

The vertical TEC in this study showed that the values vary widely from as low as 0 TECu about sunrise to about 35 TECu during the day. Depletion in TEC was also noticed about sunset and marked by the occurrence of scintillations with amaximum index value of 0.3. Results of the IRI models and the observed TEC differ considerably; hence, there is the need to improve IRI models for its adaptability to the Africa ionospheric conditions.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-011

Transient Variations of the Foci of S_q Ionospheric Current along European/African Meridian

Owolabi C, and A. B. Rabiu

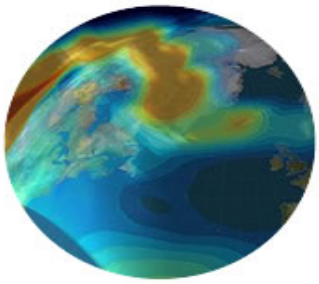
Federal University of Technology Akure, Ondo State

Department of Physics, Federal University of Technology Akure, Ondo

talk2ocleen@yahoo.com

This study investigated the characteristics of geomagnetic field variation with emphasis on the foci of the S_q ionospheric current at both hemispheres. One-minute time resolution of the horizontal component of geomagnetic dataset obtained from the chain of twenty seven (27) stations of International Real-time Magnetic Network (INTERMAGNET) and twelve (12) stations of Magnetic Data Acquisition System (MAGDAS) global network along European/African meridian with geographic longitudesbetween 0^o to 40^o E were extracted and converted to hourly values and employed to examine the configuration of S_q foci. Only quiet condition was examined as the hourly values of the solar quiet daily variation in the horizontal component of the Earth's magnetic field on IQD'S of the year 2009 for which solar activity was empirically low (average sunspot number$R_z = 3.1$). The diurnal variation of SqH shows a pre-dawn minimum, a steady early morning increase, followed by an afternoon maximum and gradually falls after sunset. This remark follows the fluctuations in ionospheric conductivity. The pre-noon and post-noon behaviour of northern and southern foci exhibit a rise mostly during pre-noon hours and a decline during post-noon hours. The results of the monthly diurnal variations indicate that the northern and southern foci exhibit hemispherical symmetry in some months of the year which were resulted from interaction between

the current systems in low and high latitude regions. The foci of the S_q manifestation marked hourly, monthly and seasonal variation. Results of S_q foci positions indicate significantly varied locations, for both hemispheres for the period of analysis, with the intermittent poleward and equatorward shift. The foci on either side are most poleward in March equinox. However, it is concluded that the foci of $S_q$current are unstable for daily, monthly and seasonal investigation.



2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-012

Opio

ABSTRACT

The network of dual frequency receivers from the Global Navigation Satellite Systems (GNSS) in Africa has provided an opportunity to make correlated studies in the African ionosphere.

Total electron content (TEC) measured using Global Positioning System (GPS) satellites at 18 different stations in the year 2011 was used to study the latitudinal variation of the ionosphere. The stations are chosen along a common longitude (30oE to 40oE) covering almost all the latitudes of the African sector. The variations in TEC investigated include; diurnal, day-to-day, seasonal, latitudinal, and annual in the different latitudes of Africa. We also presented observed behavior of ionospheric responses to a geomagnetic storm of Oct-2011 by the different latitudes using vertical TEC.

The data was analyzed using both the Gopi software version 2.2 and the satellite-data-analyzer software developed by the researcher. The results exhibited a latitudinal dependence where the values keep on increasing as you descend from high latitudes of both hemispheres, with a maximum at the geomagnetic equator. The annual and seasonal variation was investigated best using only the noontime TEC (daily peak) and our results showed the usual annual and semiannual variation in all the latitudes. However there was an equinox asymmetry where the September-October equinox registered the highest values in TEC than the March-April equinox in this year 2011. Similarly in the same year the VTEC presented a winter anomaly from almost all the latitudes. The diurnal variation exhibited a minimum which was maintained constant for long hours in the solstice months and short lived in the equinox months especially for the equatorial stations. The equatorial stations also exhibited features like noontime bite-out, night-time enhancements and high day-to-day TEC variability especially in the September equinox. The day-to-day variability was more pronounced in the station around geomagnetic latitude 16o S, a typical manifestation of the stations around the crest of the equatorial anomaly region. During the geomagnetic storm of Oct-24th to Oct-25th, there was an enhancement at the ionosphere of equatorial stations (positive effect) and depletion (negative effect) for stations far from the geomagnetic equator and we recommend more receivers preferably in a single longitude to be placed in atleast 5 degree latitudinal difference to cover all the latitudes of Africa to provide a comprehensive study such that the true crest and troughs for Africa is established.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-013

Ionospheric Group Delay Mapping over Nigeria Using a Geostatistical Approach

Olabode A. O.[1] and Adia S. O.[2]
[1]Regional Centre for Training in Aerospace Surveys, Ile-Ife, Nigeria
[2]Department of Physics, Federal University of Technology, Akure, Nigeria

Radio-wave signals of Global Navigation Satellite Systems (GNSS) propagating through the ionosphere experience a delay which is proportional to the Total Electron Content (TEC) along the signal path from the satellite to a receiver, degrading the performance of the system. Due to the sparse distribution of GNSS Continuously Operating Reference Stations (CORS) in the Nigerian region, this study uses geostatistical method to develop regional ionospheric group delay maps over Nigeria. The aim is to investigate the effect of ionospheric group delay on GNSS measurement over the regional coverage of Nigeria. Available RINEX data were obtained from 8 GNSS CORS from which TEC was estimated and ionospheric group delay determined using a Matlab programme that calculates ionospheric group delay. A geostatistical interpolation technique, Kriging was used to interpolate the values obtained to develop regional ionospheric group delay maps over the CORS using ArcGIS 10. Results were mapped for different hour regimes, where the delay shows to be high during midday (~ 9 m). As a first attempt study in the Nigerian region, result show that this is a good method to present ionospheric group delay maps over Nigeria. If more stations are installed, this approach will help characterize the ionosphere over the Nigerian region on a spatio-temporal basis more accurately.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-014

Analysis of Longitudinal Advancement of the Peak Total Electron Content in the African Equatorial Anomaly Region Using Data from GPS Receivers and GIS Stations in Kenya

Jared O. H. Ndeda[1], Paul O. Odera[2]
[1, 2] Physics Department, Jomo Kenyatta University of Agriculture and Technology (JKUAT), Kenya.
Correspondence: Jared O. H. Ndeda, Physics Department, Jomo Kenyatta University of Agric and Technology. P.O. Box 62000-00200, Nairobi, Kenya. Tel: +254 722806458. Email: jndeda6060@yahoo.com

Abstract

We investigated longitudinal advancement of the peak Total Electron Content (TEC) within the equatorial anomaly region of Kenya, based on the data from the two Scintillation Network Decision Aid (SCINDA) Global Positioning System (GPS) receivers at Jomo Kenyatta University of Agriculture & Technology (JKUAT): latitude -1.095, longitude 37.015, and at the University of Nairobi: latitude -1.274, longitude 36.808; and the two Geographical Information System (GIS) stations at Malindi: latitude -2.996, longitude 40.194, and at the Regional Center for Mapping of Resources for Development (RCMRD): latitude -1.221, longitude 36.893. The retrieved archived data from these stations were for 17th December 2009; and for 26th, 27th and 28th August 2010 - just after the solar minimum period of 2008. They were subjected to analysis by the GPS-TEC analysis application software provided by Boston College Research Institute (USA). Results reveal that the peak TEC within the region of study occurs between 8 am and 10 am. The Coastal region experiences peak TEC earlier than Nairobi region. Slight variations were also observed on the TEC plots from various stations. It can be concluded that the peak TEC advances westwards within the equatorial anomaly region; these variations are due to plasma bubbles that take place from the east to west within the equatorial region.

Keywords: *Total Electron Content (TEC), Equatorial Anomaly region, plasma bubble, Kenya*
2014-A002-P-16

2014 African Geophysical Society Conference
Book of Abstract

RELATIVE VARIABILITY OF foF2 AT OUGADOUGOU DURING HIGH, MODERATE AND LOW SOLAR ACTIVITY YEAR

[*1]Onori, E.O. [1]Somoye, E.O. [1]Adeniji-Adele, R.A. and [1]Ogwala, A.

[1*]Department of Physics, Lagos State University, Ojo, Lagos.

E-MAIL: onorieugene@yahoo.com.

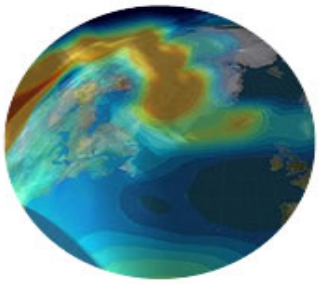
ABSTRACT

In this paper we present the diurnal, seasonal, annual and solar variation of the relative variability (VR) of ionospheric F2 layer (foF2) at Ougadougou (12.4^0 N, 1.5^0W, dip: 2.8^0 N) an equatorial station in Burkina Faso. The data set used for this work are monthly mean values of foF2 1989,1978 and 1985 corresponding to year of high solar activity (HSA), moderate solar activity (MSA) and low solar activity (LSA) respectively. The data were further analyzed statistically. Diurnal analysis from the study shows that foF2 is more prone to variability during nighttime than daytime, with two distinctive peaks that occurred after midnight (post midnight peak in the range of about 26%-40%) and after sunset (post sunset peak in the range of about 13% - 37%). Seasonally, September equinox maximum has been observed at Ougadouguo during the HSA and MSA year with values of about 26% and 38% respectively while June solstice maximum at the same station was observed during LSA year with value of about 39%. From the view point of annual and solar outcome, the coefficient of foF2 variability reached its maximum values during the

LSA year at the equatorial station. On the whole, we concluded that the relative variability (VR) of fof2 in the equatorial ionospheric station increases with decreasing solar activity especially during nighttime and hence is by some means inversely proportional to the solar ionization in the region.

Keywords: Relative Variability (VR) of foF2, Ionospheric F2 layer, solar activity.

AGS
African Geophysical Society
www.afgps.org



2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-017

CHARACTERIZING THE RELATIVE VARIABILITY OF SUNSPOT NUMBERS

[1,*]Somoye, E.O., [2]Akala, A.O., [1]Iheonu, E.E. and [1]Ogwala, A.

[1,*]Department of Physics, Lagos State University, Ojo, Lagos, Nigeria.

[2]Department of Physics, University of Lagos, Akoka, Nigeria.

femi2000somoye@yahoo.com

The characterization of the relative variability (VR) of sunspot numbers on seasonal and solar cycle scales is carried out in this study. The lower bound of high solar activity (HSA) relative variability (VR) of sunspot numbers (Rz) is 20%, while its maximum ranges between 28 – 32% and occurs during March equinox and June solstice. Variability of sunspot number is higher during moderate solar activity (MSA) in the range 22 – 62% and low solar activity (LSA) in the range 30 – 58% than during HSA. While the peak values of MSA VR occurs during September equinox on a general note, those of LSA are found to occur during the solstices. The terrestrial impact of the variabilities of sunspot numbers and therefore that of the sun is obvious in the inverse relationship of the variability of ionospheric characteristics (especially of the F2 region) and the epochs of solar cycle.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A003-O-002

2014-A003-O-003

Subsurface Strucural Studies Of Bayero University Kano Permanent Site Using Induced Polarization (Ip) And Self-Potential (Sp) Methods.

1SHEHU, J.S 2BUNAWA A.A 2 SALEH, M.

1Department of Physics, Usmanu Danfodiyo University, Sokoto.
2Department of Physics, Bayero University, Kano.
jamalshehu@yahoo.com

This paper centers on the investigation of the subsurface condition of Bayero University Kano Permanent site with the aim of understanding the lithology and also to map out the groundwater patterns within the area. To achieve this, time domain Induced Polarization (IP) and Self-Potential (SP) methods were adopted using Vertical Electrical Sounding (VES) technique. ABEM Terrameter SAS 1000 was used for the sounding with Schlumberger electrode array configuration and a total of 49 stations were sounded. IPI2WIN+IP, Microsoft Excel and Surfer 7.0 were used to analyze and interpret the measured data. The result of the analysis shows that the area is underlain by two to five subsurface layers. These layers are top soil/alluvium, laterite, weathered basement complex rocks, fractured basement complex rocks and fresh basement complex rocks. The aquiferous zone of the study area occurs in the weathered and fractured basements and its thickness ranges from 1.44 to 70.157 m while the overburden thickness lies between 1.6 and 72.104 m. Microsoft Excel was used to plot SP values against depths of investigation. The peak SP values were used in identifying areas with greater depth of flow in the study area. From the analysis of the overburden thickness, aquifer thickness and SP values, the most favorable regions for groundwater exploitation were found around VES 6,11,13,19,26,38,44 and 48. The investigation also provides information about the subsurface condition with regards to engineering construction and safe place for refuse dumping in order to avoid groundwater contamination.

Keywords: *Lithology, groundwater, Induced Polarization, Self-Potential*

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A003-O-004

SATELLITE REMOTE SENSING STUDY OF A PART OF THE BENIN FLANK AND IMPLICATIONS FOR STRUCTURAL CONTROL ON THE AUCHI GULLY, SOUTHWESTERN NIGERIA

[1]F. Kolawole and [2]A.Y.B. Anifowose

[1]Seismology Department, Chinese National Petroleum Corporation,
Rivoc Road, Trans-Amadi Industrial Layout, Port-Harcourt, Nigeria.

[2]Department of Remote Sensing & GIS, Federal University of Technology,

[1]folapoint@yahoo.com, [2]aybanifowose@futa.edu.ng

Gullies are channels which are created on the Earth's surface by running water, usually after a heavy rainfall, thereby leading to the physical removal and displacement of soil materials. Earlier workers have studied gully erosion sites in Auchi, Southeastern Nigeria, and attempted to decipher the causes as well as characterize the dynamics, and mostly the geological hazards posed to the community and its environs. This study focuses on a part of the Benin Flank, Anambra Basin, with the aim of identifying geological features and their implication on the development and growth of the erosional gullies in Auchi area.

Landsat ETM$^+$ satellite imagery covering the study area was acquired and processed through linear stretching and band filtering techniques, while various colour composites were also produced. The analysis of the various features extracted from the processed images exposed possible megascopic structural controls on the origin and development of the gullies. In addition, due to the relatively low resolution of Landsat system, a higher resolution Google Earth® image of the Auchi area was acquired in order to highlight important mechanisms and 'trouble spots' in the gully areas.

The study proposes a possible influence of landward extensions of oceanic fracture zones from the Gulf of Guinea, due to the location of the gullies on- and their rectilinearity with the structurally-controlled NE-SW trending southeastern boundary of the basement Ilesha Spur.

Keywords: Faulting, Gully erosion, Remote sensing, Tectonics

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A003-O-005

Oil Sands Exploration Using 2-D Electrical Imaging Technique

Geraldine Anukwu1*, Kola Odunaike2 and Olusola Fasunwon3

1. Department of Geosciences, University of Lagos, Akoka, Lagos

2. Department of Physics, OlabisiOnabanjo University, Ago-Iwoye, Ogun State

3. Department of Physics, University of Regina, Saskatchewan, Canada

*E-mail of the corresponding Author: ganukwu@unilag.edu.ng or chibzdine@yahoo.com

This study describes the use of two-dimensional electrical imaging technique in defining regions of oil sand deposits and determining the geometry of such deposits in Imeri, South Western Nigeria. Three field survey lines were acquired in different orientations in the study area with one of the lines above the oil sand outcrop observed in the area. The Gradient electrode Configuration was employed to obtain apparent resistivity and chargeability of the subsurface. Very high resistivity value greater than 3000 ohm-m and pronounced induced polarization effects were associated with the region were the outcrop was observed. These electrical characteristics were used in delineating oil sand zones in the study area.

Keywords: Oil sand, electrical imaging, resistivity and induced polarization

2014 African Geophysical Society Conference
Book of Abstract

2014-A003-O-006

Detailed Geophysical Investigations Of Stable And Unstable Sections Of Sarkin Pawa-Mangoro Road, Niger State, Nigeria

1Jatto S. S., 2Sule P. O., 2Ahmed A. L. and 3Kizito O. K.

1Centre for Atmospheric Research, National Space Research and Dev. Agency, Abuja

Department of Physics, Ahmadu Bello University, Zaria, Nigeria

.Federal University Lokoja, Kogi State ssjatto@yahoo.com

Geophysical investigations involving the Schlumberger vertical electrical sounding (VES) and the magnetic method have been carried out along stable and unstable sections of the SarkinPawa-Mangoro road in Niger State, Nigeria. This is to investigate the factors responsible for the incessant pavement failure within the area. A profile with a total of 28 VES stations at a separation of 50 metres covering a distance of 1350 metres was established parallel to the road pavement on each side of the road. ABEM SAS 300 terrameter was used for the measurements. The magnetic survey was conducted using the Proton Magnetometer at a station interval of 25 metres along two profiles on each side of the road and running parallel to the road pavement. The profile separation was 7 metres. The two innermost profiles are on the same VES profiles above. The geoelectric sections along the stable segments of the road show generally resistive subsurface, while the magnetic profiles show a homogeneous subsurface devoid of geological features. Beneath the unstable segments, the geoelectric sections show low resistivity clay topsoil, water absorbing substratum, and near-surface water table. The magnetic profiles indicate a prominent low magnetic linear feature which is suspected to be a fault within the basement, or an old stream channel which has been covered with sand. This magnetic feature corresponds to a visible subsidence on the earth's surface. The unstable sections, which correspond to pavement failure, can hence be delineated using geophysical investigations and thus enabling necessary remedial actions to be taken when constructing the road. **(Keywords:** Vertical electrical sounding, Magnetics, Mangoro, Geoelectric Section, Resistivity, Pavement failure

2014 African Geophysical Society Conference
Book of Abstract

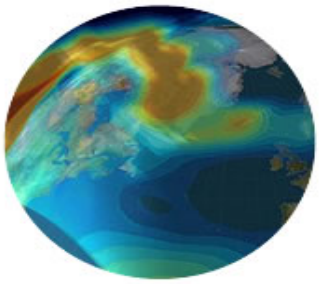
2014-A003-O-007

INFLUENCE OF MEDIA DEPTHS AND TEXTURE ON THE ATTENUATION OF MIGRATION OF BACTERIA IN SATURATED POROUS MEDIA.

*** T. A Lateef / Co- authors:*J. A. Adegoke and **A. A. Ogunjobi**
*Department of Physics, University of Ibadan, Ibadan. **Department of Microbiology, University of Ibadan, Ibadan.
***Department of Physics, Ekiti State University, Ado – Ekiti.
E-mail:lattaof@yahoo.com

The influence of depth and media texture in the migration of pathogenic organisms in porous media can not be left out in preventing groundwater contamination and proper design of a good natural filter as used in water processing units. This research examines the effects of media depth and texture on the soil attenuation of bacteria transportation. Flow – through column packed with different sizes of sand matrices were used (1 meter long, 2.79 x 10^{-2}m in diameter). Five different depths were considered (10, 20, 30, 40 and 50 cm). Exactly 2ml of bacteria (Escherichia coli) solution were dropped in to the media and the effluents were collected to determine the bacteria load present in the effluents. Effluents were normalized (C/C_o) to determine the coefficient of attenuation by fitting the curve of C/Co with depth. The results showed that the coefficient of attenuation increases with depth which range from 0.250 to 2.282 for 10cm to 50cm depth. The mean value of C/Co concentration increases with increase in particle size i.e, 0.1975 – 0.3637 for sizes between 0.150mm and 0.600mm. Statistical analysis shows that the variation of depths with bacteria attenuation of bacteria migration is exponential which is similar to theoretical findings. The R- square value fitted linearly was 0.836 and exponentially was 0.894.The efficiency of sand media as a contaminants filter and as a protecting layer rather than mere quantification through chemotactic assay as applicable to aquifer bioremediation is hence confirmed.

Keywords: Bacteria, Depth, Texture, Attenuation, Migration, Aquifer.



2014 African Geophysical Society Conference
Book of Abstract

2014-A003-P-001

2014-A003-P-002

Application of Solar Quiet-day Ionospheric Current Variation (Sq) in Determining the Mantle Conductivity-depth Structure along the Magnetic Equatorial African Region

Ugbor, D. O. and Okeke, F. N.

University of Nigeria, Nsukka

Department of Physics and Astronomy, University of Nigeria, Nsukka

dokugbor@yahoo.com

We used the quiet day ionospheric current variations (Sq) observed in Abuja, Bangui and Addis Ababa to delineate the mantle conductivity- depth structure along the equatorial African region. Spherical harmonic analysis (SHA) was employed in separating the internal and external field contributions to the Sq variations. For each of the paired external and internal coefficients of the SHA, we used transfer function to compute the conductivity- depth profile for the region. Strikingly, we observed increased conductivity values in the Earth layers. The values rose gradually from 0.007Sm-1 at 0.6km to 0.035 Sm-1 at 30km and 0.112Sm-1 at 64km all within the crust. The electrical conductivity continued increasing in the upper mantle getting to a peak value of 0.137Sm-1 at 228km after which there was a considerable drop to 0.111Sm-1 at 270km. Beyond 270km, the conductivity began to rise again with values of 0.131Sm-1 at 286km, 0.162Sm-1 at 356km, 0.227Sm-1 at 414km, 0.295Sm-1 at541km, 0.400Sm-1 at 705km and reaching another peak value of 0.461Sm-1 at 898km (close to the upper/lower mantle transition zone). We noticed a fluctuating decrease at depths beyond 898km with values of 0.433Sm-1 at 911km, 0.442Sm-1 at 1015km 0.393Sm-1 at 1066km and finally 0.444Sm-1 at 1092km.

Key words: ionospheric current variation (Sq), mantle, electrical conductivity, equatorial African region, quiet days.

2014 African Geophysical Society Conference
Book of Abstract

2014-A003-P-003

Subsurface Structural Studies of Bayero University Kano Permanent Site using Electrical Methods

[1]Bunawa A.A, [2]Shehu J. S, and [3]Saleh M
[1]Department of Physics, Bayero University, Kano
aabunawa.phy@buk.edu.ng

This paper centers on the investigation of the subsurface condition of Bayero University Kano Permanent site with the aim of understanding the lithology and also to map out the groundwater patterns within the area. To achieve this, Resistivity, Time Domain Induced Polarization (IP) and Self-Potential (SP) methods were adopted using Vertical Electrical Sounding (VES) technique. ABEM Terrameter SAS 1000 was used for the sounding with Schlumberger electrode array configuration and a total of 49 stations were sounded. IPI2WIN+IP, Microsoft Excel and Surfer 7.0 were used to analyze and interpret the measured data. The result of the analysis shows that the area is underlain by two to five subsurface layers. The aquiferous zone of the study area occurs in the weathered and fractured basement rocks. Microsoft Excel was used to plot SP values against depths of investigation. The peak SP values were used in identifying areas with greater depth of flow in the study area. From the analysis of the overburden thickness, aquifer thickness and SP values, the most favorable regions for groundwater exploitation were found around VES 11(11.97340N, 8.43710E), 13(11.97710N, 8.43420E) 19(11.97230N, 8.43110E) and 44(11.96450N, 8.42820E). The suitability of the groundwater in the area for drinking was assessed and it was found that it is safe for drinking and other domestic usages. The investigation also provides information about the subsurface condition with regards to engineering construction and safe place for refuse dumping in order to avoid groundwater contamination.

Key words: Contamination, Polarization, Potential, Resistivity, and Structural

2014 African Geophysical Society Conference
Book of Abstract

2014-A003-P-004

Spectral Analysis of Aeromagnetic Data For Geothermal Exploration in the Sokoto Basin, Nigeria

1 Nwankwo, L. I. and 2 A. T. Shehu
1Department of Physics, University of Ilorin, Nigeria
2School of Preliminary Studies, Federal University of Technology, Minna, Nigeria
levinwankwo@yahoo.com

A spectral analysis of airborne magnetic data has been made for geothermal reconnaissance studies in the Sokoto basin, north-western Nigeria. The study area is bounded by latitudes 12.5o and 13.5o North and longitudes 4.0o and 6.0o East. Depth estimates were made from the analysis of the spectra of magnetic anomalies. The rates of decay of the spectrum were used to calculate the mean depth to top and bottom of magnetic sources. These depths information were then analysed to determine the geothermal gradient and heat flows which were interpreted to reveal potential geothermal regions. The results show that the depths to deep-seated magnetic structures vary between 0.74 and 4.18 km with an average of 2.32 ± 0.92 km while crustal depth varies between 18 and 31 km. Consequently, the geothermal gradient and the heat flows were calculated and found to vary from 12 to 46 oC/km and 34 to 123 mW/m2 respectively.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A003-P-005

DESIGN AND CONSTRUCTION OF TEMPERATURE DATA ACQUISITION SYSTEM FOR SOIL TEMPERATURE MEASUREMENT

Ewang, E. S and Oladosu, O. R.
African Regional Centre for Space Science and Technology Education in English, O.A.U. Campus, Ile-Ife.
Corresponding author: ewang_arcsste@yahoo.com

The need to acquire soil temperature is of paramount important, but the means to achieve this is relatively expensive. This study aims at design and construction of temperature data acquisition system for soil temperature measurement. The PIC 18F452 Microchip microcontroller unit serves as the heart of the acquisition system, temperature sensor LM35 was embedded into temperature sensing probe. The date and time were monitored with DS1307 RTC timer and micro SD with adapter in normal SD card application was used as storage unit. The circuit was designed with Proteus ISIS and the components were placed on the Vero board as laid out in the circuit diagram and then soldered. The firmware programme that control the operation of the device written in C programming language, compiled to executable hex. Code using CCS C compiler for PIC. Calibration was carried out and the readings from the device were validated and benchmarked with that from the standard analog thermometer and automated data systems.

The result showed that there were positive correlations, and the paired t-test from the analysis also showed that there was no significant difference ($p > 0.05$) between the designed temperature system, a standard analog thermometer and an automated data logging system. A sinusoidal temperature pattern was observed for diurnal temperature with wave amplitude decreasing with soil depth. The variation was more pronounced on the top soils because they were in closer contact with the source of heat.

Key Words: Soil temperature, Data Acquisition system.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A003-P-006

Geological Mapping From High Resolution Aeromagnetic Data Of Part Of The Middle Benue Trough, Nigeria

Dr. Alabi OlusegunO.[1],Okereke Kingsley N.[2]

1. Osun State University, PMB 4494, Osogbo, Nigeria

2.Oduduwa University, Ipetu modu, Ile-Ife, Osun State, Nigeria.

Airborne geophysical surveying is the process of measuring the variation of different physical or geochemical parameters of the earth such as distribution of magnetic minerals, density location, depth, dip, susceptibility contrast, electric conductivity and radioactive element concentration. This method was used to measure parameters such as locations of boundaries, depths, dips and susceptibility contrast. The Benue Trough in Nigeria is a NE-SW trending sedimentary basin, which extends for over 800km from the northern limit of the Niger Delta to the southern limit of the Chad basin. This study aims at using high resolution aeromagnetic data of parts of middle Benue Trough to map and interpret the geology of the study area. The acquisition and processing of the data enable better understanding of the structural geologic information relevant to hydrocarbon prospecting of the study area. High resolution digital aeromagnetic data of a part of Middle Benue Trough were obtained from Nigerian Geological Survey Agency (NGSA). The data obtained were in digital form XYZ which covered a total area of 3025 square kilometer, extending from latitudes $8^0 30' N - 9^0 00' N$ and from longitudes$9^0 30' E - 10^0 00' E$. The digital data was gridded at 1km spacing using minimum curvature gridding method. The resulting data was used to plot a contour map. The basement rock's depths range from 0.546km and 10.2km. The depths determined from LWN gave a deeper depth than the depth determined from HGM. Deductions from the depth to basement analysis and the contacts identified show that the basement is divided into blocks by faults. Thus, the basements of the study area are generally high to favor hydrocarbon formation. However, there are other

factors to be considered in order to ascertain the accumulation of liquid hydrocarbon in any area. It is therefore pertinent that geochemical investigation and detailed geological mapping of the area be carried out in various identified anomaly zones.

Keywords: Basement, magnetic susceptibility, aeromagnetic, trough and depth range

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A003-P-007

The Magnetic Profile along an East- West Profile across the University of Ilorin, Ilorin West Central Nigeria

*[1]S.O. Ige, L.I. Nwankwo, M. Olanipekun

Department of Physics, University of Ilorin

[1]Email: stcymone@gmail.com

A magnetic profile using a station for geophysical techniques used to map basement complex, geology and fractures in the central part of Nigeria. The area under investigation is the University of Ilorin main campus, which covers an area of about 40km^2 .The problems that were to unravel were (1) to construct the magnetic profile in order to summarize the general geology of the area (2) to estimate the depth of the layers or the buried magnetic bodies (or rock types). The flux-gate magnetometer was used in the surveys because of its easy measuring of values and treatment of values for the construction of the profile and measurement of depths of the layers and to the buried magnetic bodies.. The profile served as a quick means of study of the geology structure of the area studied. **Keywords:** Magnetometer

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A003-P-008

Qualitative Reservoir Characterization using 3-D Seismic and Well log data over an X-field, Niger Delta, Nigeria.

Ohakwere-Eze M.[1*], **Nwankwo C. N**[2] **and Ebeniro J. O**[3]
[1]Physics department, Salem University, Lokoja, Kogi State.
[2,3]Physics department, University of Port Harcourt, River State.
E-mail: michael.ohakwereze@gmail.com*

In this study, we have embarked on the delineation and mapping of hydrocarbon- bearing reservoir HD2000 from surface seismic sections and well logs within the depth interval of 5,700ft (1,737m) and 6,200ft (1,890m). We were guided by the aim to establish the geometry, reservoir distribution, lateral continuity and structural configuration of the reservoir in the study area and to delineate hydrocarbon bearing reservoirs from surface seismic sections and well logs. In this process, we have carried out 3-D structural interpretation and estimation of the volume of hydrocarbon-in-place in the reservoirs. Well-to-seismic tie revealed that hydrocarbon bearing reservoirs were associated with direct hydrocarbon indicators (bright spots and dim spots) on the seismic sections. Two horizons were studied (HD2 and HD2_version2) and several faults mapped for the purpose of carrying out 3-D subsurface structural interpretation. This was used in generating the time structure maps. From the maps, it was observed that the principal structure responsible for hydrocarbon entrapment in the field was the anticlinal structure at the centre of the field which tied to the crest of the rollover structure seen on the seismic sections. Check shots from the control well were used to create a velocity model from which the time to depth conversion was made. Horizon slice taken shows the reservoir spans a thickness of 400ft. Direct hydrocarbon indicators were used to map the reservoir boundary. They were seen on the reflection amplitude maps as high amplitude zones (bright spots) and low amplitude zones (dim spots). Reservoir area extent estimated by square grid template method revealed that reservoir HD2000 had an area estimate of 5.29 km^2. The results show the effectiveness of the estimation techniques in the lateral prediction of reservoir properties, discriminating

litho-fluid and determining the porosity, saturation, net-to-gross ratio and moreover the reserve volume. Hydrocarbon saturation varied between 0.64 and 0.65, while effective porosity varied between 0.31 and 0.32. Estimation of the volume of hydrocarbon in place revealed that the delineated reservoir HD2000 contained an estimate of 776,545,418.22 barrels (123,460,855.4cm^3) of Hydrocarbon which shows great potential of considerable size.

(Keywords: hydrocarbon, reservoir, volume, seismic, well logs, structure, horizon)

2014 African Geophysical Society Conference
Book of Abstract

2014-A004-O-001

THE ROLE OF THE PRECISION FILTER RADIOMETER IN SOLAR RADIATION MEASUREMENTS

Maryam Idris&Rabia Said
Department of Physics, Bayero University, PMB 3011, Kano. Nigeria
Email: maryamjahun84@gmail.com

The Precision Filter Radiometer (PFR) is a research grade instrument to measure direct solar irradiance in 4 narrow spectral bands centered at wavelengths recommended by the World Meteorological Organization (WMO) for the determination of atmospheric aerosol optical depth (AOD). In this poster, we present a brief description of solar radiation and types of solar radiation measurements. We then present the working principle of the PFR and sample measurements taken by the PFR, thereby highlighting its role in solar radiation measurements

2014-A004-O-002

Retrieving Land Surface Temperature from Landsat Data for Heat Studies over Ile-Ife, Southwestern Nigeria

2014-A004-O-003

2014 African Geophysical Society Conference
Book of Abstract

2014-A004-O-004

Survey of Radiation Energy Balance in Some Selected Cities in Nigeria

ISIKWUE, B. C., Akiishi, M., and Utah, E. U.

University of Agriculture, Makurdi, Nigeria.

Department of Physics, University of Agriculture, Makurdi, Nigeria.
bcisikwue@gmail.com

The evaluations of radiation energy balance are hereby present some selected cities in the tropical forest and savannah zones of Nigeria. The data used for the study were obtained from the Nigerian Meteorological Agency (NIMET) Abuja, (1990-2010). The results among other things show that the albedo was generally high (60 to 64%), in all the locations considered, implying that majority of the solar radiation in these locations did not reach the surface. However, there are increases in the radiation balance in Port Harcourt and Makurdi locations, whereas in Enugu and Kano, the curves indicate negative or decrease in radiation balance. This implies that there is a balance in solar energy radiation budget that could enhance solar energy technologies in Port Harcourt and Makurdi towns. On the other hand, suggestions have been made on the need for seasonal considerations of the radiation balance for more efficient climatic and solar technological planning.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A004-O-005

Investigation Of Carbon (Ii) Oxide Pollution In Seven Stations In Nigeria Via Remote Sensing

T.V Omotosho[1], E.S Joel[2], O.O Adewoyin[3]

1Department of physics, Covenant University, Ota, Ogun State, Nigeria.
E-mail:omotosho@covenantuniversity.edu.ng, dayovic@yahoo.com

2Department of physics, Covenant University, Ota, Ogun State, Nigeria.

E-mail: sundayemmanuel73@gmail.com, emmanuel.joel@covenantuniversity.edu.ng

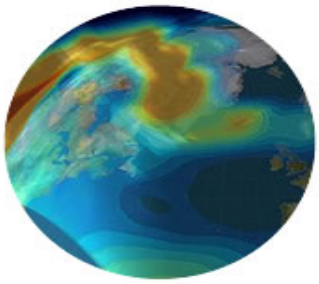
3Department of physics, Covenant University, Ota, Ogun State, Nigeria.

E-mail:segadot@yahoo.com, olusegun.adewoyin@covenantuniversity.edu.ng

A growing concern in our world today is air pollution. Carbon (II) Oxide, an air pollutant has been reported to contribute to a large number of poisoning deaths. The magnitude of the health hazard due to carbon (II) Oxide, both fatal and non-fatal, is huge and poisonings are probably more prevalent than is generally recognised. The aim of this study was to determine the level of human exposure to Carbon (II) Oxide and also to identify the major source of Carbon (II) Oxide emission within the study areas, using MOPITT (measurement of pollution in the troposphere) satellite. Carbon (II) Oxide was measured at seven environmentally different sites viz; Lagos, Port-Harcourt, Ibadan, Akwa-Ibom, Sokoto, Kano, and Abuja. From these measurements, the effect of varying levels of Carbon (II) Oxide at different environments was analyzed. Ambient Carbon (II) oxide at these sites, their monthly variation, average annual variation, seasonal variation was outlined respectively. This study revealed that Lagos has the highest ambient Carbon (II) Oxide (3.00842 ppm), followed by Port-Harcourt (3.00175 ppm), Uyo (2.85 ppm), Ibadan (2.83 ppm), Abuja (2.68 ppm), Kano (2.31 ppm), and Sokoto (2.28 ppm) in descending order. The results shows the characteristic of Carbon (II) Oxide levels encountered at the seven stations, their response to traffic and the anthropogenic activity that increases Carbon (II) Oxide levels.

Keywords: MOPITT, Air Pollutant, Health Hazard, Carbon (II) Oxide

AGS
African Geophysical Society
www.afgps.org



2014 African Geophysical Society Conference
Book of Abstract

2014-A004-O-006

ENSO and its Relationship to Changing Precipitation over the Tropical Pacific

O. R. Salau, Akinyemi S. A.
Physics Department, Faculty of Science,
Ekiti State University (EKSU), Ado – Ekiti, Nigeria
o.salau@t-online.de

El Niño/Southern Oscillation (ENSO) is a coupled ocean-atmosphere phenomenon that originates within the Tropical Pacific Ocean, which has impact of global climate and worldwide economy through atmospheric teleconnections. The variability in the ENSO induced fluctuations in the precipitation over the Tropical Pacific is investigated using Sea Surface Temperature (SST) and Precipitation data. Two strong La Niña events and El Niño events were compared in the study; the aim is to derive the relationship between changes in ENSO variability and the associated precipitation. In all, the results suggest that an increase in the strength of a La Niña event will tend to reduce the overall amount of rainfall over the Tropical Pacific while the intensity of the precipitation within the region rises as the amplitude of El Nino event strengthens.

2014 African Geophysical Society Conference
Book of Abstract

2014-A004-O-007

Monitoring Daily evapotranspiration and managing water resources in Wushishi, Niger state using Landsat 8 imagery

[+]Adeyeri, Oluwafemi, [+]Okogbue E. C. and [++]Akinluyi, F. O.

[+]Department of Meteorology, Federal University of Technology, Akure, Nigeria

[++]Department of Remote Sensing, Federal University of Technology, Akure, Nigeria

The objective of this study was to monitor daily evapotranspiration in Wushishi Niger state using Landsat-8 imagery. The study area lies on latitude $9^0$43'N and longitude $6^0$06'E.Evapotranspiration (ET) is critical for water resources and crop management. Remotely sensed thermal infrared imagery collected by Landsat-8 provides estimates of land-surface temperature that allows mapping of evapotranspiration (ET) at the spatial scales at which water is being used by different land use and land cover. The study which was conducted for day 24/04/2013 used remote sensing and GIS techniques and a Surface-Energy-Balance ET algorithm (SEBAL) which is a remote sensing-based crop ET model to estimatethe daily evapotranspiration over Umarson farms in Wushishi. The farm is in a close proximity to river Kaduna. The ET values ranged between 5.76 and 8.45 mm/day. Also the values of sensible heat, net radiation, soil heat flux and latent heat of evaporation corresponding to different sets of NDVI shows little change of trend because the site is predominantly an Agricultural area.Mapping of ET is crucial in understanding the hydrological processes for sustainable management of water resources in agriculture.

Key words: Evapotranspiration, water resources, agriculture and Wushishi

2014 African Geophysical Society Conference
Book of Abstract

2014-A004-O-001

2014-A004-O-002

Measurement of Vertical Turbulent Heat Fluxes In The Atmospheric Boundary Layers Using Eddy Correlation Techniques

I. Andrew[1] and A. Rabiu[2]

[1]Physics Department, Faculty of Science, Federal University Kashere, Gombe, Nigeria
Tel +234 7038346417, Email: ichojaandy@yahoo.ca

[2] Physics Department, Faculty of Science, Federal University Kashere, Gombe, Nigeria
Tel +234 8029466776, Email: adamrabiu@yahoo.com

Eddy correlation technique is one of the key atmospheric measurement techniques used to measuring and calculating vertical turbulent fluxes within atmospheric boundary layers. Flux which measures how much something moves through a unit area per time is dependent on the number of things crossing the area, the size of the area being crossed and the time it takes to cross the area. Vertical flux ($S/\rho c/\rho a$) which is presented as a covariance of the velocity is determined using Reynold's Decomposition. Flux = mean product of air density, vertical wind speed and the mixing ratio of the gas.

Keywords: Air density, mixing ratio, wind speed, fluxes and boundary layers

2014 African Geophysical Society Conference
Book of Abstract

2014-A004-O-003

The Role of the Precision Filter Radiometer in Solar Radiation Measurements

Idris, M., and R. S. Sa'id

Department of Physics, Bayero University, PMB 3011, Kano. Nigeria
maryamjahun84@gmail.com

The Precision Filter Radiometer (PFR) is a research grade instrument to measure direct solar irradiance in 4 narrow spectral bands centered at wavelengths recommended by the World Meteorological Organization (WMO) for the determination of atmospheric aerosol optical depth (AOD). In this poster, we present a brief description of solar radiation and types of solar radiation measurements. We then present the working principle of the PFR and sample measurements taken by the PFR, thereby highlighting its role in solar radiation measurements

2014 African Geophysical Society Conference Book of Abstract

2014-A005-O-001

Evaluation of the NeQuick model in Southern mid-latitudes using South African collocated GPS and Ionosonde data

S M Ahoua*1a, 2 , O K Obrou1b , P J Cilliers2a and J B Habarulema2b

1 Laboratoire de Physique de L'Atmosphère, Université F.H.B de Cocody, 22 BP 582 Abidjan 22, Côte d'Ivoire.ahouasylvanomax@gmail.coma, olivier.obrou@fulbrightmail.orgb

2 South African National Space Agency (SANSA) Space Science Directorate, P O Box 32 Hermanus, 7200, South Africa.pjcilliers@sansa.org.zaa ,jhabarulema@sansa.org.zab

This work investigates the performance of the NeQuick model in southern mid-latitudes. The NeQuick is used among others for the European Geostationary Navigation Overlay Service (EGNOS), developed to supplement the GNSSs systems by reporting on the reliability and accuracy of the positioning data. It is used by recommendation of the ITU-R, to compute the estimated total electron content (TEC) along the ray path of the signal from satellite to the GNSS receiver. The performance of the NeQuick is evaluated after it is adapted to the local conditions by ingesting the foF2 and M(3000)F2 recorded by the means of Ionosondes at Hermanus (34.40^{0}S; 19.20^{0}E, South Africa) and Grahamstown(33.420 S; 26.510 E, South Africa). It is then used to compute a theoretical TEC above those same areas and compared to a observed TEC derived from a co-located GPS receiver which belongs to the TrigNet network. The TEC is directlyextracted from the GPS data by means of the GPS-TEC software developed by GopiSeemala. To evaluate the modelunder different geomagnetic activity states we select three days each of quiet and magnetically disturbed days according to different solar activity indicators. The study shows a discrepancy between the modelled TEC and the Observed TEC during high solar activity epoch.

2014 African Geophysical Society Conference
Book of Abstract

2014-A005-O-002

Prediction of the Earth's Magnetic Field using Artificial Neural Network.

KAKA R.O, Oyeyemi E.O AND Rabiu O.R

AFE BABALOLAUNIVERSITY ADO EKITI

olawumikaka@gmail.com

Artificial Neural Networks (ANNs) has been employed in this work to check the feasibility of predicting Earth's magnetic field. The input parameters to the ANN are day of the year, Universal Time, 2 day running mean of the 3-hour planetary magnetic index, solar zenith angle. The output of the ANN is the predicted horizontal component of the Earth's magnetic field (H). The observed horizontal component of the Earth Magnetic Field (H) values were obtained from Tamanrasset (67.21^{o}N, 5.53^{o}W) amassed by the Algeria INTERMAGNET observatory. The data used in this work covers all periods of calm and disturbed magnetic activity spanning the period 1993-2009. A Multilayer feed forward network with a back propagation algorithm was used to train the Neural Network called HNN model. The training data set covered the period between 1993 and 2006, while data from 2007 to 2009 that was not included in the training process was used to validate the predictability of the model. The performance of the HNN model was measured by calculating the root-mean-square error (RMSE) difference between the predicted horizontal component of the Earth's Magnetic Field (HNN) and observed values (Ho). The relative deviation module mean (rdmm) was also calculated. The RMSE gave 144nT while rdmm is 0.014. In general, the HNN model generates good results when compared with Ho, although some improvements are still necessary to be implemented in order to obtain better prediction

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A005-P-001

Observation of Coronal Mass Ejections for ten year interval (2002 & 2012)

Okoli, N.A and R.S. Said
Bayero University Department of Physics, Bayero University, Kano. Nigeria.
okolinicholas@yahoo.com

In this project, in line with the time taken for coronal mass ejections from the point of ejection to the point of reaching the earth surface, an average of ten days of coronal mass ejections were selected for the observations at different time intervals of the day. Observations were done for all partial and full halo Coronal Mass Ejections (CMEs) including poor events directed towards the earth for the period between 2002 and 2012. A total data of one hundred and twenty-five (125) CMEs were observed. The results showed that there were sixteen (16) partial halos, five (5) full halos and one hundred and four (104) poor events. These represent 4% of full halos, 12.8% of partial halos and 83.2% of poor event coronal mass ejections. From this research, it can be concluded that the period between 2002 and 2012 and for the days selected, the poor events of coronal mass ejections were dominant.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A005-P-002

Total Electron Content Variability Over Malindi (1999—2002)

George OchiengOndede, Paul Baki and Andrew Odhiambo

University Department of Physics and Materials Science, P O Box 333, Maseno, Kenya
georgeochieng08@yahoo.com

This paper presents the results of the total electron content (TEC) variability around Malindi, Kenya, (03.03oN, 40.13oE). The Global positioning System (GPS) TEC data was obtained from the Malindi station, being one International GNSS Service (IGS) station with the highest data availability in the country and used to study the diurnal, seasonal and solar cycle variability from 1999 to 2002. The diurnal variability was greatest during the early morning and late evening hours of the local time and minimum during the midday and midnight. The seasonal variability was greatest during the March equinox, moderate during the September equinox and least during the solstices. There was observed enhanced nighttime variability just before midnight. This could have been caused by the neutral winds from the northern and the southern hemisphere. During the nighttime, neutral winds blow from north to south and push the spiraling ions up. The observations were so because the there was ionization in the mornings and reconnection of the ions in the evenings. During the equinoxes, the sun is directly over the equator while during the solstices when the sun is in the tropics. Of the four years studied, 2000 and 2001 experienced the highest level of TEC variability. The year 2000 was the peak season in the solar cycle. The research findings would be useful to aviation industry, the marine industry, the communication service providers and many other establishments whose operations depended on the space weather conditions.

2014 African Geophysical Society Conference
Book of Abstract

2014-A005-O-004

Ionospheric Tec Variability Inferred From Ground Based Gps Receivers In Ethiopian Sector.

Ayalew Debrie, Wolaita sodo university

The dual frequency signals from the GPS satellites recorded at Nazreth (8.570N, 39.290E) in Ethiopia have been analyzed to study the total electron content (TEC) variations for the low solar activity period of the year 2009.

In this thesis, we examined the diurnal, daily, monthly and seasonal variation of total electron content(TEC) and the effect of geomagnetic storm on total electron content (TEC)variations. The diurnal variation of TEC shows predawn minimum for a short period of time, followed by morning increase and then reaches a maximum value between 9:00 UT and 13:00 UT. The mean diurnal variations during different seasons are brought out. It is found that TEC at Nazaret is maximum during equinoctial months (March and October) this is due to high solar intensity in this period of time, and intermediate during the winter months (December and January), with minimum values during Summer months (June and July), showing a semiannual variation, and the TEC variation during the geomagnetic storm day also investigated. In this thesis we have selected the storm day of 22 July 2009 with Dst =-79 nT are analyzed. In this day the storm sudden Commencement (SSC) event registered on 21 July, 2009 and the main phase of the storm occur on 22 July. To see the effect of this storm on the value of TEC we examined the TEC variation. In this day the value of the TEC recorded maximum value at 10:00 UT and the amount of the total electron increased. Finally we analyzed the rate of change of total electron content (ROT) in order to conform our investigations. In this thesis we have selected four satellite and we have seen ROT in each individual Satellite.

2014 African Geophysical Society Conference
Book of Abstract

2014-A005-P-005

Variation of the F10.7 threshold in the solar activity dependence of fo f2 in the African EIA trough

Adeniyi, J.O.1 and *Ikubanni, S.O.2

1Department of Physics, University of Ilorin, P.M.B. 1515, Ilorin, Kwara State, Nigeria

2Department of Physical Sciences (Physics), Landmark University, P.M.B. 1001, OmuAran, Kwara State

*Corresponding author: *stevewolex1@yahoo.com; ikubanni.stephen@lmu.edu.ng;*

Long-term dependence of ionospheric parameters has been reported and documented in several literatures. Most of these works, however, have been carried out with data from different sectors of the world other the African sector. Modeling the magnetically quiet ionosphere requires a good understanding of the long-term solar activity dependence of the ionosphere and thus the need for similar studies in the African sector, especially the in the low latitude. The low latitude ionosphere is known to be the most variable of all the three latitudinal classifications.

We employed F2-layer critical frequency (f0 f2) data covering a solar cycle (solar cycle 22: 1985- 1995) and the corresponding solar radio flux (F10.7) to study the dependence of f0 f22 on solar activity around the Equatorial Ionization Anomaly (EIA) trough of the African sector. This data was obtained from the Ouagadougou ionosonde (Geographical coordinates 12.4oN, 1.5oW), Burkina Faso. Our result validates the non-linearity in the dependence as reported for the low latitude ionosphere of the other sectors, with a particular feature termed saturation. We present the diurnal and seasonal values of F10.7 whereby saturation occurs. Based on the literature available to us, this effort directed at contributing to the understanding of the climatology of the African low latitude ionosphere, byobtaining the threshold value of F10.7 value is the first of its kind. Critical examination of these valuesrevealed that although the diurnal

values vary significantly except in the December solstice, the seasonal values have no significant variation. Other important results are presented. In addition, an unexplained result from this work is that f0 f22 will be negative when the solar activity index assumes a zero value; this points to expectations in the ionosphere at extremely low solar activity.

We look forward to validating these results as new and larger volume of data becomes available.

Likewise, we suggest that similar studies be carried out with data from the African EIA crest as well as in the southern hemisphere to improve our understand of the roles of several ionosphericelectrodynamics in the observed saturation effect in the African sector.

Keywords: *Low latitude, African sector, Solar radio flux (F10.7), F2-layer critical frequency* (f0 f22), *Saturation effect.*

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A005-P-006

SOLAR FLARE EFFECTS (SFE) ON GEOMAGNETIC FIELDS ACROSS LATITUDES

[1]Ugonabo, O.J.,[1]Okeke, F.N. , and [1]Ugwu, E.B.I.

[1]Department of Physics and Astronomy, University of Nigeria, Nsukka.

A comprehensive study of Solar Flare Effects (SFE) across latitudes has been carried out using an extensive data set of two geomagnetic elements H and Z selected from 1997 to 2005. The X (intense) and M (medium) solar flares were examined under quiet conditions. Nine stations covering from equatorial to high latitudes were used in the study. The minute data were collected from the INTERMAGNET website, the solar flare data were accessed from the National Geophysical Data Centre of the National Oceanic and Atmospheric Administration, Boulder, USA, the hourly data and the international quiet days were accessed from World Data Centre for Geomagnetism, Kyoto, Japan. The study yielded some interesting results. The results revealed that pre-solar flare and solar flare amplitude variations are least in the midlatitude stations, followed by the equatorial and low latitude stations and highest in the high latitude stations. The pre-solar flare amplitude variations and solar flare amplitude variations of Z did not show any clear pattern. Correlation existed between the solar flare amplitude variations of H and the pre-solar flare amplitude variations. The ratios of $\Delta H_{SFE}/\Delta H_o$and $\Delta Z_{SFE}/\Delta Z_o$ were greater than zero for all the stations used in the study. The solar flare effect therefore enhances geomagnetic field across latitudes.

Keywords: Solar flare, geomagnetic component, variation, low, mid latitude, high, amplitude.

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A006-O-001

DAUDI_Emmanuel

The result of the occurrence of geomagnetic storms over the east African region along 96o magnetic meridian is presented. The data used were from records of geomagnetic variations measured by a fluxgate-type magnetometers installed at three stations, Nairobi (36o25′E and 1oS), Dar es Salaam (39°07′12″E and 6°24′00″S) and Maputo (32o22′E and 25o30′S) by MAGDAS project executed by the International Center for Space Weather Science and Education (ICWSE) of Kyushu University, Japan. The instruments recorded magnetic field components H, D and Z. The recorded data are both one-second and one-minute data sets. In this case, one-minute data set averaged hourly was used. The severity of each storm observed was categorized using the K-index. During the study period, eight storms were recorded and observed to occur irregularly. Three of them were major, and five were minor ones. From all stations, the time of occurrence of an SSC, the initial phase, the main phase and the recovery phase was observed to be the same, but the intensities of the storms recorded from the three stations differ. The data used had many gaps in which it was very difficult to have clear continuous variations of the earth's magnetic field.

KEYWORDS: earth's magnetic field, geomagnetic storms.

Location of MAGDAS stations and FM-CW Radar Systems (Source: Yumoto*et al.*, 2009)

2014 African Geophysical Society Conference
Book of Abstract

2014-A006-O-002

RESPONSE OF IONOSPHERIC N(h) PROFILES OVER ILORIN TO MODERATE GEOMAGNETIC STORMS

Olawepo, A.O,

Department of Physics, University of Ilorin, P.M.B 1515 Ilorin nijiolawepo@yahoo.com

Digisonde data obtained from Ilorin (Lat. 8.40N, Long.4.50E, Dip Lat.-4.1) were used to study the response of the equatorial ionosphere within the African sector to moderate geomagnetic storms of 11-13 October, 2010 and 4 - 6 February, 2011. Results revealed that the E-and F1-layers response to this category of geomagnetic storm is not as significant as what obtains in the F2-layer. F2-layer response showed both enhancement and depletion in the electron density with varying degrees depending on the extent of the depression in the Dst-index. While the effect of the main phase of 11-13 October, 2010 storm was depletion that of 4 - 6 February, 2011 was enhancement in the F2-layer. This suggests that different mechanisms may be in operation during these storms. Moderate storms are also observed to cause expansion in the F2-layer.

Keywords: Space Weather, Moderate Geomagnetic Storm, Equatorial Ionosphere

AGS
African Geophysical Society
www.afgps.org
2014 African Geophysical Society Conference
Book of Abstract

2014-A006-P-003

Disturbance Daily Variation (SD) of Electric field in the Equatorialand Mid Latitude of Africa

[1]Bello O. R [1, 2]Rabiu A. B.

[1]Space Physics Laboratory, Department of Physics, Federal University of Technology, Akure

[2]Centre for Atmospheric Research, National Space Research and Development Agency (NASRDA)

The hourly mean data of horizontal magnetic components of the earth's magnetic field at Addis Ababa an equatorial eletrojet station and Hermanusa mid latitude station in African zone was used to study the disturbance daily variation (SD) for the year 2005. There was noon time depression associated with dawn maximum and relatively low magnitude during the dusk hour as observed in Addis Ababa. The two equinoctial months also depicts noon time negative depression contrary to what was observed at the solstice months. Contrary to this result, SD in Hermanus exhibit negative depression around 1800 hr local time with positive enhancement at the pre sunrise hour. For any particular season, the SD(H) averaged for all hours of the day is lower at Hermanus than Addis Ababa. The SqH in Addis Ababa generally peak when sun is overhead around 1200 local time. Thus the sources of electrojet electric fields on quiet and disturbed days seem to be different.

2014 African Geophysical Society Conference
Book of Abstract

2014-A006-O-004

A Probe of magnetosphere-ionosphere coupling using Very Low Frequency (VLF) Radio Waves

Victor U. J. Nwankwo1,3* and Sandip K. Chakrabarti1,2

1S. N. Bose National Centre For Basic Sciences, Kolkata 700098, India

2 Indian Centre for Space Physics, Kolkata 700084, India

3Dept. of Physics & Energy Studies, Salem University Lokoja, Kogi State, Nigeria

Very low frequency (VLF) radio waves has been employed for the detection and study of various terrestrial and extra-terrestrial high energy phenomena such as solar flares, solar eclipse, gamma ray burst, lightning induced electron precipitation etc., and the subsequent variations in the lower ionosphere driven by these events. In this study, we exploit the propagation characteristics of VLF signal through the Earth-ionosphere waveguide, to probe changes in ionospheric signatures, induced by solar driven variations in magnetospheric conditions. Our study is based on the VLF data (amplitude and phase) received at ICSP, Kolkata, which is transmitted by the Australian NWC station at a constant frequency of 19.8kHz.

2014 African Geophysical Society Conference
Book of Abstract

2014-A002-P-017

CHARACTERIZING THE RELATIVE VARIABILITY OF SUNSPOT NUMBERS

[1,*]Somoye, E.O., [2]Akala, A.O., [1]Iheonu, E.E. and [1]Ogwala, A.

[1,*]Department of Physics, Lagos State University, Ojo, Lagos, Nigeria.

[2]Department of Physics, University of Lagos, Akoka, Nigeria.

femi2000somoye@yahoo.com

The characterization of the relative variability (VR) of sunspot numbers on seasonal and solar cycle scales is carried out in this study. The lower bound of high solar activity (HSA) relative variability (VR) of sunspot numbers (Rz) is 20%, while its maximum ranges between 28 – 32% and occurs during March equinox and June solstice. Variability of sunspot number is higher during moderate solar activity (MSA) in the range 22 – 62% and low solar activity (LSA) in the range 30 – 58% than during HSA. While the peak values of MSA VR occurs during September equinox on a general note, those of LSA are found to occur during the solstices. The terrestrial impact of the variabilities of sunspot numbers and therefore that of the sun is obvious in the inverse relationship of the variability of ionospheric characteristics (especially of the F2 region) and the epochs of solar cycle.