

# eBOOK OF ABSTRACTS



## FOURTH NIGERIAN GEOPHYSICAL SOCIETY CONFERENCE 2017

EXPLOITATION OF EARTH AND SPACE ENVIRONMENT  
A Highway to National Economic Recovery



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# **Abstracts of Contributed Papers**

# Parametrisation of Effective Hygroscopic Growths, Kelvin Effects and Water Activities of Atmospheric Aerosols.

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## Abstract.

In this paper the effective hygroscopic growths of atmospheric aerosols and effective radii using microphysical properties of atmospheric aerosols are extracted from Optical Properties of Aerosols and Cloud (OPAC) at seven relative humidity (50%, 70%, 80%, 90%, 95%, 98% and 99%). The microphysical properties extracted were radii of the individual aerosols and the volume mix ratios as functions of relative humidity (RH). The effective hygroscopic growths were parameterized and the modified Kohler equation was used to determine the hygroscopicity, water activities, kelvin effects, and bulk hygroscopicity and humidification factors. It was observed that the data fitted the models very well. The highest value of hygroscopic growth factor at 50% RH was found in maritime clean ( $HGF = 1.588$ ) and lowest was found in desert ( $HGF = 1.009$ ) at 50% RH and the highest value of HGF at 99% RH was found in maritime clean ( $HGF = 1.472$ ) and the lowest was found in desert ( $HGF = 1.621$ ) and for hygroscopicity the highest value at 50% RH was found in maritime tropical ( $k = 1.240$ ) and the lowest was found in desert ( $k = 0.007$ ) at 50% RH and the highest value of hygroscopicity at 99% RH was found in maritime tropical ( $k = 1.510$ ) and the lowest is in desert ( $HGF = 0.210$ ). The highest value of humidification was found in desert ( $\gamma = -0.013$ ) at 50% RH and lowest value was in arctic ( $\gamma = -0.540$ ) at 50% RH and the highest value of humidification factor was found in desert ( $\gamma = -0.105$ ) at 99% RH and the lowest is in arctic ( $\gamma = -0.540$ ) at 90% RH and also the highest value for Kelvin effect at 50% RH ( $A = 1.351$ ) found in maritime tropical and lowest value at 50% RH ( $A = 0.977$ ) found in maritime clean also for Kelvin effect at 99% RH the highest value was found in maritime tropical ( $A = 1.201$ ) and the lowest at 99% RH ( $A = 0.988$ ) was found in maritime clean and for water activities at 50% RH the highest value was found in maritime clean ( $a_w = 0.998$ ) and the lowest value of water activity at 50% RH was found in maritime tropical ( $a_w = 0.010$ ) and also the highest value of water activity at 99% RH ( $a_w = 0.999$ ) was found in maritime clean and the lowest water activity value was found in maritime tropical at 99% RH ( $a_w = 0.899$ ) and other parameters are increased with increases relative humidity.

## Keywords:

Hygroscopic growths, Relative humidity, Kelvin effect, Humidification factor, Water activity.

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# **Assessment of Heavy Metals concentration in underground water of Kano Industrial Areas and Health risk factor to the Inhabitants.**

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## **Abstract.**

The concentration of some selected Heavy metals in underground water used for consumption by the local inhabitants of the three (3) Industrial Areas of Kano State, Nigeria was assessed in which health risk potential posed by the Heavy metal concentration to the inhabitants was studied. The concentration of Mn, Ni, Pb, Zn, Cd, Cu and Fe in the water samples was determined by using an Atomic Absorption Spectrometer and it was compared to the minimum allowed limit by the Standard Organization of Nigeria (SON) and the World Health Organization (WHO). Out of the seven investigated elements, the concentration of Mn, Ni, Pb, Cd, and Cr was found to be above the minimum allowed limit given by WHO and SON. The health risk index (HRI) was calculated for both Adult and Children and It was observed that HRI for Mn, Cd in Bompai, with Mn, Cd, Cu in Chalawa and Mn, Cd in Sharada Areas is greater than 1 ( $> 1$ ) which thus indicates a serious health the risk to the inhabitants in such areas whereas safety and precaution measures need to be a consideration.

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# **Stratigraphy and Lithological Characteristics of Aquifers in the Kano Region: The Missing Links between Geophysical Surveys and the Chances of Groundwater Determination.**

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## **Abstract.**

Observations from stratigraphy of sediment and basement shows the lithological characteristics of the Kano Region. Using lithology log data revealed the stratigraphy of the region as safe, the morphology at each point is clearly visible once data are interpreted through Schlumberger (often used method in the region), but the determination of groundwater is not always feasible. The layers of Chad sedimentary formation and Basement complex have been examined through log wells for more than half a century but the results are usually confusing. Boreholes failure rates is on the increasing, and people complains about drilling companies and drilling companies shift blames for the serious depleting of aquifers across the region. In view of that, this paper seeks to identify the missing link in the state of art in borehole drillings in the region. The study, use an in-depth interviews and a sample of Vertical Electric Soundings (VES) data to identify the actual problems.

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# **Aeromagnetic Interpretation Showing Influence of Basalts to Borehole Failure over Kaura Area of Kaduna State, North-Western Nigeria.**

G.C. Afuwai<sup>1</sup>, K.M. Lawal<sup>2</sup>, P. Sule<sup>2</sup>, A.E. Ikpokonte<sup>3</sup>, Y.A. Bello<sup>2</sup> and J. Osumeje<sup>2</sup>

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## **Abstract.**

Aeromagnetic data over Kaura Area of Kaduna State, North-Western Nigeria was analyzed. The aeromagnetic anomaly map, its qualitative and quantitative interpretation helped in identifying the nature and depth of the magnetic sources in the study Area. Located between latitudes 9°30'N and 9°45'N and longitudes 8°20'E and 8°35'E, the area has an approximately landmass of 770  $km^2$  within the crystalline hydrogeological province of northern Nigeria belonging to the Younger Granite and Basement Complex suites. The interpretation revealed previously unknown folds and magnetic anomaly with a signature that is similar to those associated with Basalts in the study area with surface manifestation along areas associated with high rate of borehole failure. The residual aeromagnetic map of the study area shows positive and negative magnetic anomalies, which are distributed throughout the area. Maximum magnetic value (150 nT) was recorded at the north-western part of Mallagum-Jankasa area and the minimum value (-100 nT) seems to be evenly distributed around the entire area. A depth that ranges from outcrop to 1200m is suggested for the origin of the unexposed deep seated anomalies by the Euler deconvolution results.

## **Keywords:**

Aeromagnetic, Kaura, Borehole

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# Geoelectrical Investigation of Groundwater Potential of the Administration Block at Permanent Site, Federal University, Dutsin-ma, Nigeria

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## Abstract.

A geophysical investigation of groundwater potential was carried out at the administrative block of the Federal University Dutsinma permanent site. This was done using ABEM SAS 300 Terrameter. The Wenner and Schlumberger electrodes configurations were used for data acquisition. A total of two transverses with five Vertical Electrical Sounding (VES) stations along each traverse, having separation of 20 m apart, were investigated. It has a maximum current electrode separation ( $AB/2$ ) of 160 m. Three to four layers were observed namely; Top layer, weathered layer, fractured layer, and fresh basement layer. First layer has resistivity, depth and thickness range of  $101 - 1573 \Omega m$ ,  $13.2 - 36.6 m$  and  $6.06 - 17.3 m$  respectively. Second layer has a range of: resistivity,  $2.36 - 3040 \Omega m$ ; depth,  $0.406 - 20.9 m$  and thickness,  $0.0409 - 20 m$ . Third layer has a range of: resistivity,  $190 - 3194 \Omega m$ ; the depth,  $0.19 - 111 m$  and thickness,  $0.19 - 107 m$ . Fourth layer has a resistivity range of  $26.3 - 896 \Omega m$ ; its depth,  $0.366 - 2.23 m$  and thickness,  $0.366 - 1.22 m$ . While the fifth layer has resistivity, depth and thickness range of:  $95.7 - 1711 \Omega m$ ,  $0.44 - 50.6 m$  and  $0.44 - 49 m$ . The VES curves were interpreted using IPI2Win resistivity computer software and contour Maps were produced using SURFER 10 computer software. The results of the interpreted VES data showed that the saturated groundwater bearing layer (aquifer) lie within the weathered and fractured basement of the predominantly four-layered structure. VES 01, 02 and 03 have high potential for groundwater and are therefore recommended for borehole establishment.

## Keywords:

Groundwater, Borehole and Resistivity, vertical electrical sounding, depths to basement.

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# Analysis of Sand-Grain Sizes along a Typical River bank in Ibadan, Oyo State, Nigeria.

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## Abstract.

Variation in the grain size distribution is important in determining the pattern of sediment transport, provenance and depositional environment. The research work investigates unconsolidated sediments, characterize the particles or grains that are present and also perform the grain size analysis of Apete River using sediments samples. Six sediment samples were collected from Apete riverbank in Ibadan and were studied to establish the granulometric characteristics of the river bed sand. The sediment grain sizes were assessed in the laboratory by mechanical sieving. They were mainly silts sands of various sizes. The sediment-grained size distribution ranged from fine to medium grained size, moderately well sorted to very poorly sorted, very coarse (negative) skewed to very fine (positive) skewed and with a mesokurtic to very leptokurtic distribution. The mean grain size varied from  $1.35\phi - 2.81\phi$  which implies fine to medium grained size. The sorting values range from  $0.58\phi$  to  $1.10\phi$  representing moderately well sorted to very poorly sort. The study showed that sediments along the riverbank was transported by relatively weak longshore current with moderate deposition parallel to the berm section in a high-energy environment where waves and currents because of long distance of transport have dissipative status.

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# Statistical Analysis of Aerosol Index of NIMBUS 7 TOMS and EPTOMS Satellites Data.

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## Abstract.

In this paper, two different statistical techniques were used to analyze the meteorological satellite data. The satellites are NIMBUS 7 and EP TOMS monthly mean. The data which was obtained from NASA GSFC FTP was averaged monthly using Microsoft Excel spreadsheet. The data period for NIMBUS 7 is from January 1980 to December 1992, and January 1997 to December 2003 for EP TOMS. Both with spatial resolution of  $1.25^\circ$  (longitude)  $\times$   $1.0^\circ$  (latitude). The first technique used is the time series analysis where all the parameters are assumed independent. It was discovered that both EPTOMS and NIMBUS 7 satellites follow Winters additive model with EPTOM'S  $R^2 = 0.903$ , stationary  $R^2 = 0.466$  and significance level = 0.004. While with NIMBUS 7,  $R^2 = 0.935$ , stationary  $R^2 = 0.574$  and significance level = 0.034. Based on this however, it can be concluded that this model is appropriate for Aerosol index that has a linear trend and a seasonal effect which does not depend on the level of the series. The second one is the Empirical Orthogonal Transformation, where the data were analyzed using both the orthogonal and oblique transformations. It was discovered that the Aerosol index has two areas with two eigenvalues for EPTOMS which account to about 81.6% and NIMBUS 7 with one eigenvalue that account to 95.6%. Rotated EOF can also be employed to identify aerosols both regionally and globally.

## Keywords:

Nimbus-7 & EP TOM Satellite data, empirical orthogonal transformation, oblique transformations, time series analysis.

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# **Citing of Waste Disposal Sites around Dutse Model Int'l School and its Environs using 2D Electrical Resistivity Imaging.**

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## **Abstract.**

Most of the soil and groundwater pollution are as a result of leachate effluence from refuse dumpsite. 2D electrical resistivity imaging method was used to delineate the geoelectric layers and cite best waste disposal sites with minimum leachate influx in to groundwater. Four parallel profiles each of length 200 m and separated 120 m apart were established. Resistivity value using Syscal Irish Resistivity meter were collected for the various investigating points with electrode spacing ranging from 5 to 60 m. The collected data were arranged in Notepad in a format acceptable to the software used in generating the resistivity sections for each profile. The resistivity sections were transformed into geologic section using Surfer 9 based on the geology, borehole data of the area and standard resistivity values of earth materials. The resistivity as well as the geologic section was used to draw inferences with regards to stratification and the soil porosity of the area. The study identified all the four profiles has the best fractured rock coverage layer and favorable resistivity value of 400 to 900  $\Omega$  m. These properties of the layers allowed the down flow of fluid which aid leachate migration to the groundwater, hence, contaminating it. So Pit or Landfill should be build and use as dumping site around profiles for the waste and artificial filters such as clay should be used around the Landfills to reduce leaching of the contaminants from the Pits or Landfills.

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# Interpretation of Ground Magnetic Profiles of Parts of Ikara, Kaduna State, Nigeria.

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## Abstract.

Interpretation of ground magnetic profiles has been carried out in the parts of Ikara, aimed at making comparison with the already interpreted aeromagnetic profiles acquired from the same location. All the profiles were laid perpendicular to the direction of the strike of the fault. The ground magnetic profile data were acquired using two magnetometers (Proton Precession and EM2 lab.), one at the base station and the other along the profiles at 5 meter interval. Analytic Signal technique results of two profiles across the suspected fault zone in the study area give high peak values at distances of 50 m, 200 m, and 400 m, along profile1, while profile2 of NE–SW trend has the maximum peak values at 350 m and 450 m distances. All these peaks of analytic signals of the profiles fall within the fault zone and could be due to differing degrees of mineralization activities in the zone. The profiles were prepared for quantitative interpretation in order to estimate the depth, dip and susceptibility of the causative body using Werner deconvolution technique when the sources are assumed to be dike and contact. The depth values of the profiles range from  $3^{-10}$  m, magnetic susceptibility values obtained from the analysis, range from  $6.683 \times 10^{-4}$  to 0.58372 SI units, while dip angles have minimum of  $21.3^\circ$  and maximum of  $67.4^\circ$ . Therefore, all the values from profile analyses are indicative of the presence of shallow source anomalies with low magnetic susceptibility in the study area, in contrast with previous values of aeromagnetic data.

## Keywords:

Analytic Signal, Werner deconvolution, Ground Magnetic Data, Ikara, Profile

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# Variability of Aerosol Parameters in tropical climate using AERONET data: A case study of Ilorin.

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## Abstract.

In this paper, level 2.0 data of aerosol climatology were extracted from Ilorin AERONET site (8°19'N, 4°20'E, Alt. 350 m), Kwara State, Nigeria from January, 2005 to December, 2005. The data which consists of Aerosol Optical Depth (AOD), precipitable water (PW) and Angstrom exponent ( $\alpha$ ) were analyzed and the results were presented. Angstrom equation was used to determine turbidity coefficient in both the dry and the rainy seasons which typically last from January to April and from May to November respectively. The results, on one hand, indicated that there exist an inverse variation between the AOD and PW and between the PW and turbidity, while on the other hand, it indicated a direct variation of Angstrom exponent with PW.

## Keywords:

Precipitable water (PW), Aerosol Optical Depth (AOD), Angstrom Exponent, Turbidity Coefficient, Ilorin.

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# Influence of Anthropogenic Aerosols: Meteorological and Climatological Effects over China.

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## Abstract.

This research paper was designed to analyze the influence of anthropogenic aerosols on climate and meteorology of Beijing, the capital city of China, at the 440  $\mu m$ , 675  $\mu m$ , 870  $\mu m$  and 1020  $\mu m$  spectral wavelengths. In this paper, four years of Aerosol Optical Depth (AOD) data were extracted from level 2.0, the quality-assured almucantar products of AERONET, at Beijing-CAM, between 2012 and 2015. Angstrom exponent, curvature and turbidity coefficient were calculated using Angstrom equation to determine the physical and optical properties of aerosols, which are the indices for determining their climatological and meteorological effects in the region. The results obtained indicated that there were dominant fine-mode aerosol particles in Beijing. This prevalence of fine-mode particles in Beijing was due to anthropogenic aerosol particle generation in the region, which may result from heavy industrialization in China. These fine aerosol particles in Beijing are responsible for scattering light coming from the sun, thereby causing overall decrease in temperature and obstructing atmospheric visibility in the region.

## Keywords:

Aerosol Optical Depth (AOD), Angstrom Exponent, Turbidity Coefficient, Ilorin.

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# Determination of Electrical Conductivity of Soil Samples.

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## Abstract.

This study deals with the determination of the water content and electrical conductivities of some soil samples from Kaduna, Kano and Katsina using a conductivity meter (dialysate meter). The theory and applications of the method, calibration, precautions and other successes have been highlighted. The work was concentrated only on the soil samples extracted from the listed study areas.

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# **Applicability of Remote Sensing for Surficial Mapping of Soil Characteristics in the Rima River Floodplain.**

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## **Abstract.**

Soil survey is beneficial for food security, and remote sensing is of particular boon to rapid inventory taking of the common earths surface materials. Thus, this study attempted characterizing the soil surface of a part of the Rima River floodplain using remote sensing. Landsat 8 Operational Land Image-Thermal Infrared Radiometer (OLI-TIRS), Advanced Space-borne Thermal Emission Reflection Radiometer (ASTER), Jet Propulsion Laboratory (JPL) spectral data and laboratory test results of 31 randomly collected soil samples were combined with standard algorithms to map and analyze the soil characteristics measured. Maps were produced from the satellite data and from interpolated laboratory test values. Results indicated significantly high ( $P < 0.05$ ) relationship between remotely sensed and ground data. It was concluded that a combination of satellite imagery and laboratory soil spectra could yield detailed soil information.

## **Keywords:**

Rima, ASTER, Landsat, Soil survey, Soil Spectra

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# Measuring the Impact of Geographic Distance ON Patient Delay and Mortality during the 2014 Ebola Outbreak in Port Loko District, Sierra Leone.

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## Abstract.

Sierra Leone reported about half of the 28,646 cases recorded in the historically largest Ebola outbreak between 2014 and 2016. About a fifth of these cases were reported from Port Loko District. A number of factors have been implicated for the magnitude of the outbreak including distance. Although the effect of distance on health outcomes has been reported in previous studies, none has investigated its effect in outbreak situations. This study was, therefore, designed to examine the spatial implication of distance on case reporting pattern (patient delay) and mortality, among other factors, during the outbreak. The study was a retrospective geographically referenced cross sectional study using datasets of 1619 Ebola confirmed and probable cases in Port Loko District reported between 01 September, 2014 and 28 February, 2015. Geocoding techniques were used to assign geolocation to patient addresses. Geographic distance from the District Ebola Response Centre (DERC) was modelled using Spatial Analyst in ArcGIS 10.3 from which distance to each geocoded address was derived. The model was generated using reclassified layers of landuse landcover, Digital Elevation Model, Roads and Water networks of the study area. Logistic regression was used to investigate the relationship between the outcome variable, Status at Case Report (dead/alive), and factors such as distance, patient delay, age and gender. The level of statistical significance of  $p < 0.05$  was used. The mean age of the cohort was  $31 \pm 19$  years. Patient distance from DERC ranged from 3km to 172km (average =  $85\text{km} \pm 4\text{km}$ ) while patient delay in reporting a case was, on average  $5 \pm 3$  days. Females accounted for 55% of all cases and had a higher CFR of 31% compared to their male counterparts (27%). At the sub-district administrative level, Koya had the highest CFR (18.9%) out of the 11 Chiefdoms that comprise Port Loko District. Further analysis showed a weak negative association ( $r = 0.02$ ) between delay in reporting and patients distance from DERC. By gender, delay in reporting a case was not statistically significant ( $P = 0.27$ ). Similarly, distance from the response centre was not associated with mortality ( $p = 0.5650$ ). However, delay in reporting a case (at  $p < 0.0001$ ) and increasing age (at  $p < 0.0001$ ) were found to be associated with mortality. The study established that mortality was not associated with patient's distance from response facilities. Although weak, it was found that living closer to the DERC rather contributed to delayed case reporting. This emphasizes fear and community resistance that characterized the outbreak control efforts. Cases were more likely to be dead at time of reporting as patient delay and age increased. Hence, it is recommended that similar future outbreaks should increase social mobilization activities targeted at the older population to enhance early reporting which minimizes mortality.

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# **Evaluation of Aquifer Characteristics and Groundwater Quality using Geoelectric Method in Ode-Aye, South-western Nigeria.**

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## **Abstract.**

A total of eleven (11) vertical electrical sounding locations were occupied using the Wenner electrode configuration in the evaluation of the aquifer characteristics and in Ode-Aye, South-western Nigeria. The study was aimed at characterizing the aquifer in the area as well as assessing its potential risk to contaminant seepage in terms of the aquifer hydraulic properties and protective capacity of the overburden rock materials. The results show a lithology that is dominated by sands of various grades with surficial clay/shale bed. The study area is characterized by average to high values of the protective capacities  $P_c$ , of the overburden rock materials and high aquifer porosities and transmissivities. The average to high value of the protective capacities makes the aquifer system in the area safe from surface contamination. An average porosity and transmissivity value of the aquifer materials implies average permeable aquifers with some level of storativity, which can enhance the migration and circulation of contaminants within the ground water system over large areas if introduced into the system. These revelations are indications that the ground water quality could be impaired in the area if contaminant is introduced into the system.

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# Geoelectric Sounding to Delineate Shallow Aquiferous Units in the Benue Trough Sediments of Jootar Area, North-Eastern Benue State, Nigeria.

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## Abstract.

In Jootar, north eastern part of Benue State in Nigeria, the aquiferous unit of the Benue trough are largely sediments of different grades, but without records of their subsurface disposition. In this study, Vertical Electrical Resistivity Soundings were conducted over the study area, using Schlumberger electrode configuration, aimed at delineating the boundaries, depth range of the shallow aquiferous units, and assessing their vulnerability to near-surface contaminants. The data obtained were interpreted using computer-aided software called Interpex. The major units within the area: (i) surficial system, with materials of high resistivity, ranging from  $84 \Omega m$  to  $932 \Omega m$ , suggestive of gravelly/coarse to medium grained sand, (ii) the surficial aquiferous system, characterised by resistivity ranging from  $169 \Omega m$  to  $540 \Omega m$ , typical of medium-grained sand saturated with water and (iii) the clay/mud system, with average resistivity of  $21.7 \Omega m$ , typical of clayey/mud materials. The aquiferous zone is open to the atmosphere and is vulnerable to near surface contaminants. This study enabled the delineation of shallow aquiferous zone and their subsurface disposition. An integration of such geophysical study with lithologic logs/drilling data would enhance accurate delineation of aquiferous units and vulnerability quantification in the area.

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# Comparative Analysis of Two Photo-Voltaic Cell Module Configurations in a Low-Latitude Location

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## **Abstract.**

Solar energy is rapidly becoming an alternative means of electrical source all over the world, more importantly for lowering the global warming as the world becomes hotter every day as a result of global warming. Use of solar energy photovoltaic panels to generate electrical energy is becoming more popular. This paper is designed for comparative analysis between fixed and solar tracking system using ATmega328P microcontroller, which can be a feasible approach to obtain maximum power output from solar panels. The solar tracker was placed on a Servo Motor to move the panel in tracking the axis of the sun and keeps the panel in direction of the sun all day long. On completion of the prototype, observation was carried out consecutively for two weeks in ARCSSTE-E Hostel OAU Ile-Ife situated on coordinate  $7.4969^{\circ}\text{N}$  and  $4.5226^{\circ}\text{E}$ . The panel's output data was processed in the microcontroller thereby stored into SD Card. The performance and characteristics of the fixed and solar tracker are graphically analyzed, the results show that the control tracker by tracking the movement of the Sun is able to capture the highest levels of radiation longer than the fixed panel.

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# Study of soil-plant Heavy Metal relations and Transfer Factor Index of Vegetable Amaranths and Sunflower in some selected areas within Kano State, Nigeria.

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## Abstract.

Accumulation of heavy metal is directly associated with technological advancement. Hence as technology grows the need for a better and nature means of reducing the level of heavy metals grows. Plants absorb heavy metals from soil through ionic exchange, redox reaction precipitation. A research was conducted to analyze the heavy metals (as pollutant) in some selected areas in Kano state Nigeria using Vegetable Amaranth (*Amaranthus Cruennsus L*) and Sunflower (*Helianthus Annus*). Cadmium (Cd), Chromium (Cr), Manganese (Mn), Zinc (Zn), Lead (Pb), Copper (Cu), Iron (Fe) and Nickel (Ni) are the heavy metals of interest, in five areas: Sharada, Naibawa (N), Kofar Ruwa (K), Bayero University Enviroment (BUK-E), Screen House (BUK-S). The analysis of the result was done using Atomic Absorption Spectrophotometry (AAS) MODEL 210 VGP BUCK SCIENTIFIC. Ni (101.92 mg/kg) and Zn (105.88 mg/kg) are the highest phytoavailable values for Vegetable and Sunflower (all in) BUK-S, respectively for the month of February. In March, Zn (118 mg/kg & 117.65mg/kg) recorded the highest phytoavailable values for both vegetable and Sunflower at K and BUK-S respectively. Cd (09.79 mg/kg) and Cr (10.25mg/kg) at N and BUK-S recorded the lowest phytoavailable respectively in February. Similarly Cr (07.23mg/kg) and Cd (11.51 mg/kg) at BUK-S and BUK-E for vegetable and Sunflower respectively are the lowest phytoavailable values in March. It can be concluded that eight heavy metals have been identified (determined) in all the five (5) locations in the sequence; February: Vegetable — Ni > Zn > Mn > Fe > Cu > Pb > Cr > Cd and Sunflower — Zn > Ni > Fe > Cu > Mn > Pb > Cd > Cr. For March: Vegetable — Zn > Fe > Cu > Ni > Mn > Pb > Cd > Cr and Sunflower — Zn > Ni > Cu > Mn > Fe > Pb > Cr > Cd.

## Keywords:

Heavy Metals, Vegetable Amaranth, Sunflower, AAS and Phythoremediator.

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# Geothermal Reconnaissance of Kajuru and Environs, North Central Nigeria Using Spectral Analysis of Aeromagnetic Data.

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## Abstract.

Geothermal power is one of the most sustainable, renewable energy sources with relatively lesser greenhouse gas emission. Enhanced Geothermal System (EGS) has the capability of operating anywhere not necessarily at the tectonic boundaries. In this work, a geothermal reconnaissance survey was conducted in the basement complex of north central Nigeria, enclosing Kajuru town. The objective of the work is to assess the geothermal energy potential of the area and to identify the most suitable location for optimal performance of geothermal power plant. Spectral analysis of aeromagnetic data was used to spatially compute curie-depth points, geothermal gradient and heat-flow rate within the area. The results showed that curie-point depth of the area ranges from 1.2484 km to 37.122 km with a mean of 17.0259 km. Geothermal gradient ranges from  $15.6242^{\circ}Ckm^{-1}$  to  $464.5947^{\circ}Ckm^{-1}$  with a mean of  $56.3952^{\circ}Ckm^{-1}$  while heat flow ranges from  $37.6542 mWm^{-2}$  to  $1119.673 mWm^{-2}$  with a mean of  $138.7642 mWm^{-2}$ . Thus the shallowest underground thermal resource is at a depth of 1.2484 km with corresponding thermal gradient of  $464.5947^{\circ}Ckm^{-1}$  and heat flow rate of  $1119.673 mWm^{-2}$ . Since geothermal temperature viable for electricity generation is at least  $300^{\circ}C$  and this is attainable in the study area at a depth of about 1.2 km, the region is considered most promising for geothermal electricity power plant.

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# **Delineation of Subsurface Hydrogeology Structure of Covenant University Ota and Environs using Magnetic and Resistivity Techniques.**

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Department of Physics, Covenant University Ota, Ogun State, Nigeria

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## **Abstract.**

High resolution aeromagnetic data over Covenant Ota and environs was analyzed and this was used to investigate the heterogeneous nature of the subsurface of the area. The aeromagnetic technique was primarily used to delineate igneous rocks buried in the subsurface and to locate lineaments/faults within the area; this is because both parameters investigated are important for understanding the subsurface hydrogeology. The igneous rocks buried were identified from their high-amplitude and high-frequency of responses of magnetic properties of the subsurface. The source parameter imaging and tilt derivative were used respectively to estimate source depths and locate faults within the study area. The result revealed that there are clusters of faults in the eastern part of the study area compared to the western part and as a result, this presence of faults may likely control the occurrence of groundwater in the study area. However, further geophysical studies using resistivity technique was carried out in the area that is clustered with faults. It was observed that three (3) kinds of aquifer exist in the study area namely shallow aquifer with depth that ranged between 30 m – 68 m, semi-deep at depths that ranged from 70.8 m to 95.0 m and deep aquifer at depths that ranged from 96.0 m to 108 m. This suggests that the groundwater potential in Covenant University may be controlled by this presence of faults

## **Keywords:**

Aeromagnetic technique, resistivity technique, subsurface, groundwater

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# Estimation of Hydraulic Parameters from Dar-zarrouk Parameters for Aquiferous Zone Characterization in Iyesi Axis, Ota, Ogun State Nigeria

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## Abstract.

The cost of estimating hydraulic parameters from slug test, pumping test, soil sample analysis etc is expensive. However, these parameters such as transverse resistance and longitudinal conductance can be estimated from geophysical parameters which are cost effective, non-invasive and inexpensive. In this present study, twenty (20) geoelectric sounding were carried out in Iyesi- Jackross axis with the use of ABEM 1000 series terrameter using schlumberger array and AB/2 ranges from 240m to 420m. The result revealed that there are six lithological layers in the study area namely; topsoil, lateritic clay, clayey sand, kaolitic clay, clayey sand (low yield aquifer) and sand (Main aquifer). The aquifer's depth ranges from 45.1m to 114.7 m with resistivity values ranges from  $19.5 \Omega m$  to  $850.8 \Omega m$ . Furthermore, transverse resistance and longitudinal conductance were estimated from geophysical parameters and it was observed that longitudinal conductance is low which ranges from  $0.0127 \Omega^{-1}$  to  $0.0941 \Omega^{-1}$ . Consequently, the aquiferous unit is characterized with high transmissivity and hydraulic conductivity. Transverse resistance ranges from  $12246.00 \Omega m^2$  to  $124878.61 \Omega m^2$  and increase in transverse resistance that was observed generally indicating high transmissivity and high yield of the aquiferous units. It is therefore signifies that the study area is characterized with good groundwater potential. Further study can be carried out to estimate the boundary of aquifer thickness and the possible intrusion of Basement complex using magnetic technique.

## Keywords:

Geophysical parameters, hydraulic parameters, aquiferous zone

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# On the relationship between sunspot number and the occurrence of geomagnetic storms.

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## Abstract.

Geomagnetic storm is a space weather event that occurs as a result of the ejection of plasma from the sun to the magnetosphere. The possibility of the influence of the solar activity in the occurrence of this space weather event was investigated. The parameters considered were the disturbance storm time index (Dst) and the average sun sport number. Our results reveal that the frequency of occurrence as well as the intensity of geomagnetic storms increases with the increase in solar activity. At low solar activity (when the sunspot numbers are most likely to be lowest), moderate storms dominates, while severe geomagnetic storms occurs mostly during the period of high solar activity (when the sunspot numbers are most likely to be at its peak) and the declining year in the solar cycle. This further confirms the dependence of the occurrence of geomagnetic storms on the intensity of the solar activity.

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# On the relationship between sunspot number and the occurrence of geomagnetic storms.

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## Abstract.

This study investigates the response of the Ionospheric F2-layer peak parameters to some geomagnetic storm events of 2010 over Ilorin, Nigeria (Lat. 8.53°N, Long. 4.5°E), San Vito, Italy (Lat. 40.6°N, Long. 17.8°E), Hermanus, South Africa (Lat. 34.42°S, Long. 19.22°E) and Pruhonice, Czech Republic (Lat. 50.0°N, Long. 14.6°E). The quiet time result shows that the rise in NmF2 began earlier at San Vito, followed by Pruhonice, but the rate of ionization is highest in Ilorin. Noon bite-out that usually leads to the formation of the pre-noon and post-noon peaks are most conspicuous and highest in Ilorin. The rate of decay in NmF2 is faster in Hermanus. The hmF2 observations further reveal that the F2 layer is lifted higher in Ilorin by the fountain effect than at other stations. For disturbed NmF2 condition, more similarities in terms of NmF2 characteristics were evident from both Ilorin and Hermanus. This attribute may be partly connected with the hemispheric symmetry between the two stations in terms of their geomagnetic coordinates. Enhancement in NmF2 was observed during the main phase at all the stations except at Pruhonice. During the recovery period, NmF2 enhancement and depletions were both observed at all stations, but averagely, depletions are mostly prominent at Pruhonice. The nighttime and daytime increases were observed, respectively at Ilorin and Hermanus. The highest enhancement was recorded during the daytime at Hermanus (849%), and over Ilorin (647%) at nighttime. These observations further confirm the latitudinal and hemispheric effect in the responses of the ionosphere to geomagnetic storms.

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# Evaluation of the effect of River Jakara Waste Discharge on Groundwater Quality in Kwakwachi Area of Kano Using Electrical Resistivity Method.

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## Abstract.

Evaluation of the effect of river Jakara waste discharge on groundwater quality in Kwakwachi area Kano using electrical resistivity method was carried out. Twenty four sounding points were carried out using Schlumberger Array method for the data collection. The measurements were conducted using ALLIED OHMEGA SAS and the data collected analyzed using IPI2WIN version 7.0 software. The area of study is bounded by latitude 12.0253°N to 12.0374°N and longitude 8.5290°E to 8.3589°E. The interpretations of acquired data were based on the borehole information obtained from the area. The study area is underlined by two, three and four layers of different lithology which are the top soil (1 – 5 m), sandy clay (2 – 13 m), decomposed rock / weathered rock (10 – 40 m) , fractured rock (15 – 40 m) and fresh basement complex rock to infinity. The area around VES 6, 8, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, and 23 are identified as good for groundwater exploration with the depth to which boreholes can be sunk recommended to be 30 m to 60 m. Ground water samples from boreholes, well, and River were collected from the area with the aim of assessing the physiochemical impacts of the waste on the quality of groundwater. Levels of various parameters investigated are pH (7.12 to 7.98), electrical conductivity (1197 to 3190  $\mu\text{S}/\text{cm}$ ) and traces of metals Fe (0.42 to 2.58 mg/L), Pb (0.02 to 0.10 mg/L). These results show that the groundwater is polluted because of the high conductivity of the water samples.

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# Monitoring Soil Degradation Using Remote Sensing and Fuzzy Logic in the Drylands Areas of Kano, Nigeria.

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## **Abstract.**

Inventory and monitoring of soil degradation in the dryland regions is one of the important aspect that require to be studied especially in the areas of soil erosion and soil fertility decline. The study was carried out at Bunkure, Kano state. The main aim of this paper is to assess the soil degradation vulnerability in the areas. Three models were combined which includes the Modified RUSLE model for erosion prone areas, NDVI for vegetation indices and soil fertility map for in the GIS environment using Fuzzy logic. Remote sensing and GIS technologies were used beside the routine soil survey and laboratory analyses from a gridded (base) map of the area. The result shows that GIS and remote sensing as promising tools for soil degradation assessment. It also indicated that soil erosion and low soil fertility status as common problems in the area. The paper recommends for proper soil management which include soil tillage and application of fertilizers. It also encourages the use of Remote sensing-based assessments of land degradation at local scale using high resolution satellite images in combination with ground truthing observations, can provide a wealth of data relating to land condition and its changes.

## **Keywords:**

GIS, Remote sensing, NDVI, Erosion, Fuzzy logic, Soil Degradation

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# **Mass Media Impact on Environmental Degradation for Community Development: Study of Minjibir Local Government, Kano State.**

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## **Abstract.**

The paper examines the role of mass media in reducing environmental degradation for sustainable development. Communication generally, has a very crucial role to play in bringing about positive attitudinal change. Mass media plays a very significant role in the development of the rural and urban areas of any society. The study is anchored on development media theory. Survey research method was adopted. Findings reveal that environmental degradation contributes to increase in the high rate of poverty. The neglect of agricultural activities in the country was due to climatic change, mass media in this regard play significant role in terms of community development. The study finds out that the people of Minjibir Local Government get more information on the courses and danger of environmental degradation. In view of the findings, the study come up with the following recommendation: that there is need for increment in airtime for sensitizing people on the danger and consequences of environmental degradation and the proper solution to keep their environment clean and tidy making them safe and comfortable in order to fight against so many infectious diseases. Government at all level should completely discourage the cutting down of tress indiscriminately particularly in the north where desertification is moving exponentially. Government should at all level find solution for the use of fire wood and find alternatives that can be accessible and affordable to the populace.

## **Keywords:**

Mass media, Impact, Environmental degradation Community development in Kano State.

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# **Geospatial Analysis of Noise Pollution in Main Campus of Bayero University, Kano.**

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## **Abstract.**

Noise, often described as unwanted or excessive sound interferes with learning activities. Indeed, education environment need the minimum noise. This study analyzed noise pollution in the main campus of Bayero University, Kano. Noise data were generated using sound level meter (SLM) and GPS. Data was collected for two days, midweek and weekend in sixteen points within the university. ArcGIS 10.2 was used for the data integration and analysis. Inverse distance weighing (IDW) spatial interpolation method was employed by the study. Maps and charts were used for data presentation. In addition the study compares noise level in the area with NESREAs and WHOs standard. The result indicated that the average noise level of 68 dB in the university, exceeding the maximum level recommended. In all the sixteen location, higher noise levels were recorded in the week day and lowest in the weekend. Highest noise levels were recorded at the faculty of engineering, near the library and bus stop. The study attributed the higher noise experience in the university to frequent power outage that compels most departments and faculties to used electric generators. A significant noise is also induced by business centers and commercial activities in the university. The study recommends need for the university to explore more of solar and other environmentally friendly energy sources as alternatives. There is also need to regulate the citing of electric generators, and to ensure that the generators are only place away from the teaching and learning premises.

## **Keywords:**

Geospatial, Noise, Pollution, Learning activities, University

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# **A Geophysical Investigation of Shallow Groundwater Potential in Sokoto Basin, Nigeria.**

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## **Abstract.**

Shallow groundwater has long been identified as a potential source for augmentation of water supply and irrigation in Nigeria. In Sokoto basin, shallow groundwater is heavily relied on as another significant source of water supply. However, this water is unevenly distributed, and its occurrence is highly unpredictable. Successful development therefore needs to be promoted by prospecting and exploration studies. Geophysical survey using different techniques is now being used to explore groundwater potentials in such areas. This paper carried out geophysical survey in Gada town, Sokoto to investigate shallow groundwater and determine suitable areas for siting of hand dug wells and boreholes. Twenty eight (28) Vertical Electrical Soundings (VES) were conducted on equally spaced 100 meters interval, from eight established profiles. Geologic and geo-electric sections of the layers were constructed after results interpretation of the VES data. The result shows that the average depth (thickness) penetrated by the VES was 17.46 meters with the highest thickness being 34.28 meters, while the lowest was 0.6 meter. About 94 layers were encountered from the 28 VES points surveyed, and only 24 layers were found suitable for groundwater prospecting. The layers were all located in the third and fourth strata, with 'C' and 'E' profiles having 5 and 4 points respectively. Profile 'A' has 2 points located on the third and fourth strata, while profile 'B' has only 1 point located on the fourth layer but highly promising. All the remaining layer points are less significant as they fall within the non- suitable to moderate classes which are very unlikely to yield water. The paper recommends more research to determine the resistivity values of the deeper underlying layers using other methods of geotechnical investigation to avoid abortive or low yield boreholes. It is also recommended that future drilling should not be less than 140 meters for boreholes and 25 meters for hand dug wells.

## **Keywords:**

Groundwater, Geophysical, Sokoto Basin, Resistivity.

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# **Decryption of Subterranean features of the Waste Disposal Site at Panshekara Industrial area, Kano State, Nigeria using Geoelectrical Method.**

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## **Abstract.**

Geoelectric investigation of the subterranean features of the waste disposal site at Panshekara Industrial area, Kano, Nigeria was carried out using the Schlumberger array configuration. The area is located between latitude  $11^{\circ}52.884'N$  to  $11^{\circ}54.600'N$  and longitude  $80^{\circ}25.230'E$  to  $80^{\circ}28.518'E$ . A total of 18 vertical electrical soundings (VES) spaced 100m apart were used aimed at assessing the lithology beneath the area, delineate the aquiferous formations, its depths and thickness as well as the degree of dispersion of contaminants. The current electrodes spacing used during acquisition of data ranged from 2.0 m to 300.0 m. The interpretation of the field data was carried out using the IPI2WIN and Surfer 7.0 Software. The presence of high concentration of heavy metals at the surface of the site was found by the hydro-chemical analysis carried out by previous Researchers. The concentrations of these heavy metals are in the order  $Cr > Fe > Zn > Cu > Pb > Cd$ . The geoelectrical study revealed that many parts of the study site have narrow topsoil thickness ranges from 0.08m to 1m and in other areas there is total absent of topsoil making the site vulnerable to contamination. Areas around VES 9, 13, 14 and 18 have high volume of groundwater but with absent or narrow topsoil thickness, thus the groundwater at these VES points might be contaminated.

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# Complexity in Soil Temperature over Port Harcourt, Nigeria.

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## Abstract.

Monitoring of soil temperature is important for irrigation planning and agricultural output. Soil temperature is determined by several factors such as soil type and moisture contents. In this study, the complexity in soil temperature is investigated using two nonlinear tools: Gottwald-Melbourne 0-1 test for chaos and Tsallis Entropy. Results obtained showed seasonal variation in soil temperature for the region. The Gottwald-Melbourne 0-1 test for chaos for soil temperature in Port-Harcourt showed an inverse relationship with the mean soil temperature. No significant variation was observed in the computed entropy for soil temperature over the region. From the results obtained, soil temperature is more complex during the raining season, hence, the need for more planning during the period.

## Keywords:

Gottwald-Melbourne 0-1 test, Tsallis Entropy, soil temperature, Nigeria

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# **Ionospheric Signatures during Intense Geomagnetic Storm Main Phase at a Low-latitude Station, Ile-Ife.**

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Obafemi Awolowo University, Ile-Ife, Nigeria

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## **Abstract.**

The effect of the main phase of two intense geomagnetic storm events which occurred on August 5 – 6 and September 26 – 27, 2011 on the equatorial ionosphere have been investigated using Global Positioning System (GPS) data obtained from an Ile-Ife station (geomagnetic lat.  $9.84^{\circ}\text{N}$ , long.  $77.25^{\circ}\text{E}$ , Dip  $7.25^{\circ}\text{N}$ ). Total Electron Content (TEC) profiles during the main phase of the two geomagnetically disturbed days were compared with quiet time average profiles to examine the response of the equatorial ionosphere. International Reference Ionosphere (IRI) 2012 TEC model was also obtained from Virtual Ionosphere, Thermosphere, Mesosphere Observatory (VITMO) and the extents of deviation from measured GPS-derived TEC were examined for the main phase of the storm events. The results showed that the intensity of both storm events during the main phase which occurred at night-time correlated well with a strong southward direction of the z-component of the Interplanetary Magnetic Field (IMF-Bz) and Solar Wind Speed ( $V_{\text{sw}}$ ), with the Disturbance storm time (Dst) profile showing multiple step development. TEC depletion was observed during the main phase of the August 5 – 6, 2011 storm event with TEC recording a maximum value of 9.31 TECU. A maximum TEC value of 55.8 TECU was recorded during the main phase of the September 26 – 27, 2011 storm event depicting TEC enhancement. Significant scintillation index value of 0.57 was observed when the main phase started on August 5 – 6, 2011 followed by a prolonged suppression while there was less significant scintillation impact on September 26 – 27, 2011 with a maximum value of 0.33. The present study show that rapid energy input from solar wind during geomagnetic storm events effect large variations in TEC and significant scintillation phenomenon in the equatorial ionosphere over Ile-Ife, Nigeria.

## **Keywords:**

Geomagnetic Storm, Main Phase, TEC, Scintillation, Low-latitude Ionosphere, Ile-Ife

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# **ARCSSTE-E'S Postgraduate Diploma Programme: The Journey so far.**

O.R. Oladosu, G.I. Agbaje, L. Alli-Fadiora and A.A. Adegbite

African Regional Centre for Space Science and Technology Education in English, Ile-Ife, Nigeria

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## **Abstract.**

The African Regional Centre for Space Science and Technology Education in English (ARCSSTE-E) was inaugurated in November 1998. The Centre was established to develop indigenous skills, knowledge and capacity, through rigorous theory, research, applications, field exercises and pilot projects by running a nine-month Postgraduate Diploma (PGD) programme in the areas of Remote Sensing and Geographic Information Systems (RS/GIS); Satellite Communications; Satellite Meteorology and Global Climate; and Basic Space Science & Atmospheric Physics (BSA). In this paper is described the efforts so far made by the Centre in delivering on her mandate. It also discusses the challenges and future plans for the region in the area of SST.

## **Keywords:**

Capacity building, regional center, postgraduate diploma, Ile-Ife, Nigeria

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# **Integrated Geochemical and Geophysical Investigation of Emirin Waste Dumpsite, Ado-Ekiti, Southwestern Nigeria.**

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## **Abstract.**

An integrated physico-chemical, geochemical and geophysical investigation was carried-out in and around Emirin waste dumpsite Ado-Ekiti Southwestern Nigeria with the view to assess the extent of possible soil and groundwater pollution arising from leachate plume from the dumpsite. Seven (7) water samples were collected. which consist of three (3) hand dug wells and four (4) from different river locations beside the dumpsite. Ten (10) soil samples were collected at B horizon in and away from the dumpsite at a random interval. Ten (10) vertical electrical resistivity (VES) stations were established using schlumberger configuration with half-current electrode spacing that ranged from 1 150 m while dipole dipole profiling was carried-out along four (4) profiles. The physico chemical result shows that the Total Dissolved Solid (TDS) of the three well samples ranges between 785 21600 mg/L. While the TDS for the river samples was between 2030 2050 mg/L, both the upper and lower limit of the TDS were above the Nigerian Standard for Drinking Water Quality (NSDQW 2007) and World Health Organization(WHO 2008) maximum permissible standard. The Electrical Conductivity (EC) of both well and river samples ranges from 1200 3650  $\mu\text{cm}$  and 34200 34350  $\mu\text{cm}$  respectively was also above the maximum permissible standard. The elemental concentration of Pb, Fe, Cd and K in the soil samples located within the dumpsite are higher than those of the control point which indicate pollution. The VES interpreted result delineated three subsurface layers comprising, the topsoil, weathered layer and fresh basement. While the dipole dipole results shows that the topsoil and weathered layer has been virtually megered with characteristic low resistivity of  $<5 \Omega\text{m}$ , which is attributed to leachate infiltration in and around the zones of the dumpsite. The extent of leachate migration was estimated to be  $> 25 \text{ m}$ . It could be concluded that the soil and water in the vicinity of the investigated dumpsite has been polluted.

## **Keywords:**

Geochemical, Geophysical, Dumpsite, Leachate Soil and Groundwater Contamination.

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# Investigation of Scintillation Occurrence during Intense Geomagnetic Storms at low latitude stations.

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## Abstract.

GPS-derived scintillation index ( $S_4$ ) from three low latitude stations located at the Equatorial Ionisation Anomaly (EIA) region has been analysed with a view to knowing the contribution of geomagnetic storms on scintillation occurrence. Results showed that scintillation at low latitude stations is dependent on location, the phase of the storm and time of occurrence of storm. Addis Ababa recorded moderate values of  $S_4$ , ranging from 0.42 to 0.45 during the storm events considered. Ile-Ife recorded both low and moderate values of  $S_4$ , ranging from 0.2 to 0.42, while Bangalore station recorded the least scintillation occurrence, with  $S_4$  values ranging from 0.1 to 0.3. Results also revealed that scintillation occurrence during storms can be inhibited or triggered depending on the phase of the storm. Comparative result between scintillation occurrence during storm and that during quiet time showed that scintillation was more pronounced during quiet periods over all stations.

## Keywords:

Ionospheric Scintillation, Equatorial Ionisation Anomaly, GPS and Low Latitude.

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# Variability of Aerosol Optical Depth from Ground and Satellite-Based Measurements at 550nm Over Ilorin.

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## Abstract.

This study sought to investigate the spatio-temporal variations of aerosols over Ilorin Nigeria (8.32°N, 4.34°E) based on Moderate Resolution Imaging Spectro-radiometer (MODIS) satellite sensor Imageries taken over the study location and AERONET Cimel sun-photometer aerosol optical depth (AOD) measurement located at Ilorin (8.32°N, 4.34°E) for the year 2003, 2005, 2006 and 2007. The aerosol over Ilorin was retrieved from the corresponding area pixels using Deep Blue Algorithm for brighter surface. AERONET AOD was interpolated from 500nm wavelength to MODIS AOD wavelength at 550nm and both were compared for daily and monthly for the years considered. The MODIS data was validated using standard method and the Root Mean Square Error was calculated. AERONET Cimel sun-photometer AOD data was used as ground truth source, It was observed that AOD data retrieved from MODIS satellite instrument overestimated the values for low AOD (<1.0) and underestimated for high AOD values (>1.0), though the annual behavior of occurrence was similar. The underestimation of AOD by MODIS with respect to AERONET might be caused by the amount of surface reflectance sensed by the MODIS sensor on board TERRA ship. However, the harmattan and the dry season behaviors were found to show high AOD values with rainy season having low AOD values. AERONET shows higher AOD value in the harmattan period, than MODIS for the years of study, and vice versa during rainy season. Visibility data derived using Vermote *et al.* (2002) technique showed visibility in Ilorin was highest between the months of September through November towards the ending of raining season with the least in March during the dry season for all the years considered when the harmattan dust returns leading to rising of AOD values. The Validation procedure gave the linear equation  $y = 1.0317x + 0.0409$  and good correlation value of  $R = 0.62$  between the two sources of data namely MODIS and AERONET. This correlation value obtained was better than the correlation value obtained in validation done in Kenya Eastern part of Africa with correlation value of  $R = 0.56$  by Ngaina *et al.*, (2014). Both year 2003 and 2005 have Root Mean Square Error (RMSE) of 0.3, while 2006 and 2007 had high RMSE values of 0.5 and 0.4 respectively. The values for 2003 and 2005 falls within the RMSE values obtained in literature for coastal regions within the range of 0.2 to 0.3. The RMSE values above 0.3 may be due to high soot concentration from the biomass burning during dry season, and gas flaring of Niger Delta which might not be well in-cooperated in the Algorithm used for MODIS AOD retrieval.

## Keywords:

AOD, MODIS, AERONET, Visibility.

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# Mapping the Groundwater Flow Pattern in the Faculties of Social and Management Sciences, Usmanu Danfodiyo University, Sokoto.

J.S. Shehu

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## Abstract.

In this work, self-potential values were measured at some regularly spaced points in the study area and then plotted against the subsurface depths. The depths corresponding to peak potential values were then mapped to reveal the topography of the subsurface. The main aim is to determine the flow pattern of the groundwater due to pressure gradient. The research is intended to serve as a reconnaissance for a detail groundwater survey using resistivity method. The result of this work shows that groundwater is most likely to flow from locations 1, 4, 8 and 9 to locations 2, 3, 5, 7 and 10.

## Keywords:

Subsurface, topography and pressure gradient.

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# Geoelectrical Investigation of Aquifer Zones and Locations of Sule Lamido University, Kafin Hausa, Jigawa State for Ground Water Exploration.

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## Abstract.

Thirty vertical electrical soundings (VES) points using Schlumberger electrode configurations were sounded within the vicinity of Sule Lamido University Kafin-Hausa main campus using ALLIED OHMEGA Terrameter. The study area lies between longitude (Easting) of 8.00°E to 10.15°E and latitude (Northing) of 11.0°N to 13.00°N. The interpretation of the data acquired from the field was performed using IPI2win and Suffer (Version 11). The interpreted result was compared with the borehole log and geology of the area. The study area shows a six layered formation, Clayey sand as the first layer, with thickness ranging from 0.051 m to 3.154 m, mixed medium sand with coarse sand as the second layer, with thickness ranging from 0.229 m to 4.01 m, mixed fine sand with medium to coarse sand as the third layer, with thickness ranging from 0.024m to 6.56 m, medium to coarse sand with siltstone as the fourth layer, with thickness ranging from 0.027 m to 11.321 m, medium to coarse sand as the fifth layer, with thickness ranging from 0.080 m to 42.756 m and medium to coarse sand as the sixth layer with thickness ranging from 0.288 m to 133.93 m. Review of the past ground water exploration activity in Kafin-Hausa Metropolis shows that the maximum drilling depth of borehole in the area is 45 m. However, this research based on the acquired data analysed, and interpreted recommends a drilling depth for confined and unconfined aquifer of about 130m to 144 m and 25 m to 45 m respectively. The areas or sites recommended for optimum ground water exploration activities within the study area are areas around the just recently completed hostel near the football pitch and areas around campus mini market located around lecture theatre halls.

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# Effect of Open Dumpsite on Underground Water in Ganmo, Ifelodun LGA, Kwara State, North Central Nigeria.

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## Abstract.

This study imbibes Geophysical survey involving electrical resistivity methods (Electrical Resistivity Tomography and Vertical Electrical Sounding), Physico-chemical analysis and Bacteria Analysis of the underground water samples. Geophysical survey were conducted around a 35 years old solid waste dumpsite in Ganmo, one of the districts in Ifelodun LGA, Kwara State, North Central Nigeria, located between latitude 8°25'25" to 8°25'41"N and longitude 4°36'36" to 4°36'62"E, with the view to assessing the extent of impact of the waste dumpsite on the quality of the groundwater in the study area. Electrical Resistivity Profiling and vertical electrical sounding stations were established using Werner and Schlumberger configuration with half – currents electrode spacing that ranged from 1 to 100 m. A digital read out resistivity meter was used to acquire data in the area. A contaminant leachate plume was delineated in 2-D resistivity sections as low resistivity zones. The 2-D resistivity imaging was identified as bluish zones of low resistivity 20.9  $\Omega\text{m}$  with the depth ranging from 0.25 to 3.96 m in the entire inverse model sections. The low resistivity value of 20.9  $\Omega\text{m}$  revealed that the groundwater around the dumpsite has been contaminated to the depth of 3.19 m compare to the measured water levels. The VES results were presented in terms of resistivity, thickness and depth. The VES interpreted results delineated three subsurface layers comprising topsoil, weathered layer and the fresh basement of which the three (3) layer geo-electric sections are both H-type and A-type sounding curve. The result indicated that the 3rd layer VES has high resistivity value ranging from 650.0 to 2264.3  $\Omega\text{m}$  whose depth and thickness could not be reached. Three (3) water samples were collected, two samples from the closest hand dug wells and one sample from bore-hole for analysis. The hydro-physicochemical analysis conducted showed that wells are in good conditions actually the concentration of various parameters tested are below the WHO and FEPA standard. The result of the bacterial analysis of the water samples collected showed presence of bacterial species load of *E. coli* and *Klebsiella* which can cause severe health hazards. It is concluded that the water is not safe for domestic consumption. However water treatment is hereby recommended on all wells around the study area.

## Keywords:

Leachate plume, resistivity, contaminants, health hazard, VES.

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# Aquifers Characterization and Classification using Geophysical Data Transformation in Katsina-Ala, Central Nigeria.

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## Abstract.

Integrated approach involving electromagnetic (EM), vertical electrical soundings (VES) and in-situ borehole measurements were used to map out, characterize and statistically classified estimated aquifer characteristics in order to develop underground water productivity map in a basement complex terrain of Katsina-Ala, Central Nigeria. 15 EM conductivity profiles were carried out using Geonics EM-34 from which qualitative interpretation of conductivity data revealed points of anomaly which were subjected to depth investigation using VES. A total of 26 VES points were occupied in the present study using ABEM Terrameter SAS 300C for Schlumberger array at half current spacing of 65 m to 160 m, from which geo-electric parameters were determined. Hydraulic parameters from boreholes measurements were used to estimate a transformation constant  $\chi$  equal to  $10.7762 \Omega m^2/\text{day}$ , which was effectively used to transform geo-electric data into hydraulic parameters. Thus, hydraulic conductivity (K) ranging from 0.0672 m/day to 0.4854 m/day with average of 0.2 m/day and transmissivity (T) ranging from  $0.8621 m^2/\text{day}$  to  $12.9520 m^2/\text{day}$  with average value of  $4.7133 m^2/\text{day}$  was estimated. Statistical classification of T-values estimated revealed three classes; very low, low and intermediate classes with a variation of 0.3264 which signified a fairly heterogeneous formation thus justifying geophysical data transformation in the area.

## Keywords:

Electromagnetic, vertical electrical sounding, aquifers characterization, transmissivity classification, Katsina-Ala.

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# Application of Statistical Techniques to the Analysis of Meteorological Data of Yola Adamawa State.

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## Abstract.

In this work, three different statistical techniques were used to analysis the meteorological data of Yola Adamawa State. The Meteorological data from Centre for Atmospheric Research (CAR), sited at Kogi State University Campus, Anyigba, Nigeria and the meteorological parameters utilized are solar radiation, relative humidity, temperature and wind speed, daily data spanning for three years (2010, 2011 and 2012). The data which was recorded at five minutes intervals was averaged monthly for sunshine hours between 07.00 and 18.00 hours local time, using Microsoft Excel spread sheet. The first technique used was regression analysis, were Solar radiation was used as the dependent parameter with the remaining three parameters as independent parameters. It was discovered that the most significant parameters that contributed to solar radiations are temperature and relative humidity. The second is time series analysis were all the parameters are assumed independent. It is discovered that, Solar radiation follows Simple Seasonal (Exponential smoothing with only level and season) with  $R^2 = 0.86173$ , Stationary  $R^2 = 0.81793$  and the significance level = 0.12010, Relative humidity with Simple Seasonal,  $R^2 = 0.98466$ , Stationary  $R^2 = 0.78795$  with significance level = 0.59696, Temperature has Simple Seasonal with  $R^2 = 0.93209$ , Stationary  $R^2 = 0.83898$  and significance level = 0.07129 while the wind speed has Winters' Additive model with  $R^2 = 0.73496$ , Stationary  $R^2 = 0.83230$  and the significance level = 0.01348. The third is the Empirical Orthogonal Transformation, the data were analyzed using unrotated, orthogonal and oblique transformations. From component matrices, it is discovered that the first component has highest loadings of Temperature and Solar radiation (this corresponds to dry season) and the second component highest loadings of wind speed and RH (this correspond to rainy season). These observations show that the area has two seasons, as dry season and wet seasons, with the dry season being dominant because it has the highest eigenvalue. The values of the eigenvalues is consistent with what is observed in real-time of seven (7) months of dry season and five (5) months of wet season.

## Keywords:

Meteorological data, regression analysis, time series analysis, empirical orthogonal transformations, oblique transformations.

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# Analysis of Electromagnetic Fields from Power Lines at Iyamho Community, Edo State, Nigeria.

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## Abstract.

Presently, the effects of electric and magnetic fields from high voltage transmission power lines have become a subject of scientific discord. These fields are higher close to the power lines and fall with distance. Magnetic fields vary as the load on the power lines changes whereas electric fields stay approximately constant. Electric and magnetic fields from power lines generate enormous values of extremely low frequency electromagnetic fields. This research gives an analysis of the electromagnetic fields emitted by 11 kV high voltage transmission power lines at Iyamho Community, Etsako West Local Government Area of Edo State, Nigeria. The measurements results using ED78S Electromog meter were compared with the international standard threshold values. The results show that the magnetic field only exceeded the threshold value in the public area (Edo University premises) while the electric field at all points is still below the limit as recommended by International Commission on Non-Ionizing Radiation Protection (ICNIRP) and other standard regulatory bodies and there was a good correlation between the electric field and the magnetic field. Recommendations for some practical precautionary measures to extremely low frequency electromagnetic fields were also given.

## Keywords:

Electromagnetic Fields, Extremely Low Frequency, Threshold Values, Power Lines, Radiation.

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# Design and Implementation of a Low Cost Weather Monitoring System.

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## Abstract.

In this era of global warming, research in weather measurement and predictions are becoming more and more pertinent; getting the latest weather forecast and taking the necessary precautions have become a major issue all over the world. This research demonstrates the design and implementation of a weather monitoring system using an Arduino Mega 2560 microcontroller and some modern reliable sensors with a real time data logger and LCD. The designed weather monitoring system is advantageous in terms of its on-device display, smaller size, low cost, flexibility, portability as well simplicity in its operation and would be used for meteorological measurements of temperature, humidity, pressure, ambient light intensity also for the approximation of the dew point temperature using the Thumb Rule and calculation of altitude using the Barometric Formula. The measured data from this designed system were in good agreement with those obtained from other sources. This would make weather related data readily available for small-scale users like farmers, travellers, aircraft workers, researchers, institutions and others for the purpose of measurements, monitoring, estimation, modelling, prognostications and spatial planning so as to mitigate climate-induced environmental disasters in our communities.

## Keywords:

Climate, Data logger, Forecast, LCD, Microcontroller, Sensors, Weather

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# Mineralogical (Specially Gold) Potential Study Using Remote Sensing and GIS in North-East Sokoto Basin around Maikendi area of Kebbi State.

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## **Abstract.**

Mapping of mineralogical parameters involves taking information from many different sources depending on the prevailing features in a particular environment. An area covered by latitudes  $11^{\circ}30'4''\text{N}$  and  $11^{\circ}42'5''\text{N}$  and longitudes  $4^{\circ}35'5''\text{E} - 4^{\circ}47'5''\text{E}$  is considered in this study. Geology Map, satellite image, and ER mapper of the area were utilized. Also, various image processing technics were involved such as a color composite, band rationing, false color composite, principal component analysis, extraction of lineaments from the satellite image, spatial filtering overly of the different, maps and finally, integration of the result of produce the gold potential map for the area. The result obtained shows that the area has many zones of gold potential as shown in the gold occurrence probability map and that remote sensing can be utilized for mineralogical purposes and more research can be conducted using geophysical exploration methods.

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# **Estimation of Aquifer Parameters in Basement Complex Area of Kano Crystalline Environment, Kano State Nigeria.**

Usman Tukur Garo<sup>1</sup>, Adnan Abdulhamid <sup>2</sup> and Hussaini A. Daura <sup>2</sup> and G.I. Agbaje<sup>3</sup>

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## **Abstract.**

Aquifer parameters of Kano crystalline basement complex area was estimated using Pumping test data obtained from Hadejia–Jama’are River Basin Development Authority, RUWASA and State Ministry of Water Resources, the hydraulic properties of the aquifers were evaluated using Cooper–Jacobs’s non-equilibrium graphical procedures. The calculated results revealed that, the measured draw down varies from 7.1 – 16.4 m, the specific capacity values ranges from 1.31 – 9.22  $m^2/day$ , the transmissivity values ranges from 0.86 to 33.4  $m^2/day$  while the storage co-efficient ranges from 0.0041 – 1.32. The above range of aquifer properties has revealed the area to be of high groundwater potentials.

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# A Study of Surface Air Temperature Variations in Nigeria.

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## Abstract.

Simultaneous measurements of air temperature were carried out using an Automatic Weather Station (AWS) at 14 tropical locations in Nigeria. Diurnal variations were derived from the 5 minutes update cycle initial data for the years ranging between 2007 and 2013 respectively. The temperature trends in Nigeria revealed a continuous variability that is seasonally dependent within any particular year considered. The analysis was carried out using available data from the network and the results are presented with a focus to characterize the temperature variations at different locations in Nigeria using the mean, maximum and minimum temperatures from the north which is arid in nature to the south, which is a tropical monsoon climate type and a coastal region. Overall, temperature variations in Nigeria were observed to have higher values in the far north, attributed to the influence of Sahara Desert, which has less cloud cover and therefore more transparent to solar irradiance and lower values in the south, where there are more cloud cover and abundant vegetation. Measured maximum and minimum temperatures in Nigeria are respectively 43.1°C at Yola (North-east part of Nigeria) and 10.2°C for Jos (North-central part of Nigeria). Jos is a high altitude area and subject to the temperature-moderating influence of the Jos Plateau. Although Jos records the lowest temperatures, the temperature variations in the two seasons are significantly large for the locations under consideration. Lagos records the least temperature variations; this is as a result of the direct influence of the Monsoon originating from the South Atlantic Ocean that yields abundant rainfall (high humidity) with consequent lower temperatures.

## Keywords:

Temperature, Measurement, Variation, Maximum and Minimum and Mean.

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# General Review and Analysis of Various Solar Photovoltaic Software Applications.

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## Abstract.

In this paper we have presented all the Photovoltaic simulation software that is available in market for commercial application as well as for educational and research purpose till date. For this an extensive search was made to providing all the details of Photovoltaic simulation software presented in this paper. The investigated simulation softwares were evaluated according to the following criteria. P1 their commercial and educational availability and cost, P2 their working platform, P3 their working capacities, P4 their scope and output and P5 their updatability.

## Keywords:

Simulation, Photovoltaic, Grid connected system, software

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# **Preliminary Interpretation of Magnetic Survey Undertaken in Michael Okpara University of Agriculture (MOUAAU), Umudike, Abia State.**

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## **Abstract.**

This presents the results of a magnetic survey conducted in the campus environment of the University. The magnetic data was collected by a 3 Axis MCL6 Magnetometer. The data were collected from a 1km by 500m area along four profile line measuring about 1000m each. The separation between each profile is approximately 250m respectively. The magnetic survey was designed in such a way that deep insight into the depth to magnetic sources in the area was delineated. The data acquisition technique used requires measurements of the magnetic intensities at discrete points along traverses regularly distributed within the area of interest so as to cover enough segment used to determine the structure and the structural history of the study area. Coordinates were recorded using the WGS84 datum in the UTM zone 31N. The line orientation was approximately parallel to the regional geological strike. The Earth's magnetic field is a composite of anomalies of varying frequencies. The highest frequency events of interest are those created by geological conditions in the shallow subsurface and the lowest frequency events are caused by magnetic property contrasts at or beneath the basement surface. Intermediate frequency events are created within a sedimentary section. The result is minor but measurable anomalies. Important lateral variations and contrasts in magnetic properties of the shallow formations are brought about singularly or by some combination of faulting, deposition and mineralization associated with structural displacement.

## **Keywords:**

Magnetometer, magnetic intensities, regional, frequency, anomalies.

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# Application of Electrical Resistivity Method for Foundation Studies and Characterisation of Ground Water Regime at Permanent Site of North West University Kano, Kano State.

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## Abstract.

Vertical Electrical Soundings (VES) using Schlumberger array was carried out at twenty five (25) stations at the permanent site of Northwest University Kano, which aimed at assisting in the physical planning and developmental process of the undeveloped part of the university site. The measurement was conducted using terrameter ALLIED OHMEGA SAS. The collected data were analyzed using IP12WIN and surfer version 7.0 software. The area is bounded by latitude 12°0'20"N to 12°1'4"N and longitude 8°47'2"E to 8°48'40"E. The interpretation of the acquired data revealed that the subsurface is remarkably inhomogeneous, having a complex subsurface geological sequence. The geo-electric sections revealed three to four lithological units defined by clayey-sandy and sandy lateritic hard pan Topsoil, Weathered basement, Fractured basement and Fresh basement, Layer thickness varied from 0.2 m to 4.0 m for topsoil, 15.0 m to 33.0 m for weathered layer, 35.0 m to 40.0 m for Fractured basement, with Fresh basement having infinite thickness. Based on the resistivity values, it is concluded that the subsurface material up to the depth of 25 m was competent and has high load-bearing capacity, However, resistivity values less than 200  $\Omega$ m at depths of 10.0 m to 15.0 m indicates high clayey sand content and high degree of saturation which are indications of soil conditions requiring serious consideration in the design of massive engineering structures. From Aquifer thickness map prepared, good, moderate and poor zones were identified. The study reveals that the weathered and fractured horizons that occur in the westernmost part of the area constitute the productive water-bearing zones referred to as good groundwater potential aquifers with a thickness value greater than 20 m. The inferred areas most suitable for ground water exploitation are VES stations 01, 04, 05, 06, 13, 14 and 25.

## Keywords:

Geoelectric, Resistivity, Vertical Electrical Sounding, Inhomogeneous, Inferred.

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# Assessment of Groundwater Potential in and around Usmanu Danfodiyo University, Sokoto Permanent Site Using Vertical Electrical Sounding.

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## Abstract.

A Geo-electrical assessment of groundwater potential in and around Usmanu Danfodiyo University, Sokoto permanent site using Vertical Electrical Sounding (VES) was carried out using the Schlumberger electrical resistivity array with maximum current electrode separation of 200 m. Thirty Vertical electrical soundings (VES) were conducted along five profiles. Usmanu Danfodiyo University, Sokoto permanent campus is located on longitude 13°5'13" to 13°9'45"N and latitude 5°10'15" to 5°15'5"E and forms part of Gwandu/Kalambaina formation IPi2win (Version 3.0.1) software was used in interpreting the result curve plotted which also aided in deriving the 2D geoelectric and geologic sections. The layer resistivity and thickness color shading maps were produced employing the layer data of the study area for the first to sixth layers and these were done with the aid of the software Oasis montaj 6.4.2. Three to six subsurface layers exist in the study area. The topmost geoelectric layer has resistivity of 120  $\Omega$ m to 9124  $\Omega$ m. The lithology of the topsoil is mainly laterite to clay. The topsoil thickness ranges between 0.2 to 5.6 m, while the overburden thickness of the study area ranges between 2.4 m to 105 m. The aquifer thickness of the study area ranges between 3 to 97 m. The interpreted results suggest that the main aquifers in the study area are clay, silt sandy, fine and medium coarse sand. Productive boreholes can be located around VES DF 02, 03, 05, 06, 09, 13, 17, 19 and 28. Nine curve types have been identified within the study area. The curves are prominently of H, KH, QH, HA, HKH, AKH, QQH, KQQ and AKQ type indicating the presence of three to four layers followed by combination of curves KHKH and KQQH indicating the five to six layers. The layer interpreted acts as suitable aquifer for Usmanu Danfodiyo University and environs are the H type and H combination types which occurred in the study area. The stratification lithology of the study area revealed mainly laterite, limestone, gray clay, silt, dark clay, fine sand, medium coarse sand and dry sand which showed the formation variation obtained through interpretation of VES curves and this collaborate with the borehole log of the area.

## Keywords:

Ground water potential, electrical resistivity, geo-electric section

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# Variability of Total Electron Content during Moderate Geomagnetic Storm over FUTY GPS Station.

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## Abstract.

The dual frequency receiver was used to determine the variability of total electron content variation during moderate geomagnetic storms ( $-50 > D_{st} > -100$ ) FUTY GPS stations in Nigeria, by taking advantage of the dispersive nature of the ionosphere. The TEC data were analyzed for five days around the storm day Reductions in the diurnal TEC at the station during the period of the storm were observed. The TEC values observed for fourteen geomagnetic storms of the period 2012–2014 was used in this paper to discuss the behavior of ionospheric total electron content (TEC) during geomagnetically disturbed periods. Variation of TEC is studied in correlation with the geomagnetic index Dst and southward component of interplanetary magnetic field Bz. The main purpose of this study is to know how TEC varies from its average values with geomagnetic storms.

## Keywords:

Ionosphere, Geomagnetic Storm and TEC

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# Study of Geomagnetic Induced Current at High Latitude during Geomagnetic disturbance.

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## Abstract.

During the geomagnetic disturbances, the geomagnetically induced current (GIC) are influenced by the geoelectric field flowing in conductive Earth. In this paper, we studied the variability of GICs, the time derivatives of the geomagnetic field ( $dB/dt$ ), geomagnetic indices: Symmetric disturbance field in H (SYM-H) index, AU (eastward electrojet) and AL (westward electrojet) indices, Interplanetary parameters such as solar wind speed ( $v$ ), and interplanetary magnetic field ( $B_z$ ) during the geomagnetic storms on 31 March 2001, 21 October 2001, 6 November 2001, 29 October 2003, 31 October 2003 and 9 November 2004 with high solar wind speed due to a coronal mass ejection. Wavelet spectrum based approach was employed to analyze the GIC time series in a sequence of time scales of one to twenty four hours. It was observed that there are more concentration of power between the 14-24 Hrs on 31 March 2001, 17-24 Hrs on 21 October 2001, 1-7 Hrs on 6 November 2001, two peaks were observed between 5-8 Hrs and 21-24 Hrs on 29 October 2003, 1-3 Hrs on 31 October 2003 and 18-22 Hrs on 9 November 2004. Bootstrap method was used to obtain regression correlations between the time derivative of the geomagnetic field ( $dB/dt$ ) and the observed values of the geomagnetic induced current on 31 March 2001, 21 October 2001, 6 November 2001, 29 October 2003, 31 October 2003 and 9 November 2004 which shows a distributed cluster of correlation coefficients at around  $r = -0.567$ ,  $-0.717$ ,  $-0.477$ ,  $-0.419$ ,  $-0.210$  and  $r = -0.488$  respectively. We observed that high energy wavelet coefficient correlated well with bootstrap correlation, while low energy wavelet coefficient gives low bootstrap correlation. It was noticed that the geomagnetic storm has a influence on GIC and geomagnetic field derivatives ( $dB/dt$ ). This might be ascribed to the coronal mass ejection with solar wind due to particle acceleration processes in the solar atmosphere.

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