



Centre for Atmospheric Research

National Space Research and Development Agency

Federal Ministry of Science and Technology

Kogi State University, Campus, Anyigba, Nigeria

Summary of Activities for 2015 and 2016

December 2016



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Creating Opportunities.....



Table of Contents

DIRECTOR/CHIEF EXECUTIVES' STATEMENT : Soaring at the Global Front.....	5-6
OBJECTIVE OF REPORT.....	7
Who We Are.....	7
Mission Statement.....	7
MANDATES OF THE NASRDA CENTRE FOR ATMOSPHERIC RESEARCH.....	8
Operations.....	8
Centre Organogram	9
Technical Division.....	10
Major Active Research Projects at CAR	10-11
ANNUAL REPORT FOR THE YEAR 2015.....	12
MEMORANDUM OF UNDERSTANDING.....	13
ACTIVITIES SUPPORTED AND ORGANISED BY THE CENTRE.....	13
International School on Equatorial and Low-Latitude Ionosphere (ISELLI). 14 th -18 th September, 2015.....	13-14
The International Workshop on Space Weather and Earth's Surface Phenomena; 11 th -15 th May 2015.....	14
Setting up of Space Environment Research Laboratory (SERL), Abuja	14
Setting up of Atmospheric Facilities.....	15
Installation of All Sky Optical Imager	15
Relocation of MAGDAS & AMBER Magnetometer	15
Installation of Fabry-Perot Interferometer FPI.....	15
Installation of TRODAN Automatic Weather Station at UNIAGRIC, Makurdi	15-16
PARTICIPATION IN CONFERENCES AND WORKSHOPS.....	16
Nigerian Geophysical Society Conference. Covenant University, Ota 17 th -20 th March, 2015.....	16
NeQuick Latest Developments and Advanced Uses. 4 th May- 8 th May, 2015 at ICPT, Trieste, Italy	16
Uncertainty in Climate Modelling and Projection. 13 th July- 18 th July, 2015. ICTP, Trieste, Italy.....	16
African Geophysical Society Conference 21 st September - 25 th September, 2015. Nairobi, Kenya	16-17
Society for Environmental Toxicology and Pollution Mitigation SET POM. 22 nd -23 rd September, 2015. Lagos, Nigeria	17-18
The 14 th International Symposium on Equatorial Aeronomy. 19 th – 23 rd October, 2015. Bahir Dar University, Ethiopia	18
Organisation of Women in Science in Developing Countries (OWSD) Conference 1 st –4 th November, 2015.....	18-19
International Union of Radio Science URSI-NG. 2 nd – 5 th December, 2015. Ilorin, Nigeria	19



PHOTO PANORAMA.....	20
Staff of CAR with Dr Qian Wu of the National Centre for Atmospheric Research, NCAR during the installation of the FPI at the Space Environment Research Laboratory, Abuja in November 2015	20
Cross Section of Participants at the 2015 AGS Conference held in Nairobi, Kenya. Between 21 st -25 th September 2015	20
Cross Section of Participants at the International School on Equatorial and Low Latitude Ionosphere (ISELLI) co-sponsored by CAR. Between 14 th -18 th September 2015.....	21
SPECIAL ADMINISTRATIVE/TECHNICAL TRAINING	22
CAR ORGANISED SPACE OUTREACH PROGRAMME FOR NEXT GENERATION OF SCIENTISTS	23
FUTA 70 TH INAUGURAL LECTURE PRESENTATION ON 7 TH JULY, 2015.....	24
INDOOR SEMINARS.....	24
COLLABORATION MEETING/ OFFICIAL VISIT TO INSTITUTIONS	25
SOME VISITING SCIENTISTS TO CAR/SERL.....	25
Staff on Graduate Training	26
Staff who completed Graduate Programmes.....	26
PUBLICATIONS 2015	27
LATEST COUPLE IN CAR FAMILY	29
NEW ADDITION TO CAR FAMILY	29
List of Abbreviations and Acronyms	29
ANNUAL REPORT FOR THE YEAR 2016	329
ACTIVITIES SUPPORTED AND ORGANIZED BY THE CENTRE.....	33
WHY SPACE? 12 th April, 2016	33
3 rd National Conference of Women in Physics	33-34
Setting up Atmospheric Facilities and Maintenance	34
Upper Air Sounding System	34
GNSS (Global Navigation Satellite Systems) Receiver at SEERL, University of Benin.....	34
TRODAN (Tropospheric Data Acquisition Network) Maintenance.....	35
Progress Report of AQRL-Ilorin.....	35
PARTICIPATION IN CONFERENCES AND WORKSHOPS.....	35
The Registry International Workshop.....	35
ICTP Workshop on GNSS Use and Applications at ICTP, Trieste, Italy. 20 th June- 2 nd July, 2016.....	36
25 th COREN Engineering Assembly	36



12 th International Conference and Exhibition on Power and Telecommunication	36
National Space Dialogue & CSTD Annual Space Conference. 29 th – 31 st July, 2016.....	36-37
4 th Biennial International Conference and Exhibition on Environmental Issues (ICEI4) at Prof. Robert Boroffice Multi-purpose Hall, Obasanjo Space Centre, Abuja. 17 th - 20 th April, 2016	37
African Geophysical Society 2016 Annual Conference at Universite Felix Houphouet-Boigny FHB, Cocody Campus, de Bingerville, Abidjan, Cote d'Ivoire between 7 th -11 th November, 2016	38
SET POM International Conference held at University of Lagos between 19 th -20 th October, 2016	38
3 rd Annual Conference of the Nigerian Geophysical Society held at Landmark University Omu aran, Kwara State on 2 nd – 5 th February, 2016.....	38
Salem University Annual Lecture at Salem Lokoja on 7 th October, 2016.....	38
Astronomical Society of Nigeria Annual Conference held at Senator (Prof) Robert Ajayi Boroffice Multi-purpose Hall, Obasanjo Space Centre, Abuja. 8 th -10 th November, 2016	38
GNSS Training and System Maintenance at Nigerian Airforce Base, Sokoto between 11 th -13 th May, 2016.....	38
RESEARCH VISIT	38
2016 CAR Annual Staff Retreat	38
CAR Technical Division Round Table Discussion	39
Computer Training for Administrative and Finance Personnel	39
Zero Based Budgeting System Training of the Ministry of Budget and National Planning	39
Preparation of International Public Sector Accounting Standard IPSAS Accrual Basis Financial Statement	39
PHOTO PANORAMA.....	40-47
Training on the "Single Treasury Account"	48-51
DEVELOPMENT/ACHIEVEMENT	50
Partial Solar Eclipse Observation at Anyigba on 1 st September, 2016.....	50
Observation Experience.....	50-52
INDOOR SEMINARS.....	50
Visiting Scientists to SERL /CAR	51
Staff on Graduate Training	54
Staff who completed Graduate Programmes	52
PUBLICATIONS 2016	53-54
THE LATEST COUPLE IN CAR FAMILY	55
NEW ADDITION TO CAR FAMILY	55
BEREAVEMENT	566
List of Abbreviations and Acronyms	57-58



DIRECTOR/ CHIEF EXECUTIVE'S STATEMENT

Soaring at the Global Front

Setting out as a Research and Development agent in January 2013 within the Nigerian socio-economic straight jacket, our Centre has within 2015 and 2016 recorded a measure of achievement documented in this biennial report.

The customary organization of International schools, conferences and workshops has placed the Centre at the forefront among its peer. In 2015 we continued to build on our previous achievements and set up Space Environment Research Laboratory (SERL), a world-class scientific laboratory within NASRDA headquarters at the Obasanjo Space Centre in Abuja. An All-Sky air-glow optical Imager; first of its kind in Africa, was installed in June 2015 in the newly established Space Environment Research Laboratory, Abuja. MAGDAS and AMBER magnetometers were relocated to the new laboratory for effective coordination in September 2015. This was followed by Fabry Perot Interferometer (FPI), the first to be set up in West Africa, in November 2015. Over 400 visitors from different nations and institutions have since been to this facility in Abuja for educational and research purposes.

CAR enjoyed a strong and successful 2015 but we remain restless in our drive to shape the future of Atmospheric Research and other related activities in Space technology. Hence In 2016, in collaboration with the University of Benin we set up the Space-Earth Environment Research Laboratory (SEERL) within the University campus. A Space Weather and Atmospheric Physics Laboratory (SWAP) was also set up at the Bayero University Kano. SERL, SEERL, SWAP are our super Space Observatories which are conceived to house multiple equipment for space environment studies.

In line with our mandate, we have continued to facilitate enriched workshops, conferences, and trainings for staff, learners at various levels. In fact our scientific workshops have always been over-subscribed due to limited resources. Our staff participated in conferences, workshops, exhibitions, trainings etc both within and outside the country. We also observed routine maintenance of our growing facilities with coordinated supervision by our utility personnel in several locations across the country.



In the two years under review we have at different times and at different locations within the country set up Global Navigation Satellite Systems GNSS receiver for monitoring space weather, Upper Air Sounding System, and more units of Tropospheric Data Acquisition Network TRODAN facilities. We are determined to sustain this rapid growth and preserve the culture of international competitive research to achieve our mandate.

Our network of collaborators has continued to expand. We signed an MoU with the US National Centre for Atmospheric Research NCAR in 2015 and initiated several other international and national collaboration which are also highlighted in the body of this document. Our strength lies in our sound partnership with relevant national and international groups. So we continue to build on the existing collaboration even as we are open to new ones in the coming years.

We at CAR will continue to flap our wings as we pursue our mandate even as we have emerged from cradle to limelight and found ourselves soaring at the global front of atmospheric research. We shall continue our tradition of creating opportunities and making contribution to the socio-economic development of our Nation via our research output and capacity building programmes. In the coming years we seek to position CAR as a foremost atmospheric research centre in Africa.

The success story contained in this report is due to immerse support of Professor Seidu O. Mohammed, Director-General and Chief Executive, and the entire management of the National Space Research and Development Agency, NASRDA. The friendly work environment provided by our host community, Kogi State University Anyigba is greatly appreciated. I have found the contribution of every single staff at CAR significant in our strides as we advance from our pioneering effort to soaring at the global fronts. I look forward to greater cooperation from my amiable team of staff in the coming years.

I commit this report to every reader and welcome any suggestion as may be appropriate.

Best Wishes in 2017

Professor Babatunde Rabi
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National Space Research and Development Agency,
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OBJECTIVE OF REPORT

The report aims to disseminate the litany of activities and successes recorded biennially at the Centre for Atmospheric Research to stakeholders whilst engaging a proactive approach towards the achievement of short, mid and long term goals in strict accordance with its mandate.

Similarly, the report evaluates progress made, highlights major achievements of the Centre as well as the dynamic 21st century research challenges encountered in the atmospheric research environs and related fields.

On this note, the Centre invites significant stakeholders to curiously explore its biennial report. We trust you will find lots of impressive and thought stimulating information regarding our activities and achievements within the years in operation and in the years to come.

Who We Are

The Centre for Atmospheric Research (CAR) is the research and development hub of its parent body NASRDA which is committed to research and capacity building in atmospheric and related sciences under the auspices of the Federal Ministry of Science & Technology.

The Centre is envisioned to be a research and development arm of NASRDA and it is dedicated to: understanding the atmosphere (the air around us) and the interconnected processes that make up the Earth system, from the ocean floor through the Ionosphere to the Sun's core. The NASRDA Centre for Atmospheric Research provides research, facilities and services for the atmospheric and Earth sciences community.

Mission Statement

CAR exists to understand the behaviour of the entire spectrum of the Earths' atmosphere; promote capacity development in relevant atmospheric sciences as a way of facilitating international competitiveness in research being conducted by atmospheric scientists; and disseminate atmospheric data/products to users towards socio-economic development of the Nation.



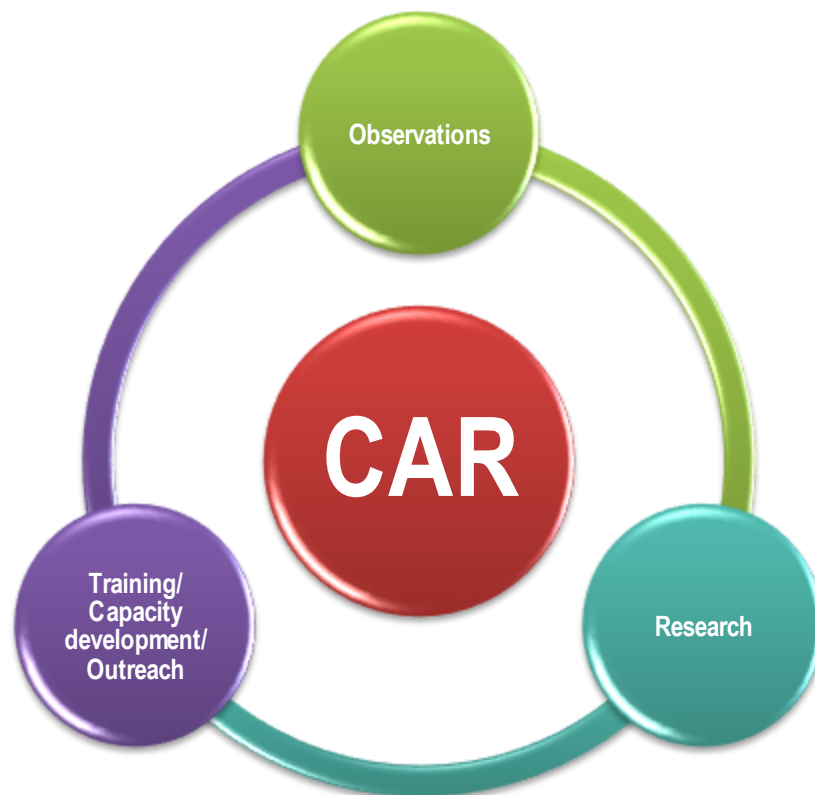
MANDATES OF THE NASRDA CENTRE FOR ATMOSPHERIC RESEARCH

The NASRDA Centre for Atmospheric Research is to provide a sound education, research and knowledge in:

- Lower atmosphere
- Upper Atmosphere (Ionospheric / Magnetospheric physics)
- Atmospheric chemistry and environmental science
- Geomagnetism
- Environmental research
- Tropospheric and trans-ionospheric radio propagation research
- Solar physics, Solar Terrestrial Interactions, Space Weather
- Human space technology Initiative
- Space debris

Operations

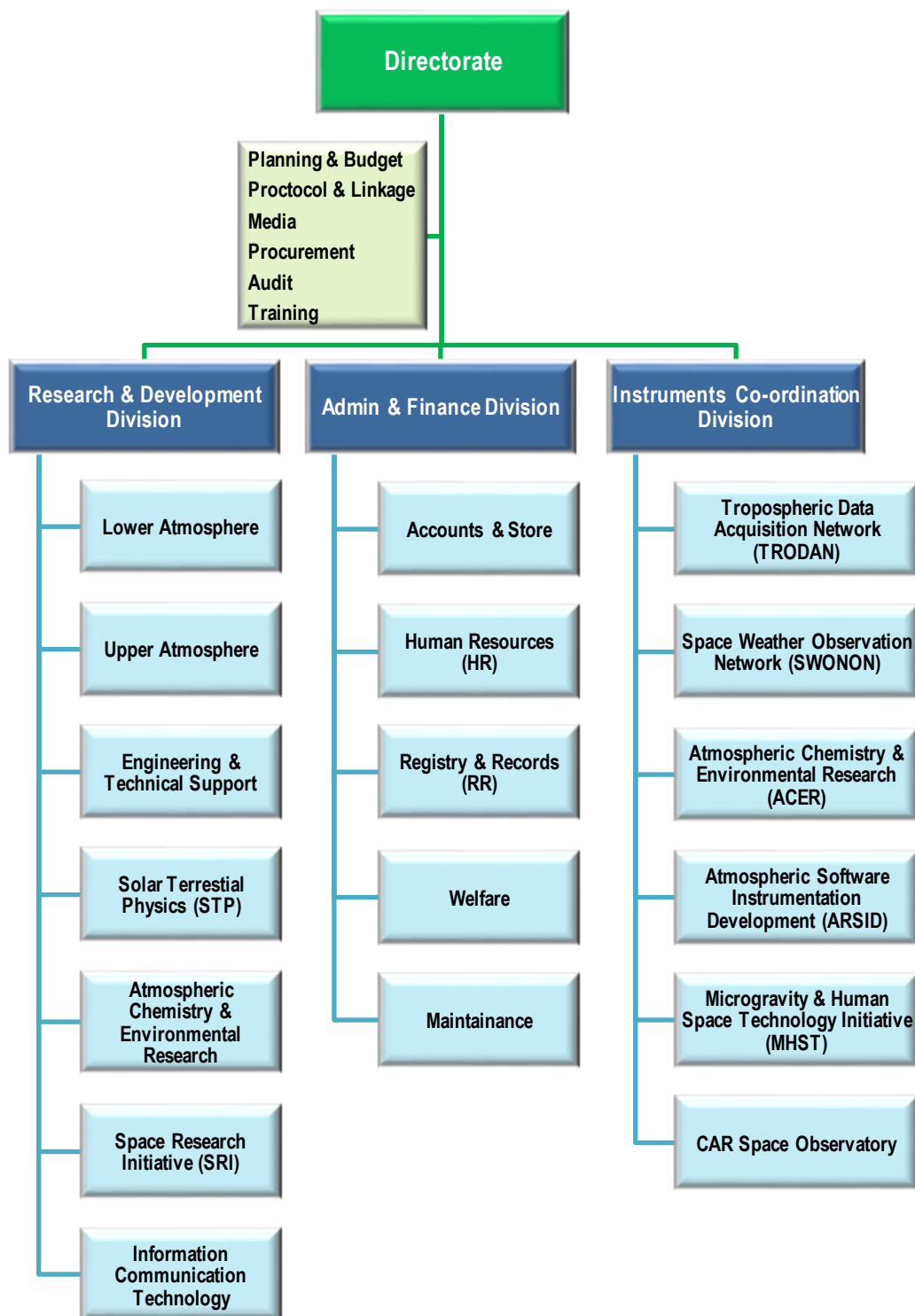
CAR is envisioned to operate in three modes: Observations, Training and Research





Centre Organogram

Our staff commitment has been one of the contributing factors to our rays of success and great work synergy. Our values and structure are the foundation on which our work is built and we are proud our Centre is established and run by experienced and committed professionals.





Technical Division

The technical division of CAR is made up of the following seven specialised units:

- i. **Lower Atmosphere LA:** The unit concentrates on research that has to do with lower portion of the atmosphere right from the sea surface through the entire spectrum of the troposphere.
- ii. **Upper Atmosphere UA:** The unit focuses on the study of the Ionosphere and magnetosphere of the Earth and other planets.
- iii. **Solar Terrestrial Physics STP:** Solar physics, Solar Terrestrial Interactions and Space Weather (Sun and heliosphere).
- iv. **Atmospheric Chemistry & Environmental Research ACER:** Environmental research, environmental impact assessment, environmental pollution, atmospheric chemistry.
- v. **Space Research Initiative SRI:** Human space technology Initiative – medical geography, Magneto-biology, space experiments as it affects agriculture, medicine and vaccine development etc, Space debris.
- vi. **Engineering and Technical Support:** Instrumentation development, maintenance of atmospheric monitoring facilities, development of equipment from locally available materials and imported sensors.
- vii. **Information Communication Technology ICT:** Software development for atmospheric research, telemetry, data portal management.

Major Active Research Projects at CAR

- i. **Space Weather Observation Network over Nigeria- SWONON**
 - Network of ground-based space observatories (facilities include magnetometers, digisondes, Ionospheric GPS monitors, optical imagers)
 - Nowcasting of state of space environment
 - Enhancement of performance of Space-based technologies
- ii. **Tropospheric Data Acquisition Network – TRODAN**
 - Network of ground stations monitoring lower atmospheric parameters (automatic weather stations, rain Radar)
 - Improvement of space-earth communication systems



iii. Atmospheric Chemistry and Environment Research – ACER

- Establishment of network of stations monitoring air quality in the atmosphere (sample collection, trace detection facilities)
- Air pollution control
- Air Quality Measurements

iv. Microgravity and Human Space Technology – MHST

- Simulating microgravity experiments that are performable in the space environment
- Food security and drug/vaccine developments

v. Atmospheric Research Software and Instrumentation Development - ARSID

- Indigenous development of Software and Instrumentation for Atmospheric Research
- Real-time maps of atmospheric parameters over Nigeria
- Now-cast of space weather over Nigeria
- Control of capital flight



Centre for Atmospheric Research

National Space Research and Development Agency

**Annual Report For
The Year 2015**

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MEMORANDUM OF UNDERSTANDING

The Centre successfully initiated Memoranda of Understanding between CAR/NASRDA and the following Institutions in 2015:

- i. UCAR/NCAR, Boulder, Colorado, USA
- ii. Osun State University, Osogbo
- iii. Bayero University, Kano
- iv. WASCAL, Akure

ACTIVITIES SUPPORTED AND ORGANISED BY THE CENTRE

In line with its mission statement, the Centre for Atmospheric Research (CAR) has enhanced its visibility in atmospheric research within and outside the shores of Nigeria through the strategic planning and implementation of a host of laudable programs listed below as part of its achievements in 2015.

International School on Equatorial and Low-Latitude Ionosphere (ISELLI). 14th -18th September, 2015

The Centre for Atmospheric Research Anyigba in collaboration with the Solar-Terrestrial Environment Laboratory, Nagoya University, Japan, Scientific Committee on Solar Terrestrial Physics SCOSTEP; and SCOSTEP's Variability of the Sun and Its Terrestrial Impact VarSITI programme organised the *International School on Equatorial and Low-Latitude Ionosphere (ISELLI)*.

The School was designed to educate postgraduate students and researchers on how to make use and analyse data retrieved from the newly installed *All-sky air-glow optical imager*. No fewer than 80 participants attended the "summer school" from 10 different countries across the world. Major speakers at the international school were:

- i. Prof. Kazuo Shiokawa, STEL, Nagoya University, Japan
- ii. Prof. Babatunde Rabiun Director, CAR
- iii. Dr. Yoshikawa Akimasa- ICSWSE, Kyushu University
- iv. Dr. Shuji Abe – ICSWSE, Kyushu University



Other CAR scientists and Engineers who participated in the workshop were: Mr. Najib Yusuf, Mr. Elemo Enoch, Dr. Daniel Okoh, Engr. Adedaja Oluwaseye, Mr. Solomon Jatto, Mrs. Aderonke Obafaye, Mr. Ezekiel Josiah, Mr. Timiyo Justice, Mr. Onuigbo Ifeanyi, Mr. Otu Jubril, Mr. Eze Francis, Mr. Shehu Sarafadeen and Mr. Mu'ayiwa Sani.

The International Workshop on Space Weather and Earth's Surface Phenomena; 11th -15th May 2015

The International workshop was organised by the Centre for Atmospheric Research, Anyigba in conjunction with the Bells University of Technology, Ota. Space weather has been described as a prevailing condition occurring around the space environment which may affect objects that are located within the region and technologies that are space-dependent. Today's navigational systems, communication and even financial transactions focus largely on space technological advancement and its efficiency to the society. Bells University of Technology has since 2012 played host to this annual contemporary revolutionary scientific meeting.

The workshop also aimed at fostering collaboration and training postgraduate students and researchers globally on the space weather activities and its impact on our environment. This attracted a total number of 40 participants from different part of the continents.

The workshop featured facilitators from CAR, Bells and other Space Science research community. Major speakers at the workshop were:

- i. Professor Babatunde Rabi, Director, CAR-NASRDA
- ii. Professor Christine Mazaudier, France

Also present at the conference too were members of staff from the Centre for Atmospheric Research Anyigba in persons of Mr. Enoch Elemo, Mr. Jatto S. S, Mr. Eze F.N, and Mrs. Aderonke Obafaye.

Setting up of Space Environment Research Laboratory (SERL), Abuja

The Centre with the support of the NASRDA has successfully set-up a state of the art research laboratory within the NASRDA Headquarters. Also, the Centre has provided an alternative solar power system to mitigate the risk of elliptic power supply currently bedevilling the country. The SERL houses the following equipment; All Sky Optical Imager, MAGDAS and AMBER Magnetometers, Fabry-Perot Interferometer (FPI).



Setting up of Atmospheric Facilities

The Centre in partnership with other research agencies within and outside the country has successfully made available some atmospheric research facilities to uphold its mandate in quality research and other related sciences listed below:

Installation of All Sky Optical Imager

The installation of the all sky optical imager is first of its kind in West Africa continent. The installation was successfully carried out between 5th - 12th June 2015. Prof. Shiokawa of STEL, Nagoya University, Japan supervised the Engineers and Scientists of the Centre during the installation. The modern atmospheric equipment shall gather ionospheric information such as plasma bubbles within our region.

Other CAR scientists and Engineers who participated in the installation were; Mr. Najib Yusuf, Mr. Enoch Elemo, Dr. Daniel Okoh, I. A. Musa, Engr. Adedaja Oluwaseye, Mr. S.S. Jatto, Mrs. Aderonke Obafaye, and Mr. Ezekiel Josiah.

Relocation of MAGDAS & AMBER Magnetometer

The Centre has effectively relocated the MAGDAS & AMBER magnetometers facilities to the newly set up Space Environment Research Laboratory (SERL), Abuja. Dr. Shuji Abe and Mr. Nishigushi of ICSWSE, Kyushu University Japan and our Centre's technical personnel played a major role in relocating the facilities.

Installation of Fabry-Perot Interferometer FPI

Another laudable effort of the Management of the Centre led by the proficient Director, Prof. Babatunde Rabi was the facilitation and selection of CAR's SERL site for installation of FPI by Dr. Qian Wu of NCAR, Colorado, and USA. The Fabry-Perot Interferometer (FPI) which was carried out from 4th-11th November, 2015.

Other CAR scientists and Engineers who participated in the installation exercise are: Dr. Daniel Okoh, Engr. Adedaja Oluwaseye, Mr. S. S. Jatto, Mrs. Aderonke Obafaye, Mr. Ezekiel Josiah and Dr. S.O Bolaji from University of Lagos who played a major role during the installation of the FPI.

Installation of TRODAN Automatic Weather Station at UNIAGRIC, Makurdi

The TRODAN manager, Mr. Najib Yusuf led the TRODAN team to install an automatic weather station at the University of Agriculture from 10th- 12th September, 2015. This recently installed



station is equipped with updated Data logger software that presents the atmospheric weather parameters at 5 minutes, hourly, monthly and yearly data respectively. Besides the TRODAN manager, Engr. Adedoja Oluwaseye and Mr. Ezekiel Josiah were also on ground during the installation.

PARTICIPATION IN CONFERENCES AND WORKSHOPS

In a quest to uphold its mission statement, the Centre for Atmospheric Research (CAR) has actively participated in the following conferences and workshops listed below:

Nigerian Geophysical Society Conference, Covenant University, Ota 17th -20thMarch, 2015

The Nigerian arm of the African Geophysical Society (NGS) held her 2nd Annual Conference themed ***“The role of the Earth and its Atmosphere on our Technology”***. The conference had eminent scientist in attendance with paper presentations from scientist working in the field of Earth and Space Science. The president of NGS, Dr Olukayode Falayi reiterated the need for scientist to carryout research that is environmentally friendly which can also be appreciated by the common man.

Prof. Babatunde Rabi, Prof. Chukwuma, Prof. Osazuwa, Dr (Mrs) Rabia among others played vital roles in making the conference a success.

NeQuick Latest Developments and Advanced Uses. 4th May- 8th May, 2015 at ICPT, Trieste, Italy

The conference was organised by the Abdul Salam International Centre for Theoretical Physics in Trieste Italy for researchers. The CAR director, Prof. Babatunde Rabi accompanied by Dr. Daniel Okoh participated in the conference and gave a presentation lecture titled: *“An Assessment of the NeQuick as a topside option on the IRI”*.

Uncertainty in Climate Modelling and Projection, 13th July- 18th July, 2015. ICTP, Trieste, Italy

The workshop was organised by the Abdul Salam International Centre for Theoretical Physics, Trieste Italy for researchers on climate modelling. Mr. Najib Yusuf participated in the workshop and presented a paper titled *“Preliminary results of Temperature Modelling using Neural Networks”*.



African Geophysical Society Conference. 21st September – 25th September, 2015. Nairobi, Kenya

The African Geophysical Society (AGS) is a dynamic, innovative, and interdisciplinary scientific association committed to the pursuit of understanding of Earth and Space for the benefit of mankind.

The fundamental objectives of AGS are to: (i) promote the study of the Earth, other planets and Space; and their environments in Africa, (ii) Promote cooperation between scientists and among scientific organizations involved in geophysics and related disciplines, (iii) initiate and participate in research programs in Earth sciences, space science and related disciplines, (iv) Advance the various relevant disciplines through scientific discussion, publication, and dissemination of information and (v) encourage programmes and research in geophysics, space science and other related disciplines that will advance economic development and sustainable growth in the African region.

The Society held its 2nd Annual conference in Nairobi, Kenya between 21st - 25th September, 2015. The Conference Programme consisted of a series of sessions with technical presentations, plenary presentations, panel discussions and working group meetings. Centre for Atmospheric Research, National Space Research and Development Agency, Anyigba, Nigeria, Scientific Committee on Solar Terrestrial Physics SCOSTEP and Variability of the Sun and Its Terrestrial Impact VarSITI sponsored the event. Over to 20 Scientist from 5 countries participated.

Highlights of the Programme included the Award of Fellows of the AGS to deserving scientists. The awardees were;

- Prof. Sunandan Basu- Institute for Scientific Research, Boston College, USA
- Dr. Keith Groves-Institute for Scientific Research, Boston College, USA
- Prof. Christine Amory Mazaudier - LLP/ Polytechnique /UMPC/CNRS, Paris, France
- Prof. Jacob O.Adeniyi- University of Ilorin, Ilorin, Nigeria
- Prof. Lee-Anne Mckinnell- South African National Space Agency, Hermanus, South Africa.
- Prof. Toshihiko Iyemori-Director, World Data Centre for Geomagnetism, Kyoto



Society for Environmental Toxicology and Pollution Mitigation SETPOM. 22nd -23rd September, 2015. Lagos, Nigeria

The Board of Trustees of the Society for Environmental Toxicology and Pollution Mitigation (SETPOM) conferred SETPOM's Fellowship awards on some eminent scholars and other professionals. They include the Pioneer Director and Chief Executive of the Centre for Atmospheric Research of the National Space Research and Development Agency (NASRDA), Prof. Babatunde Rabi'u and Professor Sonnie Oniye of the Department of Biological Sciences, Ahmadu Bello University, Zaria; Prof. Ademola Omojola of the Department of Geography, University of Lagos; Prof. Lucy Afuluenu Nwuba, Dean, Faculty of Agriculture, Nnamdi Azikwe University.

Others were Mr. Toyin Onisarotu, the Permanent Secretary, Lagos State Ministry of Agriculture; Dr. Titilayo Anibaba, General Manager, Lagos State Parks and Gardens (LASPARK); Mrs Olufunke Bamgbose of the Nigerian Petroleum Development Company Limited (NPDC); Mr Adebola Shabi, General Manager, Lagos State Environmental Protection Agency (LASEPA) and Prof. Nurudeen Olasupo of the Department of Microbiology, Lagos State University, Ojo. They were conferred with the fellows during the conference with the theme: "Environmental Management, Safety and Security," which was held at the University of Lagos, Akoka.

The President of SETPOM, Dr. Funmilayo Doherty of the UNESCO-UNEVOC Centre, Yaba College of Technology said the award of fellowship conferred on the recipients was a product of their outstanding contributions to the profession of safeguarding the environment, which is humanity's common heritage. Mr S.S Jatto, a staff of the Centre received the award on behalf of the Director.

The 14th International Symposium on Equatorial Aeronomy. 19th – 23rd October, 2015. Bahir Dar University, Ethiopia

The International Symposium on Equatorial Aeronomy (ISEA) is prepared once every three to four years since it was inaugurated in 1962 in Peru. Lower atmosphere, ionosphere scientists and experts are gathered in this event to share their new findings and also to develop strategies to tackle potential issues in their field. The 14th International Symposium on Equatorial Aeronomy was held from 19th to 23rd of October 2015 at Amhara Regional State House of Representatives



Hall and Bahir Dar University, in Ethiopia. Professor Babatunde Rabiú led scientist from Nigeria including Mr Seun Elemo to the meeting.

Organisation of Women in Science in Developing Countries (OWSD) Conference 1st – 4th November, 2015

The Organisation of Women in Science in Developing Countries (OWSD) –FUTA held her 2nd International Conference and Exhibition. The program which had as its theme, ‘**Role of Women in Science for World Security**’ was held at the Federal University of Technology, Akure, Ondo State, Nigeria.

The Lecture titled “Global Health and National Security: Prospects and Challenges in a Developing World” was delivered by Major General Dr. Tilewa Amusu- Director & Chief Consultant Haematologist, 44 Nigerian Army Reference Hospital, Kaduna. Women in various field of science were in attendance among whom were; Professor Ahbor Dolly Ighoroje, Dr Mrs. Eno E. Ituen, Professor Ibiyinka Fuwape, Dr. Helen Ogunsuyi and many other. The director of CAR Professor Babatunde Rabiú was represented by Mrs Aderonke Obafaye.

International Union of Radio Science URSI-NG. 2nd – 5th December, 2015. Ilorin, Nigeria

The International Union of Radio Science URSI-NG Held her 6th National Annual Conference with the theme: “**Space weather, Communication systems and National Security**”. The University of Ilorin played host to radio scientist across Nigeria. Also present at the event was the Director General of NASRDA ably represented by Professor Babatunde Rabiú.



PHOTO PANORAMA



Staff of CAR with Dr Qian Wu of the National Centre for Atmospheric Research, NCAR during the installation of the FPI at the Space Environment Research Laboratory, Abuja in November 2015



Cross Section of Participants at the 2015 AGS Conference held in Nairobi, Kenya. Between 21st-25th September 2015



Cross Section of Participants at the International School on Equatorial and Low Latitude Ionosphere (ISELLI) co-sponsored by CAR. Between 14th-18th September 2015.



SPECIAL ADMINISTRATIVE/TECHNICAL TRAINING

- i. Engr. Umar. A. Saleh spent about three (3) weeks at the National Centre for Atmospheric Research/ University Cooperation for Atmospheric Research, Boulder Colorado, USA between 11 and 29 May, 2015. The training was part of the effort of the management on the capacity development of our personnel. The technical training was on ozone instruments and calibration, data visualisation and air quality measurement. The training also included canister analysis of volatile organic compounds procedures and setting up of the instrumentation.
- ii. Mr. Najib Yusuf participated in the tutorial on “Community Earth System Model (CESM) from 10th – 14th August, 2015 at the National Centre for Atmospheric Research NCAR, Boulder Colorado, USA.
- iii. Workshop on “Optimum funds Management in the Midst of Cash flow” was held from 27th- 29th January, 2015 at Sheraton Hotel & Towers, Ladi Kwali, Conference Centre, Wuse Zone 4, Abuja. As part of the efforts of the management of the Centre to ensure that her staff are kept abreast of the financial/accounting techniques, two (2) staff of the centre attended the three-day workshop for Ministries, Departments and Agencies of the federal government jointly organised by the Office of the Accountant General of the Federation and the Federal Ministry of Finance. CAR staff who participated in the workshop are Mr Ogbeiwi. O. Kenneth and Mr Omede Michael.
- iv. In-House Training Workshop on “International Public Sector Accounting Standard (IPSAS) Accrual Basis for Transcript of Accounts” was held from 19th - 21th November, 2015. The training was held at the Centre for Basic Space Science (CBSS), Nsukka, Nigeria. CAR staff participants were Mr Ogbeiwi .O. Kenneth, Mrs Onuh Joyce .O, Mr Adejoh Isaac, Mr Hamza Yusuf, and Mr Omede Michael. In addition, Mr Aghedo Jude, Mr David Onimisi and Mrs Ndah Ojoago also participated in the training.
- v. Training on the "Integrated Personnel Payroll Information System (IPPIS)" was held at the Space Environment Laboratory Research, Abuja from 30th November - 2nd December,



2015. The training captured the functions of payroll officers and human resource officer. Participants of the training are Mr Kenneth Ogbeiwi, Mrs Onuh Joyce and Mrs Aderonke Obafaye.

The Centre's Accounting Unit has been very active in the following areas;

- Regular submission of monthly report to the office of the Accountant General of the Federation (OAGF) in compliance to IPSAS. The reporting staffs are Mr Kenneth Ogbeiwi Osalumense and Mrs Onuh Joyce
- Submission of annual report to the office of the Accountant General of the Federation (OAGF) in compliance to IPSAS. The reporting staffs are Mr Kenneth Ogbeiwi Osalumense and Mrs Onuh Joyce
- Establishment of Integrated Personnel Payroll Information System (IPPIS) Office in the accounting unit. The current payroll officers are Mr Kenneth Ogbeiwi and Mrs Onuh Joyce
- Monthly updating of cash book, vote book, account register and proper passing of voucher payment

CAR ORGANISED SPACE OUTREACH PROGRAMME FOR NEXT GENERATION OF SCIENTISTS

The programme was organised for school children within the categories of Junior Secondary School (JSS) 1 to Senior Secondary School (SSS) 1 as a way of motivating their interests in the field of sciences and as well as familiarising them with the activities of the National Space Research and Development Agency and its activity Centres; chief of which is **"The Centre for Atmospheric Research"**.

During the programme, guest students toured and acquainted themselves with the Tropospheric Data Acquisition Networks Project (TRODAN), Anyigba station. CAR's technical personnel highlighted the essence of the project and the atmospheric parameters that the facility measures and monitors such as: Wind Direction, Wind Speed, Rain Rate, Solar Radiation, Relative Humidity, Air Temperature, Soil, Temperature, Soil Volumetric Water Content and Barometric Pressure. At the end of the teaching, the students were availed the opportunity to ask questions thereafter, respective answers and explanations were adequately given.



Furthermore, the Centre also organised a seminar for the students titled “CAREER GUIDE IN SPACE SCIENCES FOR SECONDARY SCHOOL STUDENTS” which was presented by Mr. Ikani Ojochenemi. Facts about space science were highlighted and discussed after which he counselled the students on subjects to offer to become a sought after future Space Scientists.

FUTA 70TH INAUGURAL LECTURE PRESENTATION ON 7TH JULY, 2015

The 70th Inaugural lecture of the Federal University of Technology, (FUTA), Akure, Ondo state was delivered by Prof. Babatunde Rabi, the Director of the Centre for Atmospheric Research, Anyigba, Kogi State on 7th July, 2015.

The lecture which was tagged: “*Terrestrials and Extra-Terrestrials: Divine Nexus for Man’s Comfort*” provided a better chance for the renowned scientist to analyse facts of his research activities, achievements, contributions and its usefulness to the wider society.

He urged the young scientists to emulate the current global research method to address the various challenges eminent in their various communities, this as he said, would give Nigerians better opportunities in international relations and technology advancement.

The 70th inaugural lecture was well attended by numerous notable organisations and Universities like NASRDA, CSTD, UNILORIN, UNN, ARCSSTE-E, YABA College of Technology, other dignitaries at the event were representatives from Ondo State Ministry of Science and Technology, representatives from Unicef as well as traditional rulers within and outside the state.

INDOOR SEMINARS

- i. *Nigerian Energy Crisis: Seeking Solution in Nuclear and Biotechnology* by Mr. Ikani Ojochenemi on 25th February, 2015.
- ii. *ARSID PROJECT: Promoting Indigenous Space Instrumentation Competence* by Engr. Adedola Oluwaseye (ARSID Team) on 25th March, 2015.
- iii. *Design of a low cost Temperature Logger* by Timiyo Justice (ARSID Team) on 25th March, 2015.
- iv. *Tropospheric Data Acquisition Network TRODAN* by Mr. Najib Yusuf on 24th June, 2015.



- v. *Human Alteration of the Nitrogen Cycle: Consequences and Solutions* by Otu Jubril on 29th July, 2015.
- vi. *Solar Activities and Climate Change* by Mr. Elemo Enoch on 26th August, 2015.
- vii. *Temperature Prediction Software for Anyigba Metropolis* by Mr. Musa I.A. (ARSID Team) on 26th August, 2015.
- viii. *Technical Report from three-week capacity development training at NCAR, USA* by Engr. Umar Saleh on 9th September, 2015.

COLLABORATION MEETING/ OFFICIAL VISIT TO INSTITUTIONS

- Osun State University, Osogbo. 18th April, 2015.
- Federal University, Lokoja. 31st July, 2015.
- Landmark University, Omu-Aran. 2nd December, 2015.
- Bayero University, Kano. 5th August, 2015
- WASCAL-FUTA. 12th August, 2015.

SOME VISITING SCIENTISTS TO CAR/SERL

1. Prof Kazuo Shiokawa, STEL, Nagoya University, Japan
2. Dr Yoshikawa Akimasa- ICSWSE, Kyushu University
3. Dr Shuji Abe – ICSWSE, Kyushu University
4. Mr Nishigushi- ICSWSE, Kyushu University
5. Dr Bolaji Olawale-UNILAG
6. Dr Elijah Falayi- TASUED, Ijebu- Ode
7. Mr Folarin Jonah- National Institute for Space Research, Brazil
8. Prof A. Onugba- DVC Salem University, Lokoja
9. Dr Olawepo A. Olayinka- Landmark University, Omu-Aran
10. Nada Ellahonny- Space Weather Center, Egypt
11. Dr Wu Qian-NCAR,Boulder,USA
12. Mrs Jewel Ibang- UNICAL
13. Mr Tuyizere Sarathiel- University of Rwanda
14. Col. K. Ogbale



15. Shakir A - Sudan Khartoum
16. Engr S.A Orogade
17. Dr Spencer Onuh- Director, CSTD
18. Dr B.C Isikwue- Dept of Physics, university of Agriculture, Makurdi

Staff on Graduate Training

- i. Engr. A. U. Saleh: M.Eng., Electrical Electronic Engineering, Abubakar Tafawa Balewa University, Bauchi
- ii. Eze, N.: M.Sc., Physics, Ebonyi State University, Abakaliki
- iii. Musa, I. A.: M.Sc., Computer Science, Kogi State University, Anyigba, Nigeria
- iv. Rufai Mohammed: M.Sc., Pol. Science Nasarawa State University, Nigeria
- v. Solomon S. Jatto: PhD., Physics, Ahmadu Bello University, Zaria
- vi. Mu'ayiwa Sani; M.Sc., Physics, University of Ilorin, Nigeria
- vii. Jibrin Otu: M.Sc., Chemistry, Kogi State University, Anyigba, Nigeria
- viii. Omale R.: M.A., Kogi State University, Anyigba, Nigeria
- ix. Timiyo T. J.: M.Sc., Physics, Kogi State University, Anyigba, Nigeria
- x. Balogun, T. A.: PhD., Agric. University of Fort Hare, South Africa.

Staff who completed Graduate Programmes

- i. Najib Yusuf: M.Sc. Physics, Ebonyi State University, Abakaliki
- ii. Suleiman Abdulrahman: M.Sc., MIS University of Technology, Malaysia



PUBLICATIONS 2015

The following are the publications made by staff of the Centre during the period under review.

1. Najib Yusuf and Ayantunji, B.G. (2015). Correlation between the Sunspot Number and Troposphere Surface Refractivity in a Tropical Region. Journal of Atmospheric and Solar Terrestrial Interactions. Volume 133. P (1-6).
2. Said, R.S., Gabriel, F.I., Garba, M.B. and Najib Yusuf., (2015). Variation of Solar Radiation and its Correlation with Weather Parameters using Statistical Analysis at Yola, North-Eastern Nigeria. Journal of the Nigerian Association of Mathematical Physics. Volume 29, P (319-324).
3. Daniel Okoh and Moses Ochidi (2015). A Study on the effects of Geomagnetic Storms on Ionospheric Total Electron Content over Nigeria Using the GNSS. Journal of Applied Physical Science International. Accepted
4. Adedaja O.S., Ayantunji, B.G., Saleh, U.A., Jatto, S.S (2015). Diurnal and Seasonal Variation of Global Solar Radiation at Anyigba, North-Central Nigeria. International Journal of Engineering Science and Innovative Technology (IJEST) Vol. 4, Issue 4, P (140-145).
5. Daniel Okoh and Samuel Oliha (2015). A Study of Total Electron Content Variations over Abuja (Nigeria) using the GNSS. Journal of Space Science& Technology, 4(3).
6. A.O. Akala, E.O. Somoye, A.O. Adewale, E.W. Ojutalayo, S.P. Karia, R.O. Idolor, D. Okoh, P.H. Doherty (2015). Comparison of GPS-TEC observations over Addis Ababa with IRI-2012 model predictions during 2010–2013. Advances in Space Research, 56(8), DOI:10.1016/j.asr.2015.07.017.
7. B. I. Okere, D. I. Okoh, I. A. Obi, P. N. Okeke, F. E. Opara (2015). In search of a viable IAU-OAD Regional Node: A case for Africa. Proceedings of the International Astronomical Union; 10(H16):559. DOI: 10.1017/S1743921314012149
8. Enoch Oluwaseun Elemo, Daniel Okoh (2015). Features of the Ionosphere around the Time of the 5th August, 2014 M5.5 Orkney Earthquake. Open Access Library Journal; 02(06): 1-7. DOI:10.4236/oalib.1101566
9. Bolaji, O. S., A. B. Rabi, O. R. Bello, A. Yoshikawa, K. Yumoto, O. O. Odeyemi, and O. Ogunmodimu, 2015. Spatial variability of solar quiet fields along 96° magnetic meridian in



- Africa: Results from MAGDAS, J. Geophys. Res. Space Physics, 120, doi: 10.1002/2014JA020728.
10. Okoh, D., McKinnell, L., Cilliers, P., Okere, B., Okonkwo, C., Rabiou, A. B., 2015. IRI-vTEC versus GPS-vTEC for Nigerian SCINDA GPS stations, *Advances in Space Research*, 55, 1941–1947. DOI: 10.1016/j.asr.201
 11. Bolaji, O. S., Izang, P. A., Oladosu, O. R. Koya, F., Fayose, R. S., and Rabiou, A. B., 2015. Ionospheric Time-delay over Akure Using Global Positioning System Observations. *ActaGeophysicae*, DOI: 10.1515/acgeo-2015-0018.
 12. Rabiou, A. B.; Ogunsua, B. O.; Fuwape, I. A.; Laoye, J. A., 2015. The transient variation in the complexes of the low-latitude ionosphere within the equatorial ionization anomaly region of Nigeria. *Nonlin. Processes Geophys.* 22, 527–543, 2015. www.nonlin-processes-geophys.net/22/527/2015/ doi: 10.5194/npg-22-527-2015.
 13. Okoh, D., Yusuf N., Adedaja, O. S., Musa, I., and Rabiou, A. B., 2015. Preliminary results of temperature modelling in Nigeria using neural networks. *Weather*, 70(12), 336 – 343.
 14. Adebisin, B. O., A. B. Rabiou, J. O. Adeniyi, and C. Amory-Mazaudier, 2015. Night-time morphology of vertical plasma drifts at Ouagadougou during different seasons and phases of sunspot cycles 20–22, J. Geophys. Res. Space Physics, 120, doi: 10.1002/2015JA021737.
 15. Saleh, U. A., Y.S. Haruna, and F.I Onuigbo. (2015). Design and Procedure for Stand-Alone Photovoltaic Power System for Ozone Monitor Laboratory at Anyigba, North Central Nigeria. *International Journal of Engineering, Science and Innovative Technology India*. Volume 6 Issues 5, 2015.
 16. Saleh, U. A., Y.S. Haruna and Adedaja O. S. (2015). Evaluation of the Global Solar Radiation for Electricity Generation at Anyigba, Kogi state North Central, Nigeria. *International Journal of Engineering and Science*. . Vol. 15 Issues 6
 17. Suleiman Abdulrahman (2015) Web 2.0 Collaborative Tools for SMEs *ARNP Journal of Engineering and Applied Science*. Pages: 17833 - 17842



LATEST COUPLE IN CAR FAMILY

- Mr. Suleiman Abdulrahman of ICT unit married Hajia Zuwara Ibrahim on 4th April, 2015
- Mr. Yusuf Adamu of Record Unit got married to his dearest, Miss Mariam on 5th of April, 2015 at Ankpa Kogi State.
- Mr. John Akolo of Engineering & Technical Support Unit got married to his sweetheart, Miss Queen. A. Emmanuel on the 28th of November, 2015 at Lafia, Nasarawa State.
- Mr. Hussein Garacci of Audit Unit got married to his heartthrob, Miss Hadizat on the 5th December, 2015 at Katsina State.

NEW ADDITION TO CAR FAMILY

- Engr. Adedoja Oluwaseye of Engineering and Technical Support Unit gave birth to a baby boy on 30th January, 2015.
- Engr. Umar Saleh of Engineering & Technical Support Unit gave birth to a baby boy on 7th April, 2015.
- Mr. Otu Jubril of Atmospheric Chemistry Unit gave birth to a baby boy on 29th June, 2015.
- Mr. Timiyo Justice of Engineering & Technical Support Unit gave birth to a baby boy on 3rd July, 2015.
- Mrs Peace Onalo of Registry Unit gave birth to a baby girl on 7th July, 2015.



List of Abbreviations and Acronyms

NASRDA	-	National Space Research and Development Agency
CAR	-	Centre for Atmospheric Research
STP	-	Solar Terrestrial Physics
LA	-	Lower Atmosphere
UA	-	Upper Atmosphere
ACER	-	Atmospheric Chemistry and Environmental Research
SRI	-	Space Research Initiative
ICT	-	Information Communication Technology
TRODAN	-	Tropospheric Data Acquisition Networks Project
SGAC	-	Space Generation Advisory Council
ARSID	-	Atmospheric Research Software and Instrumentation Development
ISELLI	-	International School on Equatorial and Low-Latitude Ionosphere
SERL	-	Space Environment Research Laboratory
SEERL	-	Space Earth-Environment Research Laboratory
OWSD	-	Organisation of Women in Science in Developing Countries
SETPOM	-	Society for Environmental Toxicology and Pollution Mitigation
FPI	-	Fabry - Perot Interferometer
NCAR	-	National Centre for Atmospheric Research
GNSS	-	Global Navigation Satellite Systems
SWAP	-	Space Weather and Atmospheric Physics Laboratory
SEERL	-	Space-Earth Environment Research Laboratory
MoU	-	Memorandum of Understanding
STP	-	Solar Terrestrial Physics
LA	-	Lower Atmosphere



UA	-	Upper Atmosphere
SWONON	-	Space Weather Observation Network over Nigeria
MHST	-	Microgravity and Human Space Technology
SCOSTEP	-	Scientific Committee on Solar Terrestrial Physics
ICTP	-	International Centre for Theoretical Physics
AGS	-	African Geophysical Society
ISEA	-	The International Symposium on Equatorial Aeronomy
CESM	-	Community Earth System Model
IPPIS	-	Integrated Personnel Payroll Information System
IPSAS	-	International Public Sector Accounting Standard
OAGF	-	Office of Accountant General of the Federation
FUTA	-	Federal University of Technology Akure
CSTD	-	Centre for Satellite Technology Development
UNN	-	University of Nigeria, Nsukka



Centre for Atmospheric Research

National Space Research and Development Agency

Annual Report For The Year 2016

www.carnasrda.com

Creating Opportunities.....



ACTIVITIES SUPPORTED AND ORGANIZED BY THE CENTRE

In line with its mission statement, the Centre for Atmospheric Research (CAR) has enhanced its visibility in atmospheric research within and outside the shores of Nigeria through the strategic planning and implementation of a host of laudable programs listed below as part of its achievements in 2016.

WHY SPACE? 12th April, 2016

The Centre for Atmospheric Research (CAR) in conjunction with Space General Advisory Council (SGAC) organized a one-day space workshop tagged “WHY SPACE” on the 12th of April, 2016 at the Kogi State University Auditorium Complex, Anyigba.

3rd National Conference of Women in Physics

From June 14th to 16th June 2016 the Centre in Conjunction with Women in Physics organized the **3rd National Conference of Women in Physics** Conference (Nigeria Chapter). The 3-day event took place at the Kogi State University Campus Library Conference Hall. Participants arrived on the 14th of June 2016 and were lodged at the Harbor Bay Hotel, Anyigba. The theme of the Conference was ‘**Science and Technology in National Economic Recovery**’. The conference was geared towards empowering the female gender to choose and continue in Physics career at industrial and academic levels. An essential futuristic aim of the conference is to ensure that physics will be taught by teachers who enjoy teaching physics above everything else at all levels.

The program started at about 10:00 am on Wednesday, 15th June of 2016. The conference commenced with an opening ceremony which featured the citation of the Nigerian national anthem. The Guest Speaker at the auspicious event was Professor Christine Amory Mazaudier, An international award winner in Physics from the University of Paris, France. The President of the Women in Physics (Nigeria), Prof. (Mrs) I.A Fuwape, the Director of the Centre for Atmospheric Research, Anyigba, Prof. Babatunde Rabiú and many distinguished academicians were at the opening ceremony. Prof. Babatunde Rabiú who also doubled as the chief host of the conference gave the opening remark; which was followed by the welcome address delivered by Prof. (Mrs) Fuwape with details of the achievement of the WIP recorded so far.

Plenary papers were delivered by Professor Christine Amory Mazaudier, Dr. (Mrs) Rabia from BUK, Kano, and Dr. (Mrs) Mojisola from University of Ibadan. Quiz competition was organized during the opening ceremony for secondary schools in Kogi State which focused on Physics amid



female representatives. Four (4) out of five (5) invited schools were represented: Royal Success Academy, Abejukolo; Living Stone Secondary School, Anyigba; Federal Government College, Ugwolawo; Ochaja Girls Secondary School, Ochaja and SS Peter and Paul, Egume.

At the end of the quiz competition, Ochaja Girls Secondary School, Ochaja came 1st, Federal Government College, Ugwolawo was the runner-up while SS Peter & Paul, Egume came 3rd at the quiz competition. Certificate of participation were given to all the schools present and certificate of award alongside prizes were presented to the 1st, 2nd and 3rd position.

The activities executed in the conference followed a well-structured program. The opening ceremony was brought to a close with closing remark by the LOC Chairman, Engr. Adedaja, Oluwaseye. S.

Setting up Atmospheric Facilities and Maintenance

The Centre in collaboration with its partners has successfully installed some atmospheric facilities to advance its mandate in atmospheric research and other related sciences and also carry out maintenance routine on some of our facilities which includes;

Upper Air Sounding System

The ALIFIG International Limited is an indigenous company that donated the Upper Air Sounding System to the Nigerian Space Agency. The equipment was particular with the centres' mandate and was agreed to be installed in the Centre for Atmospheric Research, Anyigba. ALIFIG representative arrived Anyigba on Friday 8th April 2016 for the installation. The technical team together with the ALIFIG representative worked throughout the weekend to make sure the installation was successful. On Monday afternoon, the installation was completed and ready for the first test. But due to the unavailability of hydrogen gas generator which is supposed to be used to pump the balloon; the balloon could not go higher as expected. The ALIFIG representative assured that once the balloon is pumped with the said gas, it can go as high as possible to the extent it will no longer be visible with naked eyes.

GNSS (Global Navigation Satellite Systems) Receiver at SEERL, University of Benin

The GNSS receiver was installed between 19th – 21st October, 2016 at the Space Earth-Environment Research Laboratory located within University of Benin, Benin City. Dr. Daniel Okoh led the installation team and in attendance were coordinator of the SEERL, Mr. Elemo. E.O, Engr.



Adedoja Oluwaseye, Engr. Alesinloye Adeyemi and Alex Orukpe. The installation was a success and data from the location is now readily available.

TRODAN (Tropospheric Data Acquisition Network) Maintenance

The TRODAN Manager, Mr. Najib Yusuf, Engr. Adedoja Oluwaseye and Engr. Saleh Umar carried out an annual maintenance on our atmospheric facilities at several locations across the country.

Progress Report of AQRL-Ilorin

The laboratory is divided into three units, the aerosol measurement of AERONET that uses Cimel Sun photometer for aerosol optical depth measurement, the air quality measurement using Photon Air Sampler coupled with Nephelometer and the Baseline Surface Radiation Network BSRN unit that measures Solar radiation and other atmospheric parameters. The data gathered from the networks were being disseminated to researchers based on request and publications of final results are as follows;

- i. SPARTAN: An Emerging Global Aerosol Network
- ii. Global Estimates of Ambient PM_{2.5} Concentration
- iii. Annual behaviour of Average Wind speed, Temperature, and Solar Radiation at Ilorin
- iv. Investigation into the Variation of Meteorological Parameter of Relative Humidity and Temperature Seasonal Changes over four Solar Cycles at Ilorin, Nigeria
- v. Aerosol Size Distribution and Refractive Index Over Ilorin from Sun Photometer Measurement
- vi. Analysis of Flood Signature in Ilorin Rainfall Data

PARTICIPATION IN CONFERENCES AND WORKSHOPS

In a quest to uphold its mission statement, the Centre for Atmospheric Research (CAR) has actively participated in the following conferences and workshops listed below:

The Registry International Workshop: *“Improving Effective and Efficient Service Delivery in Higher Education: Quality Management as Sine Qua Non”* at FUTA, Akure between 1st to 3rd August, 2016. The workshop was held from August 1st to 3rd at the Federal University of technology, (FUTA) Akure. The Centre for Atmospheric Research, NASRDA, Anyigba sponsored five (5) of her



personnel for the 3-day workshop to enhance the effectiveness and efficiency of service delivery of the Centre.

The workshop was designed to bring together participants from across the globe to discuss issues and modern trends on how to leverage on technology for effective and efficient e-administration, promotion and adoption for International Best Standards in Higher Education Administration and related Institutions.

ICTP Workshop on GNSS Use and Applications at ICTP, Trieste, Italy. 20th June- 2nd July, 2016

The Director/Chief Executive, Prof. Babatunde Rabiun along with a staff of the Centre, Mrs. Aderonke Obafaye participated in the GNSS Workshop organized by the International Centre for Theoretical Physics, Trieste -Italy.

25th COREN Engineering Assembly

The 25th Council for the Regulation of Engineering in Nigeria was held at the International Culture and Events Centre (DOME), Akure, Ondo State, Nigeria between 8th- 10th August 2016 with the **theme** "EMBRACING THE FUTURE: Improving the Quality of Engineering Education and Practice in Nigeria". This was attended by two of our Centre's Engineers; Engr. Adedoja Oluwaseye .S. and Engr. Saleh Umar. A. In attendance were; Secretary to the Government of the Federation, Engr. B. Lawal who represented the President of Nigeria, His Excellency; Dr. Olusegun Mimiko- Executive Governor of Ondo State, Ebonyi State Deputy Governor Dr. Eric Kelechi Igwe represented His Excellency, Engr. David Umahi- Executive Governor of Ebonyi State.

12th International Conference and Exhibition on Power and Telecommunication

The International conference was held at Jos, Plateau State and the conference was tagged "Effecting Desired Development Change". Engr. Saleh Umar attended the conference which ran from the 10th- 14th of October 2016.

National Space Dialogue & CSTD Annual Space Conference. 29th – 31st July, 2016

The 2016 Space dialogue theme "*Space Technology for Self-Reliance and Sustainable Development*" was attended by notable stakeholders. The Director-General of the National Space



Research and Development Agency, Prof. S.O. Mohammed reads his welcome address followed by the address of the Chief host the Minister of Science and Technology, Engr. (Dr.) Ogbonnaya Onu. The keynote speaker Professor Oyewusi Ilbidapo-Obe, the former Vice Chancellor, University of Lagos justified the title of space dialogue through his elaborate presentation. Contribution and suggestion from stakeholders made the one day event a noteworthy one.

The Centre for Satellite Technology Development (CSTD) week is an annual Space Conference event. This year theme is tagged ***“Space Technology in Nigeria: Indigenization and Collaboration”*** was held between August 29th -31st 2016, at the premises of National Space Research & Development Agency (NASRDA) This years’ conference presents an excellent opportunity for consultants, companies, researchers and professionals within and outside the industry to collaborate on how to indigenize space technology in Nigeria. The Director of the Centre for Atmospheric Research (CAR), Anyigba, Prof. Babatunde Rabiú led the Centre’s team to the conference. To corroborate the theme of the conference, our ARSID project team were represented at the event and presented one of our indigenous projects titled ***“Design and Construction of a Low Cost Multi-Sensor Alone Automatic Weather Data Logger with SD Card Storage”***.

4th Biennial International Conference and Exhibition on Environmental Issues (ICEI4) at Prof. Robert Boroffice Multi-purpose Hall, Obasanjo Space Centre, Abuja. 17th- 20th April, 2016

The conference was co-organized by the Centre for Atmospheric Research, Anyigba. Members of the staff played major roles in the event and made tremendous contributions to include presentation of the following technical papers.

- Our Environmental Effects of Storage on the Antioxidant properties of Carica papaya by Johnson O.O and Badejo A.A.
- Aerosol Size Distribution and Refractive Index over Ilorin from Sun photometer Measurements. By Akoshile, Ajibola, Rabiú B.A., Aladodo and Sani.
- Statistical Analysis of Wind Speed Data for Energy Generation at Anyigba by Saleh, U.A, Y.S, Haruna, F.I. Onuigbo, Adedója, O.S and Najib Yusuf



African Geophysical Society 2016 Annual Conference at Universite Felix Houphouet-Boigny FHB, Cocody Campus, de Bingerville, Abidjan, Cote d'Ivoire between 7th-11th November, 2016

The President of the Society and also the pioneer Director of the Centre for Atmospheric Research, Prof. Babatunde Rabiú led the team of researchers from Nigeria to this great event. Others who participated in the conference and made technical paper presentation include; Mrs. Obafaye Aderonke (*Total Electron Content variations over Abuja during the Annular Solar Eclipse of September 1, 2016*) and Johnson, O.O (*Analysis of Root curvature and Growth rate of wheat under Gravity and Microgravity using Clinostat*).

SETPOM International Conference held at University of Lagos between 19th-20th October, 2016

Mr. Jatto Solomon attended the conference and a technical paper presentation titled '3-Dimension Surface Magnetic Susceptibility Distributions with Depth to Investigate Anthropogenic Pollutants Boundry in Abuja Metropolis'

3rd Annual Conference of the Nigerian Geophysical Society held at Landmark University Omu aran, Kwara State on 2nd – 5th February, 2016

Our Centre was duly represented at the event and a technical paper titled 'Analysis of Aerosol Optical Properties over Ilorin Nigeria' was presented by Akoshile, Ajibola, Rabiú, **Aladodo** and Sani.

Salem University Annual Lecture at Salem Lokoja on 7th October, 2016

Mr. Jatto Solomon represented the Centre at this one day event as a commitment of our Centre to the partnership between the two institutions.

Astronomical Society of Nigeria Annual Conference held at Senator (Prof) Robert Ajayi Boroffice Multi-purpose Hall, Obasanjo Space Centre, Abuja. 8th-10th November, 2016

Our Centre was represented at the astronomical annual event led by Dr. Daniel Okoh, Co-ordinator, Space-Environment Research laboratory, Abuja.

GNSS Training and System Maintenance at Nigerian Airforce Base, Sokoto between 11th-13th May, 2016

Our men were on ground for this training. They also served as resource personnel at the successful event.



RESEARCH VISIT

Dr. Daniel Okoh visited the Institute for Space-Earth Environmental Research, Nagoya University, Japan for a month (1st-29th February, 2016). This is as a result of our functional collaboration between our Centre and Nagoya University. During the visit, Dr. Okoh shared his wealth of experience with the scientists at the laboratory he visited and also learnt from them.

SPECIAL ADMINISTRATIVE/TECHNICAL TRAINING

2016 CAR Annual Staff Retreat

The staff retreat was geared towards beginning the year with setting some specific objectives to achieve under the year in view. The retreat was held at the Kogi State University Library Auditorium between 18th-19th January, 2016. Distinguish resource persons were invited to give lectures attended by staff of the Centre.

CAR Technical Division Round Table Discussion

This one day meeting was organized for the technical activities of the Centre on 15th August, 2016. The meeting was chaired by the Director, Prof. Babatunde Rabiun who applauded the technical personnel for their commitment to work. He reiterated that the achievements of the Centre are as a result of their support and charged them to do more. Reports of activities of our laboratories at AQRL and SERL were presented at the meeting by Mr. Aladodo and Mr. Jatto respectively.

Computer Training for Administrative and Finance Personnel

The ICT unit commenced a six (6) week computer training for our administrative and finance staff to enhance their productivity on handling computer related operations. The training started on 6th September, 2016 and the following packages were on offer; Computer Appreciation and Desktop Publishing, Microsoft Word, Microsoft Excel and Micro PowerPoint.

Zero Based Budgeting System Training of the Ministry of Budget and National Planning

The training was held at CBN International Conference Centre, Maitama Abuja between 22nd - 25th August, 2016. The following personnel were in attendance; Mr. Ogbeiwi K, Mrs Onuh Joyce, Mr. Jatto Solomon, Mrs Obafaye Aderonke and Mr Shaibu Tijani.

Preparation of International Public Sector Accounting Standard IPSAS Accrual Basis Financial Statement

This training was organized by the office the Accountant-General of the Federal for personnel in Ministries, Departments and Agencies (MDAs) of the Federal Government of Nigeria. Our staff who



participated in the training were; Mr. Michael Omede, Mr. Ogbeiwi Kenneth, Mrs. Onuh Joyce, Mr Shaibu Tijani. The training was held from 18th-21st October 2016 at Public Service Institute, Abuja.

PHOTO PANORAMA



Director CAR, Prof. Babatunde Rabi among Conference Participants at the AGS Meeting between 7th-11th November 2016 in Abidjan, Cote d'Ivoire



Cross Section of Professors during the 7th of October 2016 Convocation Lecture of Salem University, Lokoja.



Prof. Babatunde Rabi delivering his Lecture titled 'Raising Leaders of Influence' during the Convocation Lecture at the Salem University on the 7th of October 2016.



Cross section of observers who gathered to watch the Annular Solar Eclipse from our Centre in Anyigba on the 1st of September 2016



Director, Defence Space Administration (DSA), Air Vice Marshal T.V Udoh (M) during a courtesy visit to the SERL. Flanked by our Director, Prof. Babatunde Rabi, Coordinator SERL, Dr. Daniel Okoh and a staff of DSA on the 25th August 2016.



Director, CAR, Prof. Babatunde Rabi among participants at the GNSS workshop held in Trieste-Italy, 20th-23rd June 2016



L-R Prof Mrs. Ibiyinka Fuwape, President, WIP. Prof. Babatunde Rabi, Director/CE Centre for Atmospheric Research and Prof. Amory Mazaudier, UPMC/ICTP during the Women in Physics Conference held in Anyigba 14th-16th of June 2016.



CAR staff in a photo with Prof. Babatunde Rabi at the end of the meeting on Space Activities organized by CAR in conjunction with Space Generation Advisory Council (SGAC) on the 12th of April 2016



Group Photo of High school students with the Director during the celebration of the 55th Year "the First Man landed in Space" organized by CAR and SGAC. April 12th 2016.



Prof. Babatunde Rabi along with CAR Scientist prepare for the Sounding of the Hot Balloon on 11th April 2016.



Lead Scientist from ALIFIG, Mr Chinedu explaining some stuff on the Screen to Prof. Babatunde Rabi Director/CE of CAR while some CAR scientist look on 11th April 2016



Director of Centre for Atmospheric Research, Prof. Babatunde Rabi with the then VC FULAFIA, Prof. Ekanem Ikpi Braide during her visit to the Space Environment Research Laboratory. February 2016



Group photo of CAR staff at the end of CAR Staff retreat organized by the Centre, January 18th -19th 2016



Prof. Babatunde Rabi(M) flanked by Prof. S.S Oluyamo (FUTA),Mr. Shuaibu Abdullahi (CBSS),Mr. Najib Yusuf (Head, Technical) and Mr. Issac Adejoh at the end of the CAR Staff retreat in Anyigba between January 18th -19th 2016



Training on the “Single Treasury Account”

The training captured the usefulness of Single Treasury Account (STA) and the function of initiator officers and reviewer officers. The training was held between 23rd-25th November, 2016 at the Space Environment Laboratory, Abuja. In attendance were the Director of the Centre, Prof. Babatunde Rabi, The head of account, Mr. Ogbeiwi Kenneth, Mrs Onuh Joyce and Mrs Aderonke Obafaye

Our Accounting Unit has been very active in the following areas;

The accounting unit is designed using the financial regulations and extent circulars to guide financial expenditure in consonance with prevailing fiscal policies, ensuring that probity, accountability and transparency is obtainable in all the financial transaction of the Centre.

The Accounting Unit is made up of the following sections

- Expenditure Section/other charges
- Checking Section
- Personnel emolument (IPPIS)
- CPO (Central pay Office) Fund Section
- Advance Section
- Final account

Book of Account currently maintain in the centre base on the new directive from the Accountant General for the Federation Through the minister of Finance on the adoption of Accrual basis.

- Treasury Cash Book for Overhead
- Treasury Cash Book for Capital
- Updating of Vote Book
- Payment Voucher Register
- Checking of Payment Voucher
- General Ledgers
- Trail Balance
- Transcript



- Financial Performance
- Financial Position
- Bank Reconciliation if any
- Store records

The progress and achievements are as follows;

- To record the transaction on the basis of invoice, bills, and Receipt.
- To raise vouchers for each transactions
- To keep the vouchers in safe place after sorting them in files,
- To pay other charges when necessary.
- To reconcile the bank statements with his Centre's bank account if any.
- Preparation of transcript.
- Regular submission of monthly report to the office of the Accountant General of the Federation (OAGF) according to IPSAS compliance. The reporting staffs are Mr Kenneth Ogbeiwi Osalumense and Mrs Onuh Joyce.
- Submission of annual report to the office of the Accountant General of the Federation (OAGF) according to IPSAS compliance. The reporting staffs are Mr Kenneth Ogbeiwi Osalumense and Mrs Onuh Joyce.
- To Prepare Annual Financial Statements of the Centre according to the current provisions of civil service regulation guideline.
- Monthly updating of cash book, vote book, account register and proper checking of vouchers payment.
- Financial Controls – Financial controls include reconciliations, dividing the responsibilities and following the IPSAS Accrual basis standards of accounting.
- Control of Integrated Personnel Payroll Information System (IPPIS) Office in the accounting unit.
- Control of Government Integrated Financial Management Information System of the Centre.
- Creation of Single Treasury Account for E- collection for the Centre.



DEVELOPMENT/ACHIEVEMENT

Our ICT unit worked tirelessly in the month of February to develop upgrade and launch our official website www.carnasrda.com. Also, the ICT unit in conjunction with other personnel of the Centre monitored and supervised the installation of internet facilities by the Information Technology Resource Centre of the Kogi State University, Anyigba.

Our team of Engineers and ICT units which made of ARSID project team successfully designed and constructed a low cost stand-alone automatic weather station.

Partial Solar Eclipse Observation at Anyigba on 1st September, 2016

The staff of the Centre, students, Lecturers, children from various households and other interested passersby gathered as early as 7:00 am at the Centre and waited patiently to observe the rare occurrence of the solar eclipse brief presentation on partial solar eclipse was made by Mr. Onuigbo, Ifeanyi Francis of the technical division after which copies of the article on Partial Solar Eclipse written by The Director and Chief Executive of the centre, Professor Babatunde Rabiw was distributed along with the safety viewing glasses to the participants.

Observation Experience

The observation billed to commence at 7:16 am was obstructed by thick cloud cover over the horizon in Anyigba between 6.00am to 8.55am, however the observers who have patiently waited were rewarded with exciting views when the cloud eventually gave way at about 8:56 am. The observers had a fascinating experience while the eclipse lasted and had an interactive session with members of the staff afterwards. At about 10:15 am closing remarks was delivered by Engr. Adedola O.S, and the observation was brought to an end.

INDOOR SEMINARS

- i. A Plan of activities of ICT Unit for 2016. By Mr. Olalekan for ICT Unit 2nd March, 2016.
- ii. Social Media as an Effective Tool for Communication in CAR-NASRDA. ICT Unit by Mr. Daniel Matthew on 22nd June, 2016.
- iii. A Proposal for the Establishment of ground based Microgravity Experiment at Centre for Atmospheric Research, Anyigba. By Musa Ibrahim A. 9th February, 2016.
- iv. TRODAN Project Updates by Engr. Adedola S. O for TRODAN team on 25th May, 2016.



- v. Air Pollution By Mr. Shehu Sarafadeen
- vi. Techniques for the observation of Plant Growth under the influence of Microgravity. By Alex Orukpe.
- vii. Space; the Unseen and the Unknown. By N. Francis. 8th June, 2016.
- viii. Determination of the concentration of Pollutants (Sulphur IV Oxide, Nitrogen IV Oxide and Ozone) in ambient air- A case study of Kogi state Nigeria. By Jibril Out. 25th May, 2016.
- ix. International Public Sector Accounting Standard; Accrual Basis. By Hamza Yusuf

The Industrial Training Attaché in the centre were also subjected to seminar presentation as part of their training at the centre and the following papers were presented by the various persons

a). On the 10th February, 2016, Alilu Awah Omaye, Omojola Adewale Sunday and Bello Ohida Samson collectively presented on:

- i. The NECOP station and
- ii. Nigerian Satellites

b). On the 2nd March, 2016 Audu Mary Grace O., Moraiyewa Festus and Mohammed Abdulazeez made a Presentation on the Importance of Remote sensing.

c). On 16th March, 2016, Omale Lydia made a presentation on Flooding and its Impacts (A Case study of Lokoja flooding Incidence).

Visiting Scientists to SERL /CAR

1. Dr. Nsikan abasi Umo- Dept of Chemistry, Federal University, Lafia, Nasarawa State
2. Prof. EkaBraide- Vice-Chancellor, Federal University, Lafia, Nasarawa State
3. Prof. J.K Obatala- Media Consultant to NASRDA
4. Dr. Okere Bonaventure- Centre for Basic Space Science, Nsukka.
5. Dr. James Chibueze- National Astronomical Observatory of Japan/UNN
6. Dr. Anita Richards- Jodrell Bank Centre for Astrophysics, Alan Turing Building, University of Manchester, UK.
7. Prof. Aize Obayan- Vice-Chancellor, Landmark University, Omu-Aran, Kwara State.
8. Engr. Dr. Adeyemi- University of Abuja
9. Air Vice Marshal T.V Udoh- Defence Space Administration
10. Mrs. Lade Araba- Visiola Foundation, Maitama.



11. Prof. Christine Amory-Mazaudier- UPMC/ICTP
12. Dr Mrs. Otitaju Grace- University of Nigeria, Nsukka
13. Dr. Otitaju Olawale-Federal University, Wukari
14. Prof. D.J Arotipin- Federal University of Technology, Akure
15. Prof. S.S Oluyamo-Federal University of Technology, Akure
16. Cadets from Nigerian Defence Academy(NDA)

Staff on Graduate Training

1. Najib Yusuf (PhD in view) Bayero University, Kano
2. Omale Ramatu (MA in view) Kogi State University, Anyigba
3. Musa Aishat (Msc in view) Kogi State University, Anyigba
4. Alfa Daniel (PGDE in view) Kogi State University, Anyigba
5. Jatto Solomon Sunday (PhD in view) Ahmadu Bello University, Zaria
6. Ogbeiwi Kenneth (PhD in view) Igbinedion University, Okada
7. Aladodo Sarafadeen (MPhil in view) University of Ilorin
8. Saleh Umar (M.Eng in view) ATBU
9. Otu Jibril (Msc in view) Kogi State University, Anyigba
10. Sani Mu'awiya (Msc in view) University of Ilorin
11. Adamu Yusuf (MA in view) Kogi State University, Anyigba
12. Ikani Ojochenemi (MSc in view) University of Ilorin
13. Johnson, Omotayo Opeyemi (M.Tech in view) Federal University of Technology Akure,
14. Aghedo Jude (MA in view) Kogi State University, Anyigba

Staff who completed Graduate and Professional Programmes

- i. Dr. Balogun Taofeek Ayodeji completed his PhD from Forte University, South Africa.
- ii. Mr Ogbeiwi Kenneth: Certified National Accountant (CNA) obtained from Nigeria College of Accountancy



PUBLICATIONS 2016

The following are the publications made by staff of the Centre during the period under review.

1. O. S. Bolaji, E. O. Oyeyemi, O. P. Owolabi, Y. Yamazaki, A. B. Rabi, D. I. Okoh, A. Fujimoto, C. A. Mazaudier, G. K. Seemala, A. Yoshikawa, O. K. Onanuga (2016). Solar Quiet Current Response in the African Sector Due to a 2009 Sudden Stratospheric Warming Event: SSW connects lower with upper atmosphere, *Journal of Geophysical Research: Space Physics*, DOI: 10.1002/2016JA022857.
2. Daniel Okoh, Oluwafisayo Owolabi, Christopher Ekechukwu, Olanike Folarin, Gila Arhiwo, Joseph Agbo, Segun Bolaji and Babatunde Rabi (2016). A regional GNSS VTEC model over Nigeria using Neural Networks; a novel approach. *Geodesy and Geodynamics*, 7(1).
3. Daniel Okoh and Austin Atokolo (2016). A Study on the Effects of the Equatorial Ionization Anomaly on the Ionospheric Total Electron Content over Zaria using the GNSS. *International Journal of Pure and Applied Sciences and Technology*, 4(3).
4. Daniel Okoh and Moses Ochidi (2016). A study on the effects of Geomagnetic Storms on Ionospheric Total Electron Content. *Journal of Applied Physical Science International*, 5(4).
5. Saleh, U.A, Y.S. Haruna, F.I. Onuigbo, Adedaja, O.S. and Najib Yusuf (2016). Statistical Analysis of Wind Speed data for energy generation at Anyigba, Kogi State North-Central, Nigeria. 4th Biennial International Conference and Exhibition on Environmental Issues NASRDA, Abuja
6. Ayorinde, T. T., Rabi, A.B., and Amory-Mazaudier, C., 2016. Inter-hourly variability of Total Electron Content during the quiet condition over Nigeria, within the Equatorial Ionization Anomaly region. *Journal of Atmospheric and Solar-Terrestrial Physics*, 145, 21–33.
7. Okoh, D., Owolabi, O., Ekechukwu, C., Folarin, O., Arhiwo, G., Agbo, J., Bolaji, S., and Rabi, A. B., 2016. A regional GNSS-VTEC model over Nigeria using networks: A novel approach, *Geodesy and Geodynamics*, 7, 19-31.
8. Fuwape, I. A., Ogunjo, S. T., Oluyamo, S. S., Rabi, A. B., 2016. Spatial variation of deterministic chaos in mean daily temperature and rainfall over Nigeria. *TheorAppl Climatol.*, DOI 10.1007/s00704-016-1867-x.
9. Adedaja, T.B, Adepoju, K.A, Adedaja, O.S. and Alaga, A.T. Analysis and Distribution of Pipeline Explosion in Nigeria (1998-2016), 2016. *International Journal of Trend in Research and Development*, Volume 3(6), ISSN:2394-9333



10. Victor U.J. Nwankwo, Sandip K. Chakrabarti, Olugbenga Ogunmodimu, 2016. A probe of magnetosphere-ionosphere coupling using the propagation characteristics of very low frequency radio signal”, Journal of Atmospheric and solar terrestrial physics. DOI: 10.1016/j.jastp.2016.04.014.
11. Nasir Faruk, O.W Bello, Olugbenga Ogunmodimu, L. Olawoyin, A.A Oloyede, 2016. “Climate change and the next generation cellular system”, Ethiopian Journal of Environmental Studies and Management, 9 (2). Pages 1022 – 1035, DOI: <http://dx.doi.org/10.4314/ejesm.v9i2.8S>



THE LATEST COUPLE IN CAR FAMILY

Mr. Adejuwon Olalekan of ICT unit married Miss Toluwalope on 9th September 2016.



Mr & Mrs. Adejuwon Olalekan

NEW ADDITION TO CAR FAMILY

Mr. Aladodo Sarafadeen, a Senior Scientific Officer of lower atmospheric unit was blessed with a bouncing baby girl on 10th January, 2016.

Mr. Suleiman Abdulrahman, a Scientific Officer I of ICT unit was blessed with a bouncing baby girl on 22nd February, 2016.



BEREAVEMENT

The entire Management & Staff of the Centre regrets the loss of Mr. Mohammed Rufai, Admin Officer I who passed away on 21st March, 2016. May His Gentle Soul Rest in Perfect Peace!





List of Abbreviations and Acronyms

BSRN	-	Baseline Surface Radiation Network
NASRDA	-	National Space Research and Development Agency
CAR	-	Centre for Atmospheric Research
FUTA	-	Federal University of technology
CSTD	-	Centre for Satellite Technology Development
GNSS	-	Global Navigation Satellite Systems
ICE14	-	International Conference and Exhibition on Environmental Issues
OAGF	-	Office of the Accountant General of the Federation
SERL	-	Space Environment Research Laboratory
SEERL	-	Space Earth-Environment Research Laboratory
CBN	-	Central Bank of Nigeria
MDAs	-	Ministries, Departments and Agencies
DSA	-	Defence Space Administration
IPPIS	-	Integrated Personnel Payroll Information System
IPSAS	-	International Public Sector Accounting Standard
CPO	-	Central Pay Office
CBSS	-	Centre for Basic Space Sciences
ICT	-	Information Communication Technology
TRODAN	-	Tropospheric Data Acquisition Networks Project
SGAC	-	Space General Advisory Council
ARSID	-	Atmospheric Research Software and Instrumentation Development
NDA	-	Nigerian Defence Academy
UNN	-	University of Nigeria, Nsukka
CNA	-	Certified National Accountant
NASRDA	-	National Space Research and Development Agency
CAR	-	Centre for Atmospheric Research
STP	-	Solar Terrestrial Physics
LA	-	Lower Atmosphere
UA	-	Upper Atmosphere
ACER	-	Atmospheric Chemistry and Environmental Research



SRI	-	Space Research Initiative
ICT	-	Information Communication Technology
TRODAN	-	Tropospheric Data Acquisition Networks Project
ARSID	-	Atmospheric Research Software and Instrumentation Development
FHB	-	Felix Houphouet-Boigny