



**CENTRE FOR ATMOSPHERIC RESEARCH**

**NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY**

**FEDERAL MINISTRY OF SCIENCE AND TECHNOLOGY**

# Annual Report

## 2017-2018

*...Creating Opportunities*



**CENTRE FOR ATMOSPHERIC RESEARCH**  
**NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY**  
**FEDERAL MINISTRY OF SCIENCE AND TECHNOLOGY**

# **Annual Report**

## **2017-2018**

## Contents

FOREWORD BY THE DIRECTOR/CHIEF EXECUTIVE .....	6
OVERVIEW .....	8
INTRODUCTION .....	8
Mission .....	9
Mandates.....	9
OPERATIONS.....	10
ORGANOGRAM.....	11
RESEARCH AND DEVELOPMENT (R&D) DIVISION OF CAR.....	12
MAJOR ACTIVE RESEARCH PROJECTS AT CAR .....	12
Space Weather Observation Network over Nigeria - SWONON .....	12
Space Weather Observation Network over Africa - SWONOA.....	12
Tropospheric Data Acquisition Network – TRODAN .....	13
Atmospheric Chemistry and Environment Research – ACER .....	13
Microgravity and Human Space Technology – MHST.....	13
Atmospheric Research Software and Instrumentation Development - ARSID .....	13
CAR AND HER SPACE RESEACRH LABORATORIES .....	14
OVERVIEW OF CAR LABORATORIES.....	15
National Air Quality Research Laboratory (NAQRL) University of Ilorin .....	15
Space Environmental Research Laboratory (SERL) NASRDA Headquarters Abuja.....	15
Space Earth Environment Research Laboratory University of Benin .....	16
Space Weather and Atmospheric Physics Laboratory (SWAP) Bayero State University Kano .....	16
ANNUAL REPORT FOR THE YEAR 2017 .....	18
Development/Achievement Recorded By The Centre for Atmospheric Research in 2017.....	18
Setting up of Atmospheric Facilities.....	18
Installation of Automatic Weather Station .....	18
Installation of Septrentrio GNSS Receiver .....	18
Installation of Magnetometer .....	18
Installation of VLF (SOFIE) Single Frequency Receiver .....	19
Production of Magnetometers.....	19
Completion of Maintenance of Atmospheric Facilities .....	20
Development of a Web-based IUCAR Directory.....	20
MEMORANDUM OF UNDERSTANDING .....	22

Collaborations in the Pipeline.....	22
ACTIVITIES SUPPORTED AND ORGANISED BY THE CENTRE.....	22
2nd International School on Equatorial and Low-Latitude Ionosphere (ISELLI -2) 10 <sup>th</sup> – 16 <sup>th</sup> September 2017 .....	23
E.E Balogun National Symposium on Atmospheric Research on 27 <sup>th</sup> July 2017 .....	24
One Day Symposium on Space Weather themed: “Is Space Weather a Threat to our Daily Lives?” on 7 <sup>th</sup> September 2017. ....	25
Space Workshop – SEERL UNIBEN .....	25
1 <sup>st</sup> National Workshop on Microgravity and Environmental Research .....	27
15 <sup>th</sup> National Council on Science and Technology (11 <sup>th</sup> -15 <sup>th</sup> December 2017) .....	28
PARTICIPATION IN CONFERENCES AND WORKSHOPS .....	28
1 <sup>st</sup> International Conference on Science and Sustainable Development, Covenant University, Ota. 20 <sup>th</sup> June 2017 .....	28
ICTP - International Centre for Theoretical Physics, Trieste, Italy. 12 <sup>th</sup> June - 17 <sup>th</sup> November 2017 .....	29
Nigerian/Portuguese scientists’ Conference between 4 <sup>th</sup> - 5 <sup>th</sup> December 2017.....	29
2017 Nigerian Meteorological society (NMetS) International Conference, 20 <sup>th</sup> - 24 <sup>th</sup> November 2017.....	29
Nigerian Geophysical Society (NGS) Conference, Bayero University Kano, 9 <sup>th</sup> -12 <sup>th</sup> May 2017. ....	29
7th National Conference of the Astronomical Society of Nigeria ASN, 28 <sup>th</sup> November – 1 <sup>st</sup> December 2017. ....	30
Participation In The Technology And Innovation Expo 2017 (3 <sup>rd</sup> – 7 <sup>th</sup> April 2017).....	30
2017 CAR Annual Staff Retreat.....	31
Partial Solar Eclipse Observation .....	32
VISITING SCIENTISTS TO CAR/SERL.....	33
STAFF ON ACADEMIC PROGRAMMES .....	34
Staff Who Have Completed Post Graduate Programmes .....	34
Staff Undergoing Post Graduate Programmes .....	34
SPECIAL ADMINISTRATIVE/TECHNICAL TRAINING .....	35
Training on GIFMIS budget Preparation Subsystem.....	35
Organ-Accumulator-Applying Space Science Agriculture” seminar on 16 <sup>th</sup> - 17 <sup>th</sup> January 2017 .....	35
4 <sup>th</sup> international Workshop on Applications of ICT on Education Healthcare and Agriculture. 25 <sup>th</sup> -27 <sup>th</sup> July 2017 .....	36
CSTD Annual Space Conference/Exhibition. 22 <sup>nd</sup> – 23 <sup>rd</sup> August 2017 .....	36
CENTRE FOR ATMOSPHERIC RESEARCH NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY (NASRDA)	
NOMINAL ROLL AS AT 2017.....	37



VISITS BY INTERNATIONAL SCIENTISTS.....	40
Institute Of Energy And Climate Research, Julich, Germany.....	Figure40
RESEARCH VISIT .....	40
Postdoctoral Research Fellowship.....	40
RECOGNITIONS/ AWARDS .....	41
Inspection Visit .....	41
PAPER PRESENTATIONS IN 2017 .....	41
INHOUSE SEMINAR.....	42
PUBLICATIONS 2017 .....	42
PHOTO PANORAMA.....	45
CENTRE FOR ATMOSPHERIC RESEARCH’S ACHIEVEMENTS FOR THE YEAR 2018.....	51
INSTALLATION OF VERY SMALL APERTURE TERMINAL (VSAT) AT CAR ANYIGBA .....	51
CONSTRUCTION OF HIGH PRECISION TELEMETRY WEATHER MONITORING STATION (HPTWMS) .....	52
SPACE WEATHER OBSERVATION NETWORK OVER NIGERIA - SWONON .....	54
DAILY SPACE WEATHER NOWCAST AND FORECAST .....	56
Tropospheric Data Acquisition Network (TRODAN).....	57
The Atmospheric Monitoring Equipment Network .....	58
Objectives of Atmospheric Monitoring Equipment Network AMEN.....	59
HYBRID ATMOSPHERIC PARAMETERS MONITORING (AtPaM) PROJECT .....	61
UNMANNED AERIAL VEHICLE (UAV) FOR ATMOSPHERIC OBSERVATION.....	62
Objectives of UAV.....	63
Total Lunar Eclipse Occurence .....	65
INSTALLATION OF WORLD WIDE LIGHTING MONITOR (WWLLN) RECEIVER .....	66
ROUTINE CHECKS AND MAINTENANCE.....	66
PARTICIPATION IN CONFERENCES AND WORKSHOPS .....	66
CAR AT NASA: National Aeronautics and Space Administration(NASA) - Aeronet Deployment in Africa.....	66
Other Programs Attended by CAR Staff .....	67
ICTP Workshop on Space Weather Effects on GNSS Operations at Low Latitude 23 <sup>rd</sup> April - 4 <sup>th</sup> May 2018 .....	68
Nigeria Geophysical Society (NGS) 5 <sup>th</sup> Annual International Conference .....	69
Nigerian Society of Engineers 2018 Week/Annual General Meeting Ajaokuta Branch 15 <sup>th</sup> Aug. 2018....	69
Science and Technology and Innovation Expo 2018 (5 <sup>th</sup> – 9 <sup>th</sup> , March 2018) .....	70
Objectives of the programme include:.....	70

African Leadership Conference on Space Science for Sustainable Development.....	72
Basic Science National Conference (BASNAC) 2018 .....	72
Kogi State World Science Day and 21 Young Scientist Competition (KYSGA-21 Governor’s Award).....	72
Mountain Top University MTU 4th University Distinguished Lecture.....	73
13th Mosobalaje Oyawoye Faculty of Science Endowed Lecture .....	73
CBSS Space Centre Week 2018. 3 <sup>rd</sup> - 7 <sup>th</sup> December 2018.....	73
ACTIVITIES SUPPORTED AND ORGANISED BY THE CENTRE.....	73
Annual CAR Staff Retreat 2018 .....	74
1 <sup>st</sup> National Workshop on Air Quality: Air Quality Research and Sustainable Development: The Nexus, Prospects & Challenges from the 13 <sup>th</sup> -16 <sup>th</sup> March 2018. ....	74
Prof. E.E Balogun 2 <sup>nd</sup> National Symposium on Atmospheric Research. 16 <sup>th</sup> August 2018.....	75
Commissioning of CAR Laboratory Complex and Engineering workshop .....	76
World Space Week themed: Space Unites the World. 10 <sup>th</sup> October 2018 .....	76
SPACE WORKSHOP: Space Products as Tools for Socio-Economic Development & National Security..	78
STAFF WHO COMPLETED GRADUATE PROGRAMMES IN 2018.....	79
STAFF UNDERGOING GRADUATE PROGRAMMES .....	79
STUDENT INDUSTRIAL WORKS EXPERIENCE .....	81
MEMORANDUM OF UNDERSTANDING .....	81
Signing of Memorandum of Understanding.....	83
COLLABORATIVE OUTREACHES / COURTESY VISITS / RESEARCH.....	84
Osun State University, Osogbo, Osun State .....	84
Cecilia Ibru University, Delta State .....	85
Kebbi State University .....	85
Familiarisation Visit by Students of Nigerian Naval Secondary School, Okura .....	85
Two Months (1 <sup>st</sup> August - 30 <sup>th</sup> September 2018) Bench/Research visit to ACOM .....	85
Courtesy Visit To The University Of Benin.....	85
Courtesy Visit to the Federal University of Petroleum Resources (FUPRE) Delta State.....	85
Courtesy Visit of Delegates from Space-Earth Environment Research Laboratory to the Commissioner of Science & Technology Edo State .....	86
Visitors at the Accounting Unit of CAR during the course of the year 2018 .....	87
Special Administrative/ Technical Training .....	87
IN-House Seminar and Training.....	88
PAPER PRESENTATIONS.....	88

PUBLICATIONS 2018 .....	89
E-MEDIA PUBLICATIONS .....	92
CAR CONGRATULATORIES .....	93
PHOTO PANORAMA .....	95
Kogi State World Science Day Celebration & 21 Young Scientists Competition (GOVERNORS AWARD) 2018. .....	97
Nigerian Society of Engineers 2018 Week/AGM Ajaokuta Branch. 15 <sup>th</sup> August 2018 .....	98
E.E Balogun National Symposium on Atmospheric Research on the 16th August 2018.....	101
Air Quality Workshop .....	102
CAR Staff Retreat 2018 .....	103
Photos From CAR Staff Retreat Dinner.....	104
Bowen Courtesy Visit/MOU Signing To CAR_NASRDA.....	106
Visits To Serl Laboratory In 2018 .....	108
Okura Navy Secondary School Visit To CAR Anyigba.....	109
Pictures From The Science And Technology 2018 EXPO .....	113
COMMISSIONING OF CAR LABORATORY COMPLEX AND ENGINEERING WORKSHOP.....	117
LIST OF ABBREVIATIONS AND ACRONYMS.....	120

## FOREWORD BY THE DIRECTOR/CHIEF EXECUTIVE



The past two years 2017 and 2018 marked our 5<sup>th</sup> and 6<sup>th</sup> years of existence as a Global Centre of Excellence in Atmospheric Research. Over the past 6 years, CAR has evolved from being a newly established organisation to an award winning institution with global recognition in the field of atmospheric sciences.

We continued to run with our scientific mission to improve our understanding of the behaviour of the entire spectrum of the Earth's 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.

Our extant core research focus includes: space weather, tropospheric studies, atmospheric research software and instrumentation development, microgravity and human space technology, atmospheric chemistry and environmental research. With observational facilities littered over our beautiful national landscape and international collaborative research; it is no gainsaying that within our five years of existence, we have attained the status of a world-class R & D CoE in atmospheric research. Our Centre has established cooperation with leading global institutions in our fields of relevance. We indeed live up to our slogan of 'creating opportunities' in all our activities and interactions.

In addition, over the years we have also established the following network of observatories: National Air Quality Research Laboratory, University of Ilorin (2014); Space Environment

Research Laboratory SERL, NASRDA, Abuja (June 2015); Space-Earth environment Research Laboratory SEERL, University of Benin (September, 2016); Space Weather and Atmospheric Physics Laboratory SWAP Lab, Bayero University Kano (April 2017) and the Atmospheric and Space Weather Reserrach Lab., ASWeRL, Uniosun, Osogbo (January 2017).

We are summarily involved in research activities that cover a wide range of ecosphere from the bottom of the ocean via the atmosphere to the centre of the Sun. Precisely, on 6<sup>th</sup> January 2018, we started the first daily nowcasting of the space weather condition in Sub-Sahara Africa. We continue to maintain our ways by engaging in field observations, promoting research and capacity building. Our activities are documented in our annual report series freely available in the public domain at our webpage - [www.carnasrda.com](http://www.carnasrda.com).

Our strength as a Centre is in our teamwork and I quite appreciate every staff that has contributed to make this report a reality. The Media unit is greatly appreciated for the editing and printing works. I commit this report to every reader and welcome any suggestion as may be appropriate.

Wishing each and everyone a rejoicing 2019

**Professor Babatunde Rabi**

Director and Chief Executive

Centre for Atmospheric Research,

National Space Research and Development Agency,

Federal Ministry of Science and Technology, Anyigba, Nigeria

[www.carnasrda.com](http://www.carnasrda.com)

## OVERVIEW

The year 2017 earned its remarkable place in the history of the Centre for Atmospheric Research CAR-NASRDA alongside previous years since its inception as one of the Research & Development arms of the National Space Research and Development Agency (NASRDA). True to its mission, several milestones were achieved amidst limitations and general challenges in the R&D space. For the laudable achievements recorded, “*resilience*” has been the tacit watch word made practical at the Centre for Atmospheric Research whilst engaging a forward-looking approach towards achieving its long-term goals in tandem with its mandate.

In light of the above, this report brings to the fore, the major achievements of the Centre for Atmospheric Research. In addition, it also highlights possible outlook for the succeeding year.

The Centre in its honour hereby invites key stakeholders to peruse through the contents of its bi-annual report to be abreast with its track record trusting that the material will add value to readers, space research enthusiast, as well as prospective investors and partners who may be desirous of advancing the frontiers of R & D in atmospheric science to a more sustainable and value driven horizon.

## INTRODUCTION

The Centre for Atmospheric Research (CAR) is the research and development activity centre of NASRDA that is committed to research & capacity building in atmospheric sciences under the support of the Federal Government of Nigerian through the Federal Ministry of Science and Technology.

The Centre received an executive approval to function in capacity of a full-fledged centre in the month of January, 2013 as the seventh activity centre of NASRDA. Since its inception, the Centre has gone on to be a trail blazer in the field of atmospheric research and has also gone on to sign Memorandum of Understanding with over 20 Nigerian Universities as well as with a host of other International research partners across the globe all under the cerebral and value driven leadership qualities of the Centre’s pioneer and incumbent Director/Chief Executive Officer, Professor Babatunde Rabi.

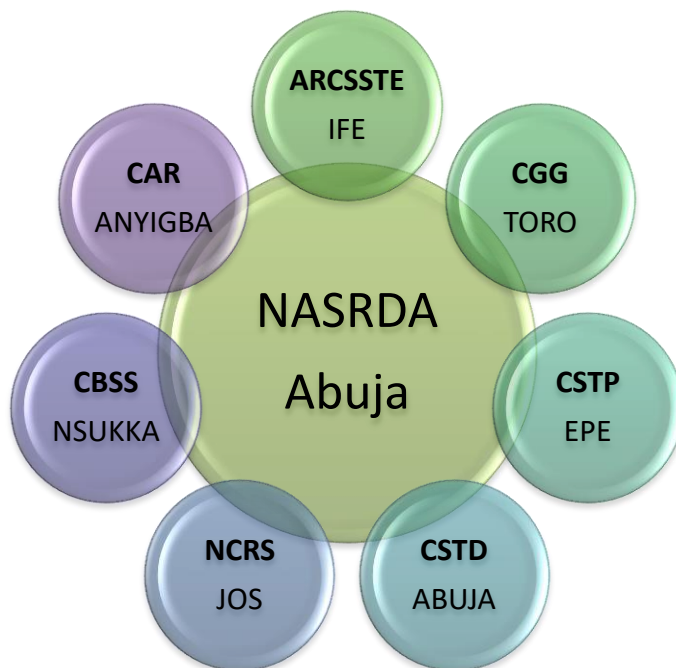


Figure 1: NASRDA and its activity Centres.

## Mission

- To understand the behaviour of the entire spectrum of the Earth's atmosphere and related physical, biological and social systems
- To promote capacity building in relevant atmospheric sciences as a way of facilitating international competitiveness in research being conducted by atmospheric scientists.
- To disseminate atmospheric data and products to user toward socio-economic developments to the nation.

## Mandates

CAR is committed to research and capacity building in the atmospheric and related sciences. CAR shall be dedicated to understanding the atmosphere (the air around us) and the interconnected processes that makeup the Earth system, from the ocean floor through the ionosphere to the Sun's core. The Centre for Atmospheric Research provides research directions, facilities, and services for the atmospheric and Earth sciences community.

Furthermore, NASRDA through the Centre for Atmospheric Research is to provide sound education, research and knowledge in the following areas illustrated in Figure 2:

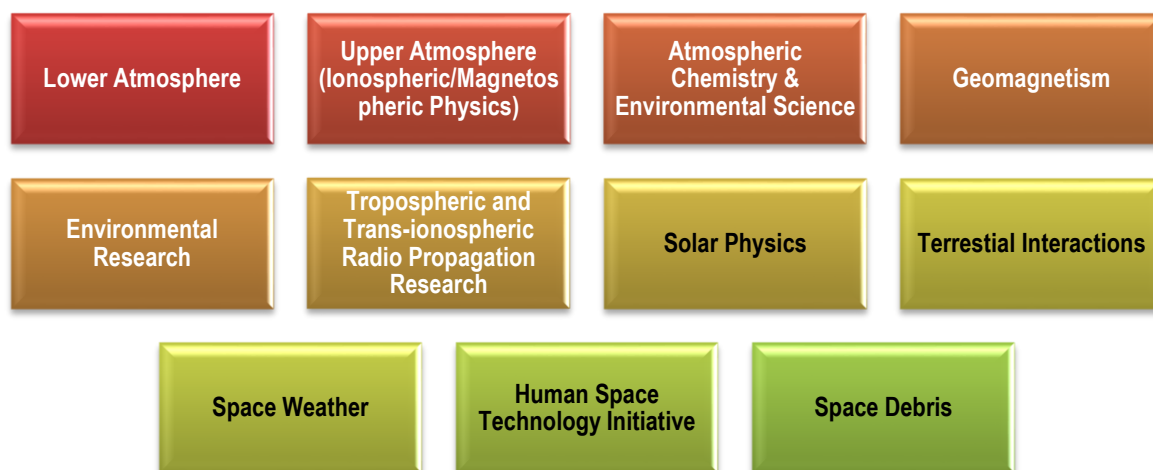


Figure 2: Core mandates of Centre for Atmospheric Research

## OPERATIONS

Centre for Atmospheric Research is envisioned to operate in three modes: Observation, Training, and Research.

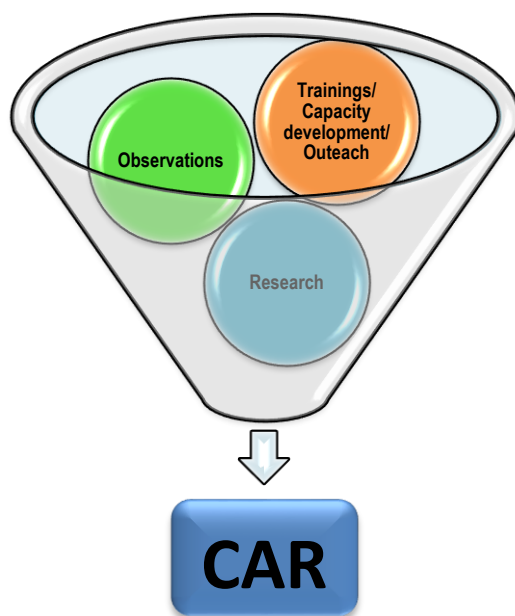


Figure 3: Chart of the core operations of Centre for Atmospheric Research.



## ORGANOGRAM

The Organisational chart of the Center for Atmospheric Research is illustrated below:

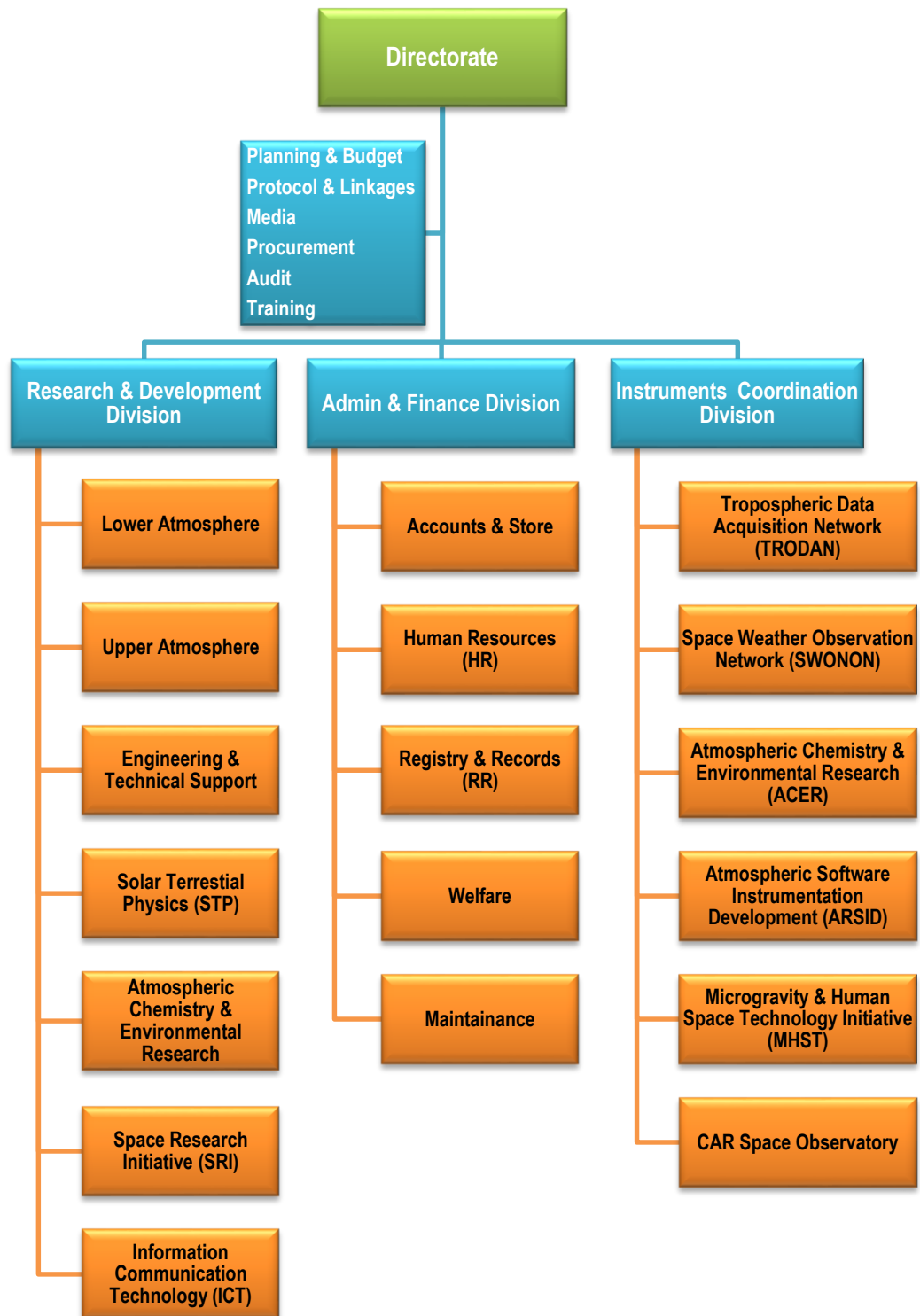


Figure 4: Organogram of CAR

## RESEARCH AND DEVELOPMENT (R&D) DIVISION OF CAR

The R & D division of CAR is made up of seven specialised units listed below:

- i. **Lower Atmosphere (LA):** The LA 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 UA unit focuses on the study of the Ionosphere and magnetosphere of the Earth and other planets.
- iii. **Solar Terrestrial Physics (STP):** The STP unit deals with Solar physics, Solar Terrestrial Interactions and Space Weather (Sun and heliosphere).
- iv. **Atmospheric Chemistry & Environmental Research (ACER):** The ACER unit is concerned with environmental research, environmental impact assessment, environmental pollution and atmospheric chemistry.
- v. **Space Research Initiative (SRI):** The SRI unit deals with 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 (ETS):** The ETS focuses on instrumentation development, maintenance of atmospheric monitoring facilities, development of equipment from locally available materials and imported sensors.
- vii. **Information Communication Technology (ICT):** The ICT unit is saddled with the responsibility of software development for atmospheric research, telemetry, data portal management.

## MAJOR ACTIVE RESEARCH PROJECTS AT CAR

### Space Weather Observation Network over Nigeria - SWONON

#### Space Weather Observation Network over Africa - SWONOA

- 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

### **Tropospheric Data Acquisition Network – TRODAN**

- Network of ground stations monitoring lower atmospheric parameters i.e automatic weather stations, rain Radar
- Improvement of space-earth communication systems

### **Atmospheric Chemistry and Environment Research – ACER**

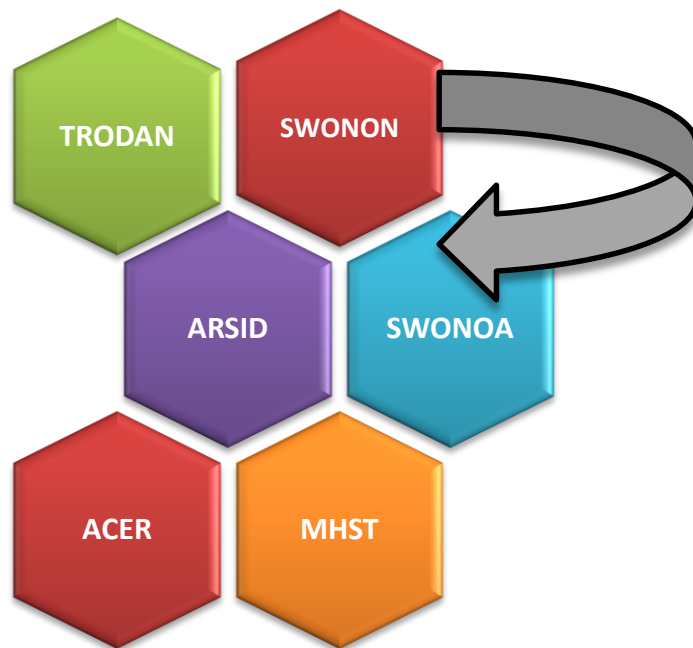
- Establishment of network of stations monitoring air quality in the atmosphere i.e sample collection, trace detection facilities
- Air quality measurements

### **Microgravity and Human Space Technology – MHST**

- Simulating microgravity experiments that are performable in the space environment as it affect food security and drug/vaccine developments

### **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



*Figure 5: Chart illustration of CAR active Research Projects*

## CAR AND HER SPACE RESEACRH LABORATORIES

The Centre for atmospheric research has over the years, established several observational facilities across the country, equipped with assorted state of the art scientific equipment for monitoring space and earth environments. With its mandate geared towards making space science and development application which is an integral part of the overall strategies for sustainable National development, each laboratory is saddled with the following responsibilities:

- Serve as a training hub for space science, technology and applications
- Function as a data bank for research purpose (data from the equipment shall be collected, stored and made available for research purpose)
- Investigate and embark on research relevant to the mandate of the Centre

In this regard, CAR's operation is made efficient via an hexagonal relationship resonating amongst six major affiliate laboratories. Below is a table and chart highlighting CAR affiliate laboratories and their corresponding year of establishment.

S/N	Laboratories	Location	Year
1	National Air Quality Research Laboratory (NAQRL)	University of Ilorin, Kwara State.	2014
2	Space Environmental Research Laboratory (SERL)	NASRDA headquarters Abuja	2015
3	Space Earth-Environmental Research Laboratories (SEERL)	University of Benin, Edo State	2016
4	Space Weather Atmospheric Physics (SWAP)	Bayero University Kano, Kano State	2017
5	Atmospheric and Space Weather Research Laboratory (ASWeRL)	Osun State University, Osun State.	2017
6	Central Laboratory for Atmospheric Research (CLAR)	Anyigba, Kogi State.	2017

*Table 1: lillustration of CAR Affiliate Laboratories*

## OVERVIEW OF CAR LABORATORIES

### **National Air Quality Research Laboratory (NAQRL) University of Ilorin**

The laboratory which began operation in 2014 and is home to equipment such as the Magdas, Ionosonde to mention a few. The observational laboratory is divided into three units namely the aerosol measurement unit of AERONET which uses Cimel Sun photometer for aerosol optical depth measurement, the Air quality measurement unit which uses 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 - Emerging Global Aerosol Network
- ii. Global Estimates of Ambient PM<sub>2.5</sub> 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

### **Space Environmental Research Laboratory (SERL) NASRDA Headquarters Abuja**

The Space Environment Research Laboratory was established in June 2015 as one of the Space Research Laboratories of the Centre for Atmospheric Research NASRDA responsible for hosting world-class scientific equipment that is useful for studies of the Space Environment and Supporting manpower development both Nationally and Internationally for advancements in space research.

SERL houses the following:

- The MAGDAS & AMBER Magnetometers
- The All Sky Optical Imager,
- Fabry Perot Interferometer (FPI)
- GPS SW Monitor
- SOFIE

### **Space-Earth Environment Research Laboratory University of Benin**

In September 2016, the successful collaboration between CAR-NASRDA led by the Director/CEO, Professor Babatunde Rabiou with the University of Benin led to the establishment of the Space-Earth Environment Research Laboratory (SEERL) within the university campus. This collaboration saw the successful installation of the GNSS receiver from 19<sup>th</sup> – 21<sup>st</sup> October 2016 at the Space Earth-Environment Research Laboratory located within the University of Benin, Edo State.

### **Space Weather and Atmospheric Physics Laboratory (SWAP) Bayero State University Kano.**

The Space Weather and Atmospheric Physics Laboratory (SWAP) located in the University Campus of Bayero University was set up in 2017 in collaboration with Bayero University Kano (BUK), Kano State. The partnership between the two institutions also saw the installation of the automatic weather station in BUK in May 2017. The laboratory hosts facilities and supports research in the area of Space Weather and Atmospheric Physics.



**CENTRE FOR ATMOSPHERIC RESEARCH**  
**NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY**

**FEDERAL MINISTRY OF SCIENCE AND TECHNOLOGY**  
**KOGI STATE UNIVERSITY CAMPUS, ANYIGBA, NIGERIA.**

*[www.carnasrda.com](http://www.carnasrda.com)*

**DECEMBER 2017**

## ANNUAL REPORT FOR THE YEAR 2017

### Development/Achievement Recorded By The Centre for Atmospheric Research in 2017

In the year under review, the Centre recorded significant achievements in actualising the vision and mandates of NASRDA. The achievements, starting from the beginning of the year, are chronicled in the following sections of this report.

#### 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 Automatic Weather Station

The installation of the automatic weather station at the Bayero University Kano, was successfully carried out between the 9<sup>th</sup> - 12<sup>th</sup> of May, 2017 led by the TRODAN team manager, Mr Najib. This weather station aims at playing a pivotal role in now-casting and data generation accessible for space researchers. Alongside the TRODAN manager were Engr. Adedoja Oluwaseye and Mr Ezekiel Josiah who were also on ground to play key roles during the installation.

##### Installation of Septrentrio GNSS Receiver

The GNSS receiver was installed at the Space-Earth Environment Research Laboratory, University of Benin on the 9<sup>th</sup> of February, 2017 at about 12:46 pm by a team of scientist and engineers led by Dr Dan Okoh. Other members of the team who played a major role in the installation are Mr Enoch Elemo, Engr. Alesinloye Adeyemi and Mr Alex Orukpe.

##### Installation of Magnetometer

A new magnetometer was installed at Salem University, Lokoja, between 24<sup>th</sup> - 26<sup>th</sup> January 2017. The installation was facilitated by Mr Jatto S. Solomon and Mr Ezekiel Josiah.



Figure 6: Installation of Magnetometer at Salem University.



### **Installation of VLF (SOFIE) Single Frequency Receiver**

The SERL Acting Coordinator, Mr Jatto Solomon led the team to install the VLF receiver at the Space Environmental Research Laboratory, Abuja on the 12<sup>th</sup> August 2017. Also, installed by Mr Jatto S. and Mr J. Ezekiel was the DLR Germany SOFIE equipment which was equipped with GPS antenna.



*Figures 7: Mr J. Ezekiel, during the installation of SOFIE*

### **Installation of U-blox GNSS receiver**

The installation of the U-blox GNSS receiver at the Space Environmental Research Laboratory was successfully carried out on the 23<sup>rd</sup> of June 2017 led by the Installation team, Dr Bola Abdulrahim of Centre for Satellite Technology Development and Mr Jatto of CAR. This equipment was facilitated by the collaboration of Centre for Atmospheric Research with Abdus Salam ICTP, Trieste Italy.

### **Installation of WWLLN Receiver**

On 20<sup>th</sup> October 2017, SERL hosted another equipment called the Worldwide Lighting monitoring system which is instrumental to lower atmospheric lighting observations in Nigeria. This monitoring system was installed at SERL observation station due to the CAR successful overseas collaboration with the University of Washington, USA. Installation team: Mr Jatto S. and Mr J. Ezekiel.

### **Production of Magnetometers**

Leveraging on CAR's partnership with recognised institutions, exchange programs, conferences and workshops, the Centre for Atmospheric Research's team of scientists and engineers

successfully constructed 6 (six) locally- made magnetometers awaiting distribution across the Nation.

#### **Completion of Maintenance of Atmospheric Facilities**

CAR's team of proficient Scientists and Engineers carried out their scheduled annual maintenance on the Centre's facilities at several locations across the country between January and February 2017. The routine checks and facility maintenance turned out to be a huge success with utility observation feedback.

#### **Development of a Web-based IUCAR Directory**

Spurred by the intellectual idea of the Director of CAR, Prof. Babatunde Rabi, the ICT unit launched an Inter University Corporation for Atmospheric Research (IUCAR) a web directory page: [http://carnasrda.com/iucar\\_form/](http://carnasrda.com/iucar_form/)

The aim of this initiative was to bring together researchers, scientist and institutions with interest in atmospheric and space sciences with the goal to:

1. Set up a one-stop database for all researchers and institutions with relevance in atmospheric sciences;
2. Provide a meeting platform for all researchers in fields of relevance to atmospheric sciences in Nigeria;
3. Foster effective partnership among researchers of similar scientific interest;
4. Promote international competitive research among members;
5. Promote professionalism and instill sound academic culture in members;
6. Establish a formidable team capable of forming alliance with international teams with the aim of pursuing long-term scientific programs; and
7. Work with the Centre for Atmospheric Research and other national entities to promote research, observational programs, training and formulation of policies relevant to atmospheric sciences in Nigeria.

The directory is open to all stakeholders in relevant atmospheric science.

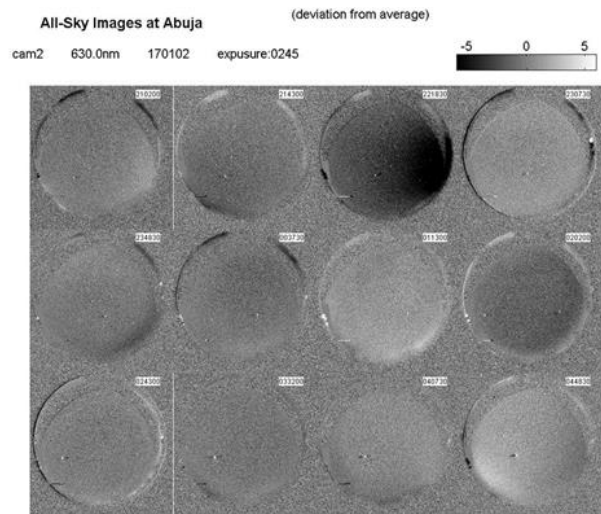
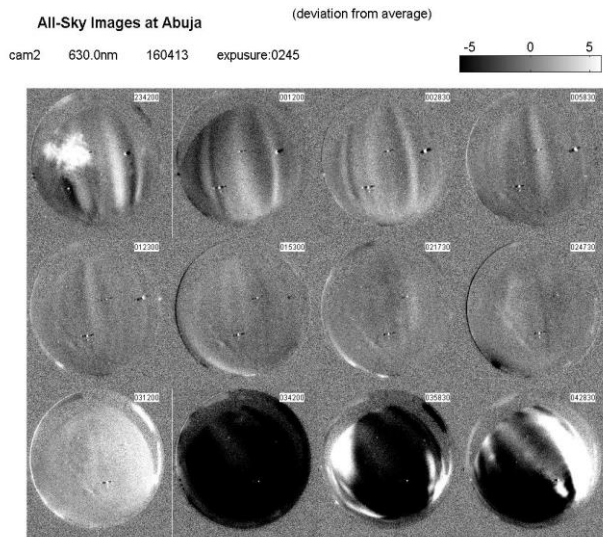


Figure 8: Sample illustration of quick -view images with observed and no observed bubble structures.

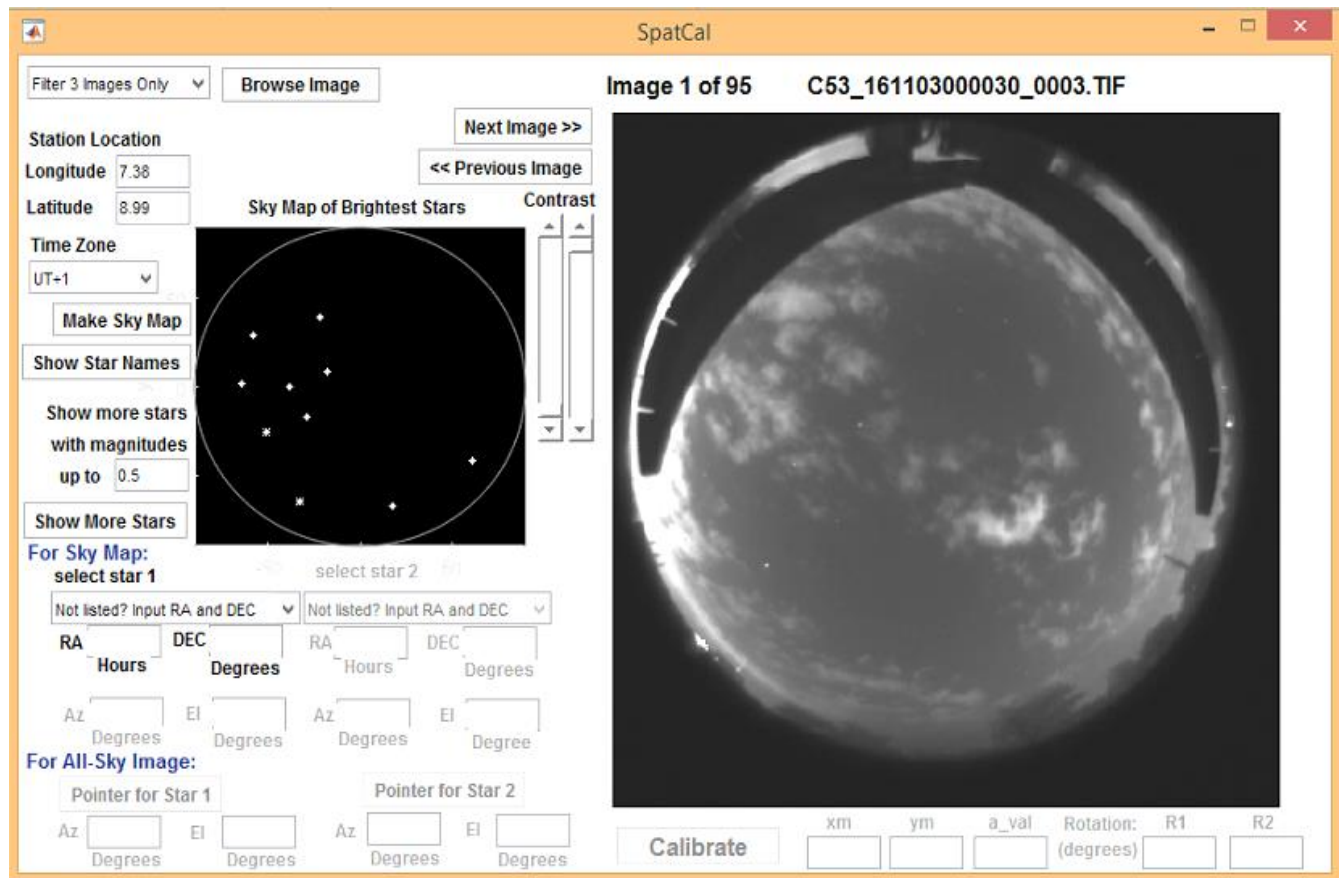


Figure 9: Screen shot of Plasma bubbles structures

## MEMORANDUM OF UNDERSTANDING

CAR successfully brokered partnerships with various local and foreign institutions through the signing of MoU.



The Centre successfully initiated Memorandum of Understanding between CAR/NASRDA and the following Institutions in 2017:

- i. Cross River University of Technology, Calabar
- ii. University of Medical Sciences, Ondo
- iii. Covenant University, Ota, Ogun State.

### Collaborations in the Pipeline

- a. Collaboration initiative symposium between CAR and Institute of Energy and Climate Research, Julich, Germany.
- b. West African Science Service Centre on Climate Change and Adapted Land – Federal University of Technology, Akure (WASCAL - FUTA)
- c. Western University, Ogara, Delta State.
- d. Madonna University and
- e. Federal University of Petroleum Resources, Delta State.

## ACTIVITIES SUPPORTED AND ORGANISED BY THE CENTRE

In line with its mission statement, the Centre for Atmospheric Research 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 2017.

### **2nd International School on Equatorial and Low-Latitude Ionosphere (ISELLI -2) 10<sup>th</sup> – 16<sup>th</sup> September 2017**

The Centre for Atmospheric Research Anyigba in collaboration with JSPS core-to-core program B. Asia-Africa Science Platforms, Japan; Centre for International Collaborative Research (CICR); Institute for Space-Earth Environmental Research (ISEE); Nagoya University, Japan; and Inter-university Upper Atmosphere Global Observation Network (IUGONET), Japan; Project for Solar-Terrestrial Environment Prediction (PSTEP), MEXT, Japan; The Scientific Committee on Solar Terrestrial Physics (SCOSTEP) and Covenant University, Canaan Land, Ota, Nigeria organised the *International School on Equatorial and Low-Latitude Ionosphere (ISELLI 2)* at Covenant University, Canaan Land, Ota, Ogun State .

The school programme was aimed at capacity building of young researchers and graduate-course students in Ionospheric and Space Weather Physics. No fewer than 60 persons participated in the programme: 14 instructors, and 46 trainees were in attendance from 11 different countries across the globe.

The international school Co-Directors are:

- i. Prof. Kazuo Shiokawa, Centre for International Collaborative Research (CICR), Institute for Space-Earth Environmental Research (ISEE), Nagoya University, Japan
- ii. Prof. Babatunde Rabiun Director, Centre for Atmospheric Research, National Space Research and Development Agency, Nigeria.

Other CAR scientists who participated in the workshop were: Mr Najib Yusuf, Dr Daniel Okoh, Mrs Aderonke Obafaye, and Mrs Abimbola Onijamah.



Figure 10: Prof. Babatunde Rabi, Prof. Kauzo Shiokawa a flanked by a cross- section of participants at ISELLI 2. Sept 10th-16th 2017

### **E.E Balogun National Symposium on Atmospheric Research on 27<sup>th</sup> July 2017**

The Centre for Atmospheric Research (CAR) in collaboration with Department of Physics and Engineering, Obafemi Awolowo University Ile Ife, National Space Research and Development Agency (NASRDA), Africa Regional Centre for Space Science and Technology Education-English (ARCSSTE-E) and Cooperative Information Network (COPINE) organised a National symposium themed: “Atmospheric Research in Nigeria” in honour of Prof. Elisha Ekundayo Balogun, an erudite scholar of the department of Physics and Engineering Physics, Obafemi Awolowo University OAU on the 27<sup>th</sup> of July 2017. The event was organised to commemorate his 80<sup>th</sup> birthday and to highlight the contributions of the great icon to the development of atmospheric research in Nigeria and in the global community at large. A full text of the Keynote on Atmospheric Physics in Nigeria: “*A Glimpse into the Past, Assessment of the Present and a Speculation into the Future*” was delivered by Prof. Ezekiel Oluyemi Oladiran. The Director/ Chief Executive of CAR, Prof. Babatunde Rabi was also in attendance.

## **One Day Symposium on Space Weather themed: “Is Space Weather a Threat to our Daily Lives?” on 7<sup>th</sup> September 2017.**

The one-day public lecture themed “Is Space Weather A Threat To Our Daily Lives?” delivered by Dr Endawoke Yizengaw (Senior Scientist & PI of Amber project, Institute for Scientist Research, Boston College) held on the 7<sup>th</sup> of September 2017 at the National Space Research and Development Agency, Obasanjo Space Centre, Abuja, Nigeria. It was webcasted live by the Centre for Atmospheric Research (CAR- NASRDA) for thousands of people from all over the world to watch.

## **Space Workshop – SEERL UNIBEN**

The workshop was organised by the Space Earth-Environment Research Laboratory at the University of Benin Campus, Benin City, Edo State. SEERL is an out station of the Centre for Atmospheric Research under its parent body, National Space Research and Development Agency (NASRDA) on the 16<sup>th</sup> of May 2017 titled “Space Exploration: A Step into the New Frontier”. This event was hosted by the Director of CAR, Prof. Babatunde Rabi

During the course of the programme, a one-time Federal Minister of Science and Technology, Prof. Emmanuel Emovon gave a keynote address which chronicled various notable events that have taken place under the Federal Ministry of Science and Technology, down to a concise overview of NASRDA. He concluded by encouraging participants on the need to devote keen attention to Science and Technology as well as young school leavers and students to consciously make Science a choice of career.

Subsequently, a well put together presentation titled “*Space Exploration: A Step into a New Frontier*”, was done by the Director/CEO of CAR-NASRDA in person of Prof. Babatunde Rabi. The presentation further sparked research interests and curiosities in the minds of scientists present at the event. In addition, the presentation demystified grey areas enshrouding the exploration of Space. Also, Prof. Rabi stated that all the Centres of NASRDA in Nigeria offer Space products without fee, solely for research purposes.

Towing the line for knowledge sharing was the turn of Space Generation Advisory Council (SGAC) ably led by Mrs Erinfolami Funmi who made presentations on contemporary events in

the International Space Station (ISS) which is approximately 400km from the earth surface. She charged guests at the event on the need to invest in space programmes.



*Figure 11: Staff of CAR. From L-R: Mr Enoch Elemo, Co-ordinator, SEERL, Uniben, Mr Najib Yusuf, Head of R & D in CAR, Dr Ogah, Deputy Director of CAR, Prof. Babatunde Rabi, Director/CE of CAR, Mr Alex O. Orukpe, Mr Micheal Inah and Engr A. Yemi*





*Figure 12: Cross Section of participants at the Space Exploration Workshop*

## **2<sup>nd</sup> National Workshop on Microgravity and Environmental Research**

The 2<sup>nd</sup> National Workshop on Microgravity and Environmental Research was held from the 26<sup>th</sup> to 29<sup>th</sup> of November 2017. The event saw a large gathering of researchers, scientists, captains and representatives of industries and students with keen interests in Microgravity and Environmental sciences converged at the Centre for Atmospheric research, Anyigba to attend the first National Workshop on Microgravity and Environmental Research with the theme “Microgravity and Environmental Research for Sustainable Development”. The event was organised by the Centre with the primary aim of advancing the cause of Microgravity and Environmental Research in Nigeria towards sustainable development, and it was expected to create endless opportunities for collaborative research and offer novel means of improving the present quality of life of people without jeopardising the chance of future generation.

In the workshop, which attracted over 60 registered participants from across Nigeria, a total of twenty - three (23) oral presentations were made by participants and invited lecturers from an assortment of relevant disciplines and institutions spread across the country on various subject

matter among which are Agriculture, Flood, Health Care, Material Sciences and Industrial Development, Climate Change and Renewable Energy, among others.

The keynote speakers were Prof. Daniel J. Arotupin from Federal University of Technology, Akure, Dr Mrs. Laureta N. Ofodile, Convener Environmental Research Group, Yaba College of Technology, Lagos, Dr Bonaventure I. Okere, Ag. Director/CE, Centre for Basic Science, National Space Research and Development Agency, Nsukka. Other renown academicians present were Prof. T. V. Omotosho from Covenant University, Ota, Prof. J. O. Ogunwole from Federal University, Oye - Ekiti and others.

### **15<sup>th</sup> National Council on Science and Technology (11<sup>th</sup> -15<sup>th</sup> December 2017)**

The 15<sup>th</sup> National Council on Science and Technology held from 11<sup>th</sup> – 15<sup>th</sup> December 2017 was organised by the Federal Ministry of Science and Technology at the Imaguero College, Benin City, Edo State. The council is saddled with the responsibility of formulating policies to promote science and technology in the country. Consequently, the program was graced by the Honourable Minister of Science & Technology, Dr Ogbonaya Onu; Former Minister of Science & Technology 1985 – 1989, Prof. Emmanuel Emovon; Permanent Secretary of the Ministry, Dr (Mrs) Amina Mohammed Bello Shamaki, Edo State Governor, ably represented by the Honourable Commissioner of Science and Technology, Edo State, Hon. Emmanuel Agbale, Esq, Director Generals and representatives of all the Parastatals under the Federal Ministry of Science and Technology, State Commissioner of Science and Technology, Nigeria Defence, Nigeria Police Force, National Parks, and the organised private sector.

### **PARTICIPATION IN CONFERENCES AND WORKSHOPS**

The Centre for Atmospheric Research (CAR) actively participated in the following conferences and workshops listed below:

#### **1<sup>st</sup> International Conference on Science and Sustainable Development, Covenant University, Ota. 20<sup>th</sup> June 2017**

The Department of Physics, Covenant University held her 1<sup>st</sup> International conference themed “**Science and Sustainable Development**”. The conference had eminent speakers in attendance with paper presentations on the pathway to sustainable development. The Chief Executive of CAR, Prof. Babatunde Rabiw who was a keynote speaker at the conference, presented the

keynote address on “*Scientific Research: A Critical Input to Sustainable Development*”. He reiterated the need for further investment in scientific research, having favourable policy for science and technology, infrastructural development for technological applicability, and the promotion and patronage of science and technology to further harness a basis for sustainable development.

#### **ICTP - International Centre for Theoretical Physics, Trieste, Italy. 12<sup>th</sup> June - 17<sup>th</sup> November 2017**

The Director/Chief Executive, Prof. Babatunde Rabiú along with a staff of the Centre, Mrs Aderonke Obafaye participated in the ICTP (T/ICT4D) Joint Experiment on High Frequency Radio Propagation.

#### **Nigerian/Portuguese scientists’ Conference between 4<sup>th</sup> - 5<sup>th</sup> December 2017**

The Ministry of Science and Technology organised a Nigerian/Portuguese Scientists conference, themed: “Science Technology and Nigeria/Portugal Collaborative Framework”. It was aimed at enhancing collaboration between Portuguese and Nigerian scientists. This conference was hosted by NASRDA in Abuja. Dr Elijah Falayi, a space weather scientist presented on behalf of our Centre. Staff in attendance included Dr Jatto, Mrs Aderonke Obafaye, Mrs Abimbola Onijamah and Miss Omotayo Johnson.

#### **2017 Nigerian Meteorological society (NMetS) International Conference, 20<sup>th</sup> - 24<sup>th</sup> November 2017.**

The Nigeria Meteorological society (NMetS) organised her 31<sup>st</sup> annual general meeting themed “Climate Change and Environmental Resources Management Issues” at Enugu State University of Science and Technology (ESUT) Business School. The Director of the Centre for Atmospheric Research was the keynote speaker.

#### **Nigerian Geophysical Society (NGS) Conference, Bayero University Kano, 9<sup>th</sup> -12<sup>th</sup> May 2017.**

The Nigerian Geophysical Society Conference (NGS), held at the Bayero State University, Kano between the 9<sup>th</sup> - 10<sup>th</sup> of May 2017. The keynote address at the event was delivered by the Director of the Centre for Atmospheric Research, Prof. Babatunde Rabiú. Our Staff Mr Najib Yusuf and Muawiya Sani were in attendance.

## **7th National Conference of the Astronomical Society of Nigeria ASN, 28<sup>th</sup> November – 1<sup>st</sup> December 2017.**

The ASN 7<sup>th</sup> national conference held in Coal City University, Enugu had in attendance our astute Director/ Chief Executive, Prof Babatunde Rabiou who delivered a keynote address. Other highlight of the conference was the conferment of the title of a “Fellow” on him in recognition for his contributions to space science across africa by the society. CAR staff were also in attendance to participate and support our Director.

## **Participation In The Technology And Innovation Expo 2017 (3<sup>rd</sup> – 7<sup>th</sup> April 2017)**

The Federal Ministry of Science and Technology organised her annual Technology and Innovation Expo Conference 2017 which showcased the activities of the various agencies under the ministry. The Centre for Atmospheric Research, Anyigba represented by Dr Daniel Okoh, Mr Jatto Solomon, Mr Jubrin Out, Mrs Aderonke Obafaye, and Mrs Abimbola Onijamah had on display, motion Pictures of the first airglow observation of plasma bubbles for the continent, GNSS ionospheric map over Nigeria developed by scientists in the Centre, the All Sky Optical Imager. The attention received highlighted the need for continuous research towards building sustainable capacities for solutions in atmospheric challenges.



*Figure 13: R – L; Dr Daniel Okoh, Senior Scientist and Coordinator of Space Environmental Research Laboratory (SERL) explaining the usefulness of the GNSS ionospheric map over Nigeria developed by scientists in the Centre at the Technology and Innovation Expo 2017 on the 3<sup>rd</sup>-7<sup>th</sup> of April 2017.*



## 2017 CAR Annual Staff Retreat

The management of the Centre for Atmospheric Research (CAR) Anyigba organised its annual staff retreat on April 19<sup>th</sup> 2017 at the Conference Hall, Entrepreneurship Building, Anyigba, Kogi State University campus with key resource speakers as: Hajiya Bilkisu Talatu Ahmed (NASRDA), Dr Mrs. Justina Ekere (UNN). Lectures covered include, “Adherence to Civil Service Rules” and “Developing a Culture of Financial Discipline”. An invited technical presentation titled: “Non-Linear Approach to the Study of the Atmosphere” was also delivered by Mr Samuel Ogunjo. Also, outstationed laboratory coordinators gave detailed report of the activities of the lab. The retreat was aimed at:

- Ushering staff members into the activities for the year
- Reiterate the Centres’ commitment, mandate and mission
- Review past years’ success and challenges
- Promote team work and team bonding
- Strategise plans for the year ahead in line with our mandate



*Figure 14: Photo of CAR staff at the end of the just concluded Staff Retreat on the 19<sup>th</sup> of April 2017. Centre-right Resource person Dr Mrs Justina Ekere from the University of Nigeria, Nsukka flanked by Prof. Babatunde Rabi, Director/CE of CAR and Centre-left is our Resource person Hajiya Bilikisu T. Ahmed, Assistant Director Welfare & General Matters, Dept. of Admin & Finance NASRDA.*

## Partial Solar Eclipse Observation

Nigerian experienced the partial solar eclipse observation billed to commence on Sunday, 26<sup>th</sup> of February 2017 at approximately 3:54 pm Nigerian local time. The annular partial eclipse visible across southern South America in the morning ended in south-western Africa at sunset. Precisely, this eclipse was visible in Chile, Argentina (South America), Atlantic, Africa, and Antarctica. This is the time when the axis of the Moon's shadow passes closest to earths' center and is the time when the greatest eclipse will occur. The observers all over the country had a fascinating experience while the eclipse lasted as predicted. Viewing glasses were shared for both staff and students of the institutions who were available for the sighting. The University management were not left out as the number one man of the Institution, Vice Chancellor, Prof. F. F. O. Orumwense participated in the exercise in company of his Deputy Academics, Prof. Falodun. The university media unit was also in attendance with about five staff from the unit.

The clarity of the viewing wasn't 100% because of the climatic condition. The heavy thunderstorms hindered the visibility of the viewing. We had isolated viewing especially when the cloud was a bit clearer. A very visible viewing was observed around 8:52 am, 9:20 am and about 9:58 am.



Figure 15: R-L: Mr Enoch Elemo, Uniben SUG President, Engr Yemi and Mr Alex Orukpe



Figure 16: Uniben Student enjoying a view with the safety viewing glasses

## VISITING SCIENTISTS TO CAR/SERL

1. Dr Afuwai G Cyril - Federal University Dutsinma
2. Air Cdre L.I Oluwatoyin - Nigerian Airforce
3. Dr Kayode Odumayomi - ESS - NASRDA, Abuja
4. Dr J. D. Dodo - CGG, NASRDA
5. Prof. Odunayo M. Oluwatosin – DVC, UNIMED, Ondo
6. Dr Yemisi Jeff Agboola - UNIMED
7. Dr Igwe O. Ewona - UNICAL
8. Engr Ayeni A.Umaru - ESS, NASRDA
9. Gabriel F. Ibeh- North American University, Benin Republic
10. Dr O. Segun Bolaji- University of Tasmania, Hobart, Australia
11. Dr Endawoke Yizengaw - Boston College
12. Ekpa Jones - OAUGF, Abuja
13. Sunmola Ayomide - University of Lagos
14. Dr Maxwell O. Kanu - Taraba State University
15. Dr A. O. Akala - University of Lagos
16. Dr L. Adeoti - University of Lagos
17. Olaniyan Olumide - Nigerian Meteorological Agency
18. Dr Elijah Falayi – Tai Solarin University.

## STAFF ON ACADEMIC PROGRAMMES

### Staff Who Have Completed Post Graduate Programmes

S/N	NAME	PROGRAMME	INSTITUTION	STATUS
1	Musa I. A.	MSc Computer Science	Kogi State University, Anyigba	Completed
2	Ikani Ojochenemi	MSc. Ionospheric and Communication Physics	University of Ilorin	Completed

Table 2: List of Graduate Programs Completed

### Staff Undergoing Post Graduate Programmes

S/N	NAME	PROGRAMME	INSTITUTION	STATUS
1.	Adedaja Oluwaseye	PhD Engineering	Tshwane University of Technology, Pretoria. South Africa	In progress
2.	Yusuf Najib	PhD Atmospheric	Bayero State University	In Progress
3.	Ogbeiwi Kenneth Osalumense CNA	PhD Accounting	Igbinedion University, Okada	In Progress
4.	Shehu Sarafadeen A.	PhD	University of Ilorin	In Progress
5.	Johnson O.Omotayo	M.Tech Food Science Tech	Federal University of Technology Akure	In Progress
6.	Onuigbo Ifeanyi Francis	PGD in Electrical/Electronic Engineering	Enugu State University of Technology	In Progress
7	Obafaye. Aderonke	M.Sc. Environmental Physics	University Of Agric Makurdi.	In Progress
8.	Balogun, T. A	PhD. Agric	University of Fort Hare, South Africa.	In progress
9.	Timiyo T.J	M.Sc. Physics	Kogi State University, Anyigba.	In Progress
10.	Omale R.	MPA	Kogi State University, Anyigba	In Progress
11.	Alfa Daniel	PGD Management	Kogi State University, Anyigba	In Progress
12.	Kumben Plangnan	MPA	Nassarawa State University, Keffi	In progress
13.	Shehu Sarafadeen.A.	PhD Physics	Univeristy of Ilorin	In Progress
14.	Saleh Abubakar Umar	M.Sc. Info Tech	NOUN	In Progress



S/N	NAME	PROGRAMME	INSTITUTION	STATUS
15.	Eze Francis N.	M.Sc. Info Tech	NOUN	In Progress
16.	Muawiya Sani	M.Sc. Physics	University of Ilorin	In Progress
17.	Akolo John A.	M.Sc. Info Tech	NOUN	In Progress
18.	Adamu Yusuf	M.Sc. Public Admin	Kogi State University	In Progress
19.	Idah Ojoago	HND	Adekunle Ajasin University	In Progress
20	Saleh Abubakar Umar	M. Eng	Abubakar Tafawa Balewa University	In Progress
21.	Orukpe Oseghale A.	M.Sc. Plant Biochemistry	University of Benin	In Progress

Table 3: List of Graduate Programs in progress

## SPECIAL ADMINISTRATIVE/TECHNICAL TRAINING

### Training on GIFMIS budget Preparation Subsystem

This training was organised by the Federal Ministry of Budget and National Planning on the budget preparation platform for 2018 using the GIFMIS. Our staff who participated in the three days training include Mr Ogbeiwi Kenneth, Mrs Onuh Joyce, Mr Solomon Jatto, Mrs Aderonke Obafaye and Mr Gideon Eboseremhen. The training was held from 31<sup>st</sup> July – 2<sup>nd</sup> August 2017 at the CBN, International Conference Centre, Abuja.

### Orgon-Accumulator-Applying Space Science Agriculture” seminar on 16<sup>th</sup> - 17<sup>th</sup> January 2017

On 16th January, 2017, a one-day seminar was organised by the Centre for Atmospheric Research, National Space Research and Development Agency, Federal Ministry of Science and Technology, Kogi State University Campus, Anyigba at The Entrepreneurial Development Centre, Kogi State University, Anyigba to discuss and deliberate on the proposal, “The Orgone Accumulator – Applying Space Science to Agriculture” for possible funding.

*“The evaluation of Orgone Accumulator Charged Seeds on Growth and Yield of Maize and Okra in Rainforest Agro-Ecological Zone of South West Nigeria”.*

The application of Orgone energy is suspected to be a promising method of improving plant growth and yield. Owing to the challenges posed by food insecurity today, ensuring food security for the increasing population demands that all available means should be explored. In the light of this, the Centre, in line with its mandate, approved a research proposal “Evaluation

of Orgone Accumulator Charged Seeds on Growth and Yield of Maize and Okra in Rainforest Agro-Ecological Zone of South West Nigeria". The project falls under the Space Research Initiative Unit.

The preliminary study was undertaken at the Teaching and Research Farm of the Federal University of Technology, Akure, Nigeria to evaluate the influence of the Orgone accumulator charged seeds on the growth and yield of maize and okra. Two varieties (local and improved) of each crop were tested. Data collected on growth and yield parameters were subjected to analysis of variance. These preliminary findings showed that Orgone accumulator charge has some potentials that need further exploration. It is therefore recommended that, further experiments are to be conducted with seeds of crop charged with Orgone accumulator at varying periods.



Figure 17: CAR staff at the "Orgon-Accummulator-Appling Space Science Agriculture" seminar on 16<sup>th</sup>-17<sup>th</sup> January 2017.

#### 4<sup>th</sup> international Workshop on Applications of ICT on Education Healthcare and Agriculture. 25<sup>th</sup> -27<sup>th</sup> July 2017

The 4<sup>th</sup> international workshop on Applications of ICT on Education Healthcare and Agriculture held at the Senator (Prof.) Robert Ajayi Boroffice Multi-purpose Hall, Obasanjo Space Centre, Abuja on the 25<sup>th</sup> -27<sup>th</sup> July 2017 focused on how technology brings people around the world together and can be used to foster the agricultural industry for sustainable development and food security. The centre was represented at the workshop by Mrs Bimbo Onijamah.

#### CSTD Annual Space Conference/Exhibition. 22<sup>nd</sup> – 23<sup>rd</sup> August 2017

The Centre for Satellite Technology Development (CSTD) week is an annual Space Conference event. This year's theme, tagged "*Integration of Space Technology in Nigeria: A Spectrum of opportunities*" was held between August 22<sup>nd</sup> - 23<sup>rd</sup> 2017 at the premises of the National Space

Research & Development Agency (NASRDA). The Director of the Centre for Atmospheric Research (CAR), Anyigba, Prof. Babatunde Rabiun led the Centre's team to the conference. To corroborate the theme of the conference, the 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"*.

### **CENTRE FOR ATMOSPHERIC RESEARCH NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY (NASRDA) NOMINAL ROLL AS AT 2017**

S/N	SURNAME	FIRST NAME	OTHER NAMES	QUALIFICATION	DESIGNATION
1	Prof. Rabiun	Akeem	Babatunde	Ph.D Physics	Director
2	Dr Ogah	Arewa	James	Ph.D App. Geophysics	D. Director
3	Dr Gbobaniyi	Emiola	Olabode	Ph.D Atmospheric Science	Ass. Director
4	Mr Okpanachi	Danjuma	Akubo	B.Sc/MBA Financial Mgt.	Chief A.O
5	Mr Yusuf	Najib		M. Sc Physics	Chief S.O
6	Mr Adejoh	Isaac		H.N.D Pub. Admin	Ass.Chief E.O
7	Mr Elemo	Enoch	Oluwaseun	B. Tech. /M.Sc Physics	Ass.Chief S.O
8	Mrs Omale	Ramatu		B.Sc. Education	Ass.Chief A.O
9	MR ABDUL	DANJUMA	ALI	Hnd/Pgd Management	Ass.Chief E.O
11	Dr Ogunmodimu	Olugbenga		Phd Physics	Ass.Chief S.O
12	Mr Omede	Michael		B.Sc. / Edu. Economic	Ass.Chief A.
13	Dr Okoh	Daniel	Izuikedinachi	Phd Physics	Ass.S.O
14	Mr Musa	Ibrahim	Aishat	B.Sc. Computer	P.S.O
15	Mr Alfa	Daniel		H.N.D Bus. Admin	P.E.O I
16	Engr. Adedaja	Oluwaseye	Samson	B.Eng./M. Eng. Mechanical	P.S.Engineer
17	Miss Kumben	Plangnan	Inusa	Hnd Pub. Admin	P.E.O I
18	Mr Jatto	Solomon	Sunday	B.Sc./M.Sc Geophysics	S.S.O
19	Mr Shehu	Sarafadeen	Aladodo	M.Sc. Physics	S.S.O
20	Mr Ogbeiwi	Kenneth	Osalumense	B.Sc./M.Sc Acc. / Fin.	S.A.O
21	Mr Engr. Alesinloye	Adeyemi	Raifu	B.Eng. Electrical	S. Engineer

S/N	SURNAME	FIRST NAME	OTHER NAMES	QUALIFICATION	DESIGNATION
22	Engr Saleh	Abubakar	Umar	B.Engr. E/E	S. Engineer
23	Mr Eze	Francis	Nkem	B.Sc. Phy./ Astro.	S.S.O
24	Mr Isah	Musa		M.Sc Pub. Admin	S.A.O
25	Mrs Onuh	Ojonugwa	Joyce	H.N.D Bus/ Admin	P.E.O I
26	Mr Muawiya	Sani		B.Sc. Physics	S.O. I
27	Mr Akolo	John	Adigidzi	B.Sc. Computer Sc.	S.S.O.
28	Mr Abdulrahman	Suleiman		B.Sc. Ict, M.Sc Itm	S.S.O.
29	Mr Timiyo	Tebe-Ebi	Justice	B. Tech. Physics Elect	S.S.O
30	Mr Otu	Jibril	Onimisi	B.Sc. Chemistry	S.S.O
31	Mr Garacci	Husseini		H.N.D Banking/ Fin	S.E.O
32	Mr Yusuf	Hamza		B.Sc. Accounting	Accountant I
33	Mr Adamu	Yusuf		B.Sc. Pub. Admin	A.O. I
34	Mr Akoh	Samson		Hnd/Pgd Mangt	A.O. I
35	Mrs Onijamah	Abimbola	Adetayo	M.Sc Intern. Magt.	Planning Office I
36	Mrs Akinola	Olufunmilayo	Olanike	B.Sc Phy/M.Tech	S.O. I
37	Mr Ikani	Ojochenemi		B.Sc. Physics	S.O. I
38	Mr Onuigbo	Ifeanyi	Francis	H.N.D Elec. Elect	Engineer I
39	Mr Omede	Okolo	Ali	B.E Soc/Studies	S.E.O
40	Mrs Ndah	Ojoago		N.C.E Pes/ Crs	S.E.O
41	Mr Aghedo	Jude		B.Sc. Bus. Admin	A.O I
42	Mr Orukpe	Oseghale	Alex	B.Sc.Sc.Lab.Tech	S.O I
44	Mr Adejuwon	Opeyemi	Olalekan	B. Eng Computer. Engineering	Engineer I
45	Mrs Obafaye	Aderonke	Adekemi	B.Sc Physics, P.Gd Envir. Physics	S.O I
46	Miss Johnson	Opeyemi	Omotayo	B.T. Food Sc. Tech.	S.O I
47	Mr Inah	Michael	Idoko	B.Sc.Pol. Science	A.O I
48	Mr Onimisi	Isiaka	David	B.Sc. Economics	A.O I
49	Mr Eboseremhen	Gideon		B.Sc/Edu Economic	Planning Officer I
50	Mr Okeme	Adah	Abutu	B.Sc Pub. Admin	A.O I
51	Mrs Mohammed	Zainab		Dip. Pub. Admin	H.E.O
52	Mrs Yakubu	Fatimatu		N.C.E. Eng/Sos	H.E.O
53	Mr Bature	Dawash	Solomon	B.Sc Sociology	A.O. I
54	Mr Yahaya	Ibrahim		B.Sc. Pub. Admin	A.O I

S/N	SURNAME	FIRST NAME	OTHER NAMES	QUALIFICATI-ON	DESIGNATION
55	Mr Momoh	Attah		Hnd Bus. Admin	H.E.O
56	Mrs Sule	Halima	Muhammed	Hnd Pub. Admin	H.E.O
57	Mr Awulu	David	Akowe	Hnd Public Admin	H.E.O
58	Miss Onuh	Mercy		N.C.E. Sos/Pes	H.E.O
59	Mr Hassan	Sule		N.C.E A. Edu. English.	H.E.O
60	Mr Audu	Pius		B.Edu. Management	A.O. li
61	Mr Ezekiel	Josiah		N.D. Mech. Engr.	H.T.O
62	Mrs Onalo	Peace		N.D. Pub. Admin	H.E.O
63	Mrs Shehu	Rabi		B.Sc. Sociology	H.E.O
64	Mr Shaibu	Tijani		B.Sc. Accounting	E. O
65	Mr Onwubolu	Kelvin	Omebu	O. Level	Chief C. O
66	Mr Amedu	Omede	Hassan	Nce Sos/Econs	E. O
67	Mr Maha	Jibrin		N.D Pub. Admin	E. O
68	Mr Aboh	Ibrahim	Muhammed	N.D. Pub. Admin	E. O
69	Mr Baba	Isiaka		O. Level	Chief D. M
70	Mr Umar	Musa		T. Grade 2	E. O
71	Mrs James	Ojone		O. Level	Chief C. O
72	Mr Abutu	Kabiru		Diploma Mass.Comm	E. O
73	Mr Adaji	Tijani		O. Level	Senior C. O
74	Mr Ismaila	Mohammed		O. Level	Senior C. O

Table 4: List of CAR Staff



## VISITS BY INTERNATIONAL SCIENTISTS

### Institute Of Energy And Climate Research, Julich, Germany

CAR played host to delegates from Institute of Energy and Climate Research, Julich, Germany on the 28th of July 2017. Following a successful presentation and tour round the facilities, discussions ran on possible research collaboration in solar resource measurement and estimation with both institutions showing optimum commitment.



*Figure 18: Visitors from Institute of Energy and Climate Research, Julich, Germany flanked by our Director, Prof. Babatunde Rabi*



*Figure 19: Visitors from Institute of Energy and Climate Research, Julich, Germany flanked by our Director, Prof. Babatunde Rabi*

## RESEARCH VISIT

The coordinator of SERL, Dr Daniel Okoh, was at Nagoya University, Japan as a visiting researcher for six months which spanned from March 2017 to September 2017. During his stay in Japan, he developed a software that is now accepted for calibration on the All Sky Optical Imager.

### Postdoctoral Research Fellowship

Dr Daniel Okoh, coordinator of the SERL visited the Indian Institute of Geomagnetism Navi, Mumbai, India as a postdoctoral research fellow for the period 1<sup>st</sup> October - 31<sup>st</sup> March 2018. He carried out a research on Ionospheric Total Electron Content TEC variation over Africa during the period of visit.

## RECOGNITIONS/ AWARDS

- The Director of CAR, Prof. Babatunde Rabiú received a *“Recognition Award”* on the 11<sup>th</sup> of May 2017 from the Vice Chancellor of Bayero State University in recognition of his outstanding contribution to Space Science.
- The Nigeria Geophysical Society on the 12<sup>th</sup> of May 2017 presented the Centre for Atmospheric Research with an *“Award of Excellence”* through her amiable Director, Prof. Babatunde Rabiú.
- Covenant University, Canaan Land, Ota, honoured Prof Babatunde Rabiú with a *“Special Recognition Award”* on the 13<sup>th</sup> of September 2017 for his teething contribution to the progress of science in Nigeria.

## Inspection Visit

The Head of Space Research Initiative Unit, Mr Musa I. A. and two other staff of CAR, Mr Olalekan A. and Miss Omotayo Johnson, on the directive of the Centre’s Director/CEO, embarked on an inspection visit to the experimental farm for the Orgone - Accumulator Research project at Akure from 29<sup>th</sup> – 30<sup>th</sup> September 2017. They were received and taken round the farm by the project coordinator, Dr Akinagbe Oluwolé, Dr Adebayo Raphael and Dr Fayeun Lawrence. The exercise was successfully concluded.

## PAPER PRESENTATIONS IN 2017

- I. “Activities of the Research and Development Division of the Centre for Atmospheric Research (CAR), Anyigba”, CAR Retreat January 2017.
- II. “Investigation on the impact of Nigerian Climate on Global Climate. PhD Proposal. February 2017.
- III. “The Study of Surface Temperature Variations in Nigeria”. 4<sup>th</sup> Nigerian Geophysical Society Conference, Kano. May 2017.
- IV. “Atmospheric Measurements and AQ Program at the Centre for Atmospheric Research (CAR), Anyigba” PMEH World Bank Symposium, July 2017 Lagos.
- V. “Viewing Outer Space from Earth”. Space Week Outreach for Primary and Secondary Schools, Lokoja in October 2017.
- VI. “Space Exploration: A Step Into A New Frontier” was done by Prof B. A. Rabiú, Director/CE of CAR

## INHOUSE SEMINAR

The following seminars were organized by CAR during the period in review.

- i. *"Temperature Variations and the Recent Climate Change in Nigeria"*, CAR Internal Seminar 2017.
- ii. Paper presentation titled *"Air Quality Program"* at the Centre for Atmospheric Research (CAR), Anyigba".
- iii. *"CAR Seminar Presentation Standard"* by Musa I.A. on the 22<sup>nd</sup> March 2017.
- iv. *"Construction of a Low-Cost Sun Photometer for Aerosol Observations"* by Ifeanyi O. on 22<sup>nd</sup> March 2017.
- v. *"Impact of Meteorological Parameter on the Relation between Aerosol Optical Properties and Air Pollutions in Anyigba"* by Shehu S.A. on 26<sup>th</sup> April 2017.
- vi. *"Solar Radiation And it Effect On Environment"* by Gloria I.O and Victoria O.F on 26<sup>th</sup> April 2017.
- vii. *"TRODAN Station Telemetries"* by Suleiman A. on 12<sup>th</sup> April 2017
- viii. *"Construction of A Long Periodic Dipole Antenna for Solar Radio Burst(CALLIST)"* by Ifeanyi O. on 7<sup>th</sup> June 2017.
- ix. *"Urbanization Impact on Rural/Urban Tempterature Variation"* by Isaac O. Agama on 14<sup>th</sup> June 2017
- x. *"Connection of CAR Administrative Building to the National Grid"* by Odawn David O. on 14<sup>th</sup> June 2017
- xi. *"Update on TRODAN Project"* by Engr. Saleh.A.U. on 5<sup>th</sup> July 2017.
- xii. *"Deforestation: Causes, Effects and Solution"* by Lawal Yakuq on 5<sup>th</sup> July 2017
- xiii. *"Basic Technologies for Air Pollution control IN Industrials"* by Ahmodu Annas and Akoh David E. on 5<sup>th</sup> July 2017
- xiv. *"Effects of Ionospheric Spatial TEC Gradients on Communication Systems and GPS Positioning Accuracy"* by Ikani Ojochenemi on 19<sup>th</sup> July 2017

## PUBLICATIONS 2017

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



1. Najib Yusuf, Daniel Okoh, Ibrahim Musa, Samson Adedaja and Rabia Said A., (2017). Study of the Surface Air Temperature Variations in Nigeria. Scopus (Bentham open). The Open Atmospheric Science Journal. Publisher Id: TOASCJ-11-5. Vol. 11 P54-70. DOI: 10.2174/1874282301711010054
2. Daniel Okoh, Babatunde Rabi, Kazuo Shiokawa, Yuichi Otsuka, Bolaji Segun, Elijah Falayi, Sylvester Onwuneme, Rafiat Kaka (2017). First Study on the Occurrence Frequency of Equatorial Plasma Bubbles over West Africa Using an All-Sky Airglow Imager and GNSS Receivers. Journal of Geophysical Research, 122 (12), pp. 12430-12444, <https://doi.org/10.1002/2017JA024602>
3. O. S. Bolaji, E. O. Oyeyemi, A. O. Adewale, Q. Wu, D. I. Okoh, P. H. Doherty, R. O. Kaka, M. Abbas, C. Owolabi, P. A. Jidele (2017). Assessment of IRI-2012, NeQuick-2 and IRI-Plas 2015 models with observed equatorial ionization anomaly in Africa during 2009 sudden stratospheric warming event, Journal of Atmospheric and Solar Terrestrial Physics, 164, 203-214.
4. Emeka Ojubo, Daniel Okoh, David Okeya, Najib Yusuf, George Adukwu., (2017). The Response of Meteorological Parameters to the September 1 2016, Solar Eclipse as Observed in Anyigba. Research & Reviews: Journal of Space Science & Technology. RRJoSST (2017) Volume 6, 16-24 Issue 1 ISSN: 2321-2837. ISSN: 2321-6506.
5. Okoh, D., Onwuneme, S.; Seemala, G., Jin, S., Rabi, B., Nava, B., Uwamahoro, J., 2018. Assessment of the NeQuick-2 and IRI-Plas 2017 models using global and long-term GNSS measurements, Journal of Atmospheric and Solar-Terrestrial Physics, Volume 170, 1-10.
6. Lawal, H. A., Lester, M., Cowley, S. W.H., Milan, S.E., Yeoman, T.K., Provan, G., Imber, S., A. B. Rabi, 2018. Understanding the global dynamics of the equatorial ionosphere in Africa for space weather capabilities: A science case for AfrequaMARN. Journal of Atmospheric and Solar-Terrestrial Physics. <https://doi.org/10.1016/j.jastp.2018.01.008>
7. Okoh, D., Obafaye, A. A., Onudibia, M. E., Rabi, A. B., 2017. Total Electron Content Variations Over Abuja During the Annular Solar Eclipse of September 1, 2016. Research and Reviews: Journal of Space Science and Technology, 6(2), 1-8
8. Amory-Mazaudier, C., Fleury, R., Petitdidier, M., Soula, S., Masson, F., Rabi, A. B., et al., 2017. Recent Advances in Atmospheric, Solar-Terrestrial Physics and Space Weather From a

North-South network of scientists [2006-2016]. PART B : Results and Capacity Building. Sun and Geosphere, 212/ 2-Supplement, 21-69

9. Eyelade, V. A., Adewale, A. O., Akala, A. O., Bolaji, O. S. , Rabiou, A. B., 2017. Studying the variability in the diurnal and seasonal variations in GPS total electron content over Nigeria, *Ann. Geophys.*, 35, 701-710, 2017 <https://doi.org/10.5194/angeo-35-701-2017>
10. Rabiou, A. B., Folarin, O. O., Uozumi, T., Abdul Hamid, N. S., and Yoshikawa, A., 2017. Longitudinal variation of equatorial electrojet and the occurrence of its counter electrojet, *Ann. Geophys.*, 35, 535-545, doi:10.5194/angeo-35-535-2017.
11. Migoya-Orué, Y., Folarin, O. O., Radicella, S., Alazo-Cuartas, K., and Rabiou A. B., 2017: Evaluation of NeQuick as a model to characterize Equatorial Ionization Anomaly over Africa using data ingestion, *Advances in Space Research*. <http://doi.org/10.1016/j.asr.2017.01.013>
12. Bolaji, O., Owolabi, O., Falayi, E., Jimoh, E., Kotoye, A., Odeyemi, O., Rabiou, B., Doherty, P., Yizengaw, E., Yamazaki, Y., Adeniyi, J., Kaka, R., and Onanuga, K., 2017. Observations of equatorial ionization anomaly over Africa and Middle East during a year of deep minimum. *Ann. Geophys.*, 35, 123-132, doi:10.5194/angeo-35-123-2017,
13. Usikalu, M. R., Rabiou, A. B., Oyeyemi, K. D., Achuka, J. A., Maaza, M., 2017. Radiation hazard in soil from Ajaokuta North-central Nigeria. *Iranian Journal of Radiation Research*, 15(2), 219-224, DOI: 10.18869/acadpub.ijrr.15.2.219
14. Alagbe, G. A., Afolabi, O. O., Fayomi, E. S., Ayorinde, T. T., Rabiou, A. B., 2017. Latitudinal Variation Of Occurrence Of Amplitude Scintillations Over Lagos And Ilorin, *International Journal of Innovative Research and Advanced Studies*, 4 (11), 366- 370
15. Usikalu, M.R., Fuwape, I. A., Jatto, S. S., Awe, O. F., Rabiou, A. B and Achuka, J.A., 2017. Assessment of radiological parameters of soil in Kogi State, Nigeria. *Environmental Forensics*, 18 (1), 1-14.
16. Rabiou, A. B., Folarin, O. O., Uozumi, T., and Yoshikawa, A., (2017). Simultaneity and asymmetry in the occurrence of counterequatorial electrojet along African longitudes, In 'Ionospheric Space Weather: Longitude and Hemispheric Dependences and Lower Atmosphere Forcing', *Geophysical Monograph 220*, First Edition. Edited by Timothy Fuller-Rowell, Endawoke Yizengaw, Patricia H. Doherty, and Sunanda Basu. American Geophysical Union, John Wiley & Sons, Inc. pp. 21-31.

17. Fuwape, I. A., Ogunjo, S. T. , Oluyamo, S. S., Rabiou, A. B. , 2017. Spatial variation of deterministic chaos in mean daily temperature and rainfall over Nigeria. Theor Appl Climatol., DOI 10.1007/s00704-016-1867-x. (2017) 130:119-132

## PHOTO PANORAMA



*Figure 20: Students being taken on a tour of the weather station site by Engineer A.Oluwaseye of CAR at Rivers State University of Science & Technology, Port Harcourt.*



*Figure 21: Locally fabricated drones on display by student participants at the space workshop on the 10<sup>th</sup> of September, 2018 held at the University of Benin Main Campus (Ugbowo) Edo State, Nigeria.*



*Figure 22: Cross Section of student and tutor participants at the the space workshop on the 10<sup>th</sup> of September, 2018 held at the University of Benin Main Campus (Ugbowo) Edo State, Nigeria.*



*Figure 23: Picture pose by students and tutor participants at the space workshop on the 10<sup>th</sup> of September, 2018 held at the University of Benin Main Campus (Ugbowo) Edo State, Nigeria.*





Figure 24: NASRDA Stand



Figure 25: Car Staff L -R; Engr Adeyemi Alesinloye, Mr Elemo Enoch and Mr Alex Orukpe



Figure 26: Dr Ogonbaya Onu Honorable Minister of Science Technology



Figure 27: Prof. Emmanuel Emovon, Former Minister of Science and Technology



Figure 28: Cross Section of Participants



Figure 29: Cross-Section of Nasrda Staff



Figure 30: Students on tour to SERL-CAR



Figure 31: Students taking notes during tour at SERL, Abuja.



Figure 32: Professor Sandro Radicella of ICTP Trieste with Prof. Babatunde Rabi in Italy





Figure 33: L\_R- Miss T. Johnson, Mrs B. Onijamah, Dr E. Falayi and Mrs A. Obafaye during the Nigerian /Portuguese Scientists' conference on 4<sup>th</sup>- 5<sup>th</sup> Dec, 2017.



Figure 34: Participants at the Nigerian /Portuguese Scientists' conference in NASRDA held between 4<sup>th</sup>-5<sup>th</sup> December, 2017



Figure 35: ICELLI -2 participants on an Excursion to Olumo Rock, Abeokuta, Nigeria



Figure 36: Courtesy Visit by Nigerian Navy, NNSS, Okura.



Figure 37: DCAR taking men of Nigerian Navy NNSS Okara on tour around CAR facility.



Figure 38: UAV Training by CAR Staff



Figure 39: UAV Training



**CENTRE FOR ATMOSPHERIC RESEARCH**  
**NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY**

**FEDERAL MINISTRY OF SCIENCE AND TECHNOLOGY**  
**KOGI STATE UNIVERSITY CAMPUS, ANYIGBA, NIGERIA.**

*[www.carnasrda.com](http://www.carnasrda.com)*

**DECEMBER 2018**



## **CENTRE FOR ATMOSPHERIC RESEARCH'S ACHIEVEMENTS FOR THE YEAR 2018**

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 2018. In furtherance, the Centre has also become a regional hub for space weather education and research in Africa as she continues to intensify her participation in space weather research and training activities.

In light of the above, a litany of projects/activities undertaken during the year under review has been carefully documented below for your perusal.

### **INSTALLATION OF VERY SMALL APERTURE TERMINAL (VSAT) AT CAR ANYIGBA**

VSAT is a two-way satellite communication system ground station for transmitting data was installed and configured according to specification by a group of in-house ICT and Engineering staff of the Centre on the 9<sup>th</sup> – 11<sup>th</sup> January 2018 to enhance effectiveness in digital communication as it relates to the operations of CAR. The VSAT is primarily installed for real-time communication with our atmospheric equipment distributed across the nation to ease data collection and for effective monitoring of the equipment.



*Figure 1: CAR's technical team during the installation of the VSAT led by Engr. Adedoja Oluwaseye*

## CONSTRUCTION OF HIGH PRECISION TELEMETRY WEATHER MONITORING STATION (HPTWMS)

CAR-NASRDA's technical team made up of Engineers, ICT and other scientists on 10<sup>th</sup> January 2018, unveiled an ambitiously constructed AtPAM project- the installation of a High Precision Telemetry Weather Monitoring Station. This equipment is an improved indigenous hybrid design that comprises of an atmospheric weather and the greenhouse gases parameters. The system decentralises the separate procurement of atmospheric weather monitoring station and the greenhouse gases equipment in line with the Centre's mandate. The achievement of this successful construction has added a feather to the cap of CAR's technical team. In addition, the sustainability of this production will enhance economic development of the Nation. The diverse Tech- team was led by Engr. Adedoja Oluwaseye.



*Figure 2: CAR's technical team during the configuration of the Telemetry Weather Monitoring Station.*





Figure 3: CAR's diverse technical team and partners during the configuration of the High Precision Telemetry Weather Monitoring Station (HPTWMS).



Figure 4: CAR's Telemetry Weather Monitoring Station.

## SPACE WEATHER OBSERVATION NETWORK OVER NIGERIA - SWONON

SWONON is a network of ground-based space observatories and its facilities are used for now-casting of the state of space environment and for enhancement of performances of space-based technologies.

The objectives of SWONON include:

- Monitoring and now-cast space weather over Nigeria
- Developing in-country expertise for implementation, operations, processing and analyses of space weather processes

The goal is to set up a network of ground-based space observatories. The said facilities include magnetometers, digisondes, Ionospheric GNSS monitors, and optical imagers.

**NIGTEC**

**Nigerian GNSS TEC (NIGTEC) Model**  
Centre for Atmospheric Research  
National Space Research & Development Agency

**Diurnal Profile**

☐ For Entire Year

Day  1-31

Month  1-12

Year  2010-2018

Longitude

Latitude

Station ID

Hour Resolution  hours

**RUN**

**Spatial Map over Nigeria**

Day  1-31

Month  1-12

Year  2008-2018

Hour  0-24 UT

Longitude Range: 2-15 degrees

Latitude Range: 4-14 degrees

Longitude Resolution  degrees

Latitude Resolution  degrees

**RUN**

Figure 5: Screen display of the Nigerian GNSS Model

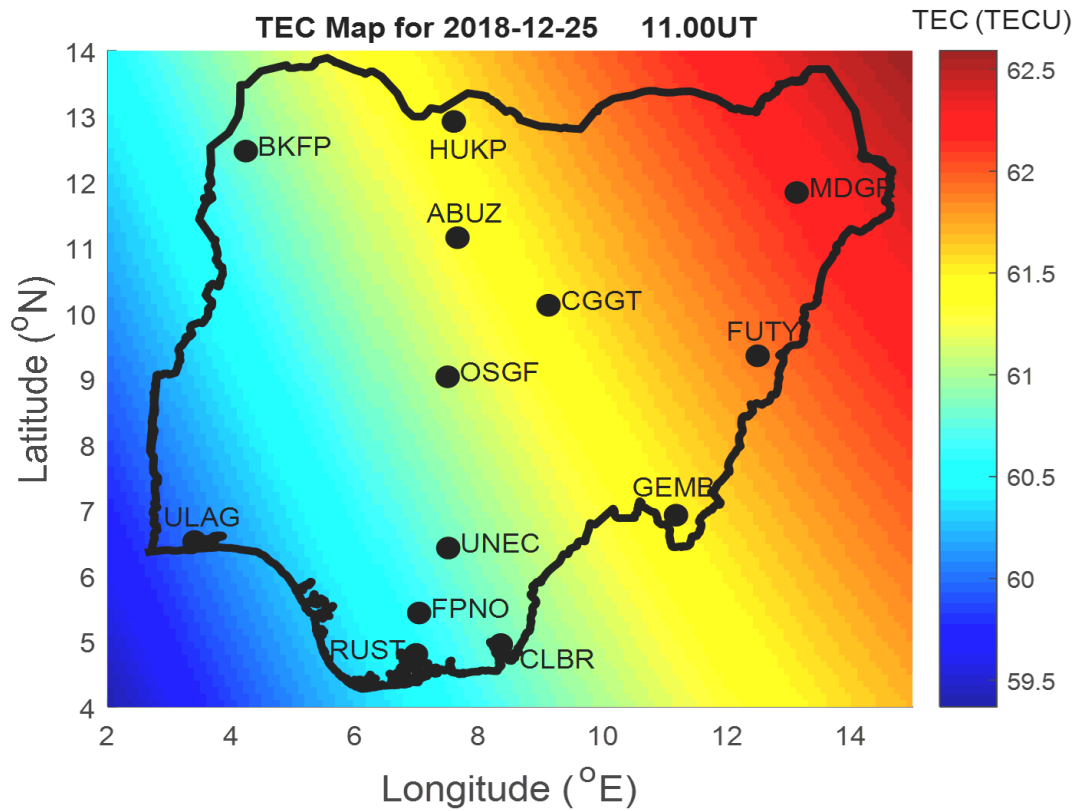
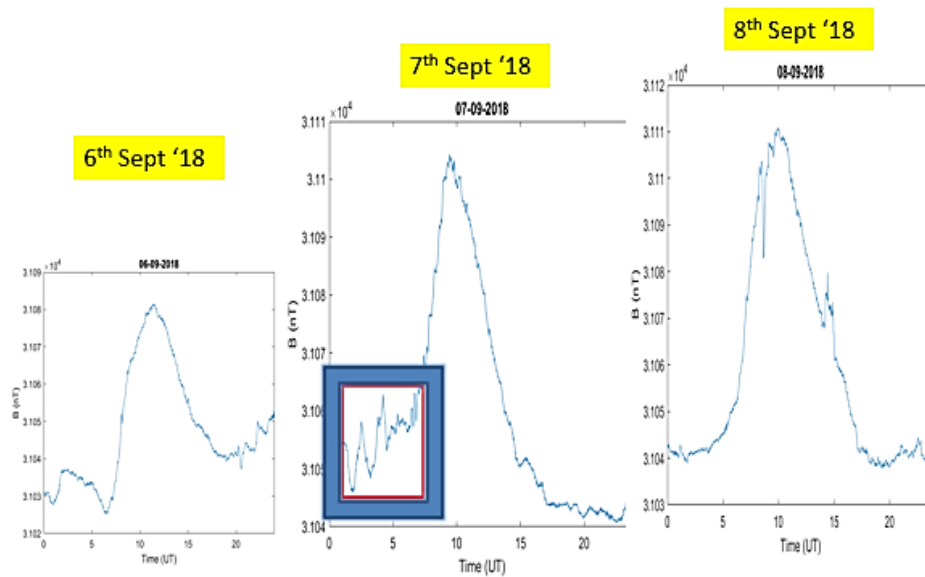


Figure 6: Demonstration of the Ionospheric TEC Map over Nigeria for local midday of 25th December 2018, using a SWONON product.



CAR Magnetometer captured Earth tremor signature over Abuja



42

Figure 7: Earth tremor signature as captured by Magnetometer installed in Abuja.

## **DAILY SPACE WEATHER NOWCAST AND FORECAST**

Space weather studies by the Centre for Atmospheric Research has put Nigeria on the global map alongside countries with similar expertise, and has greatly enhanced global data repository especially along the equator with peculiar characteristics. Space Weather refers to the conditions on the Sun, and in the Solar wind, magnetosphere, ionosphere and thermosphere that can influence the performance and reliability of Space-borne and ground-based technological Systems and can endanger human life or health (Wright *et al.*,1997), CAR has hereby set up a daily space weather nowcasts for the benefits of the public and in particular, patrons of space technology dependent systems/ operations in Nigeria. The Centre commenced its first daily now-casting of the space weather condition in Sub-Sahara Africa on 6th January 2018.

Currently, a 3-day forecast and a monthly forecast of the ionospheric conditions to the space weather casting system have been added. This product is freely broadcasted for users on the Centre's webpage at [www.carnasrda.com](http://www.carnasrda.com). Tens of millions of global users including Nigerians have continued to patronise space-dependent technologies whose functionality and efficiency are prone to space weather hazards.



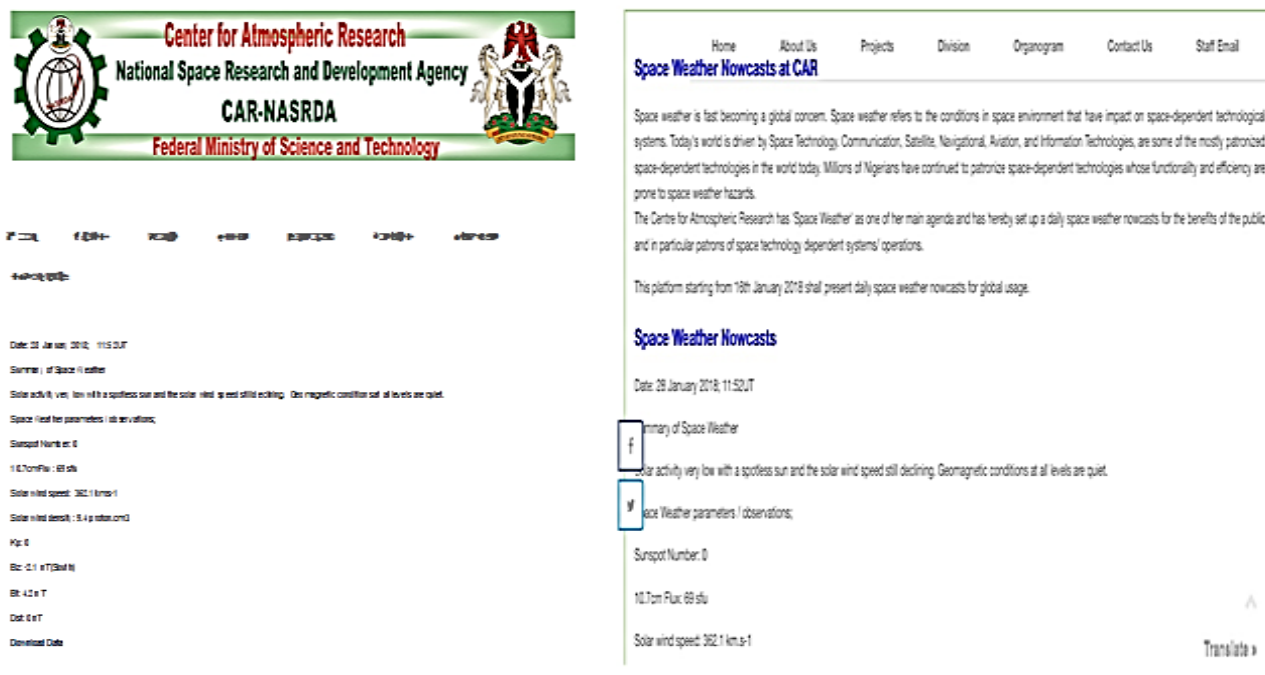


Figure 8: A Screen Shot from [www.carnasrda.com/nowcasts](http://www.carnasrda.com/nowcasts)

## Tropospheric Data Acquisition Network (TRODAN)

The TRODAN was initiated to reflect all the Lower Atmospheric Research facilities and projects at CAR which comprises of the following:

- Atmospheric Monitoring Equipment Network (AMEN)
- Microwave Propagation Project (MPP)
- Micro Rain-Radar Projects (MRRP)

These facilities are networks established to provide our own terrain real-time research data to the scientific communities in Nigeria and at a global scale. Prior to this initiative, the dearth of data in this part of the world became a hindrance to the research communities. The initiative is therefore designed to centralise, simplify and solve the difficulties experienced by the Nigerian scientist while searching for data for the lower atmospheric research among others. These three

research projects are dedicated research facilities for frontline characterisation of the Nigeria troposphere, hence the need to integrate them and bring them under one umbrella, that is, TRODAN.

### The Atmospheric Monitoring Equipment Network

The Centre for Atmospheric Research runs 19 weather stations under the TRODAN project in 19 locations. The Automatic Weather Stations currently measure the following atmospheric parameters: Rain Rate, Solar Radiation, Air Temperature, Relative Humidity, Soil Temperature, Wind Speed, Wind Direction, Barometric Pressure, and Volumetric Soil Water Content. The station locations are enumerated as below. Twenty (20) units of Atmospheric Parameters monitors are presently running at different locations in the country. Eight more units are currently being deployed.

S/N	Station	Code	Latitude (°N)	Longitude (°E)	Elevation (m)
1	Abuja	ABJ	9.0667	7.4833	536
2	Akungba	AKB	6.984833	5.597842	175
3	Akure	AKR	6.964125	4.604775	131
4	Anyigba	ANY	7.298861	6.829728	420
5	Bauchi	BAU	10.036086	9.693946	575
6	Enugu	ENG	6.857817	7.407819	359
7	Jos	JOS	10.7	8.963859	981
8	Lagos	LAG	6.434389	3.322639	7
9	Lapai	LAP	9.059333	6.829726	242
10	Makurdi	MKD	7.373553	8.811881	140
11	Minna	MIN	9.572394	6.422447	223
12	Nsukka	NSk	6.857817	7.407819	359
13	Nsukka	NSk	6.857817	7.407819	359
14	Ogbomosho	OGM	6.770808	3.429056	78
15	Port Harcourt	PTH	4.784836	6.991839	20
16	Redeemer's University	RDM	6.874108	3.543475	88
17	Sokoto	SOK	13.130525	5.1315022	302
18	Abia State Univ, Uturu	UTU	6.8	5.7	450

S/N	Station	Code	Latitude (°N)	Longitude (°E)	Elevation (m)
19	Yola	YOL	9.292661	12.390747	260
20	Rufus Giwa Polytechnic Owo	RGP	7.23°	5.55°	309

*Table 1: CAR's TRODAN Stations*

Currently, the TRODAN projects have registered success with the usage of the data in undergraduate and postgraduate projects, including PhDs. Many research papers and publications both locally and internationally, have also been achieved.

#### **Objectives of Atmospheric Monitoring Equipment Network AMEN**

- To establish a network of stations carrying out simultaneous basic measurements of meteorological and climatic variables, in real time, at five minutes update cycles.
- To provide real time data for scientists and researchers interested in atmospheric research and relevant fields in Nigeria, Africa, and the world at large.
- To have a fully computerised real-time online data achieve for dissemination so that the research results from atmospheric groups will support decision and policy making under a wide range of scenarios of meteorological and climatological threats in Nigeria.
- To develop a real-time data acquisition and delivery system as an important tool for public education and awareness purposes during emergency management events.
- To extend AMEN project beyond the present number of stations, to cover all the states in Nigeria at first with the hope of expansion to other African countries.
- To produce after a long period of data collection and analysis a comprehensive technical report of the analysis results meteorological and climatic conditions in Nigeria, so that these results will assist in designing future equipment that suits our terrain.



Figure 9: Sample Station on the AMEN Project



Figure 10: Sample Hardware and Software parts of the AMEN Equipment





*Figure 11: Sample Station on the Microwave Propagation Project.*

## **HYBRID ATMOSPHERIC PARAMETERS MONITORING (AtPaM) PROJECT**

One of the Centre's research products is the hybrid Automatic Atmospheric Parameters Monitor AtPam which is fully automated. The atmospheric parameters monitor station is configured for wireless transmission of observations to a remote server and routinely powered by a solar power unit for constant power in the station. The monitor consists of a weatherproof enclosure which contains a highly reliable indigenous data logger, barometric pressure sensor, 65 watts, 12V battery, and charge controller.

The automated monitor equipped with a standard set of sensors that are configured for measurements of air temperature, soil temperature, metallic probe for soil moisture, relative humidity, wind direction, wind speed, rainfall amount, sunlight intensity, barometric pressure, and sensors for carbon dioxide, carbon monoxide and ozone measurements. These sensors are powered by batteries of 12V and 5V. Visual Basic (VB.net) software is used for the measurement display, Xampp server is used for data storage on the server, and the data logger is used for data logging on the equipment.

AtPaM equipment which was designed and coupled in-house by staff of CAR in collaboration with our partners with intent of replicating and distributing the equipment to various

operational locations across the country. Presently, the AtPaM has been dispatched and installed in three locations with the first situated in the Centre's premises at Anyigba while remaining two are situated in Abia State University, Uturu and Rufus Giwa Polytechnic Owo, Ondo State (all deployed and configured between July and November 2018). Data from the AtPaM is accessed by downloading the data logged in the data logger of the AtPaM either through the memory card or transferred to the server through telemetry. Meanwhile, there is standalone measurement of Tropospheric Ozone using 2B Ozone monitor facility at the Centre for data archiving and analyses. The Centre also carries out routine check of the equipment and synoptic observation of the atmospheric conditions during the visitation to the site. The archive data collected through the AtPaM is regularly validated with standard measurement of concentration of Ozone in parts per million (ppb) measured by both the Ozone monitor and TRODAN meteorological dataset for the meteorological data of the AtPaM equipment.



Figure 12: AtPam installation at Rufus Giwa Polytechnic, Owo.



Figure 13: Picture of the Ozone monitor configured

## UNMANNED AERIAL VEHICLE (UAV) FOR ATMOSPHERIC OBSERVATION

The Centre is also engaged in the development of an ADC100V01 Long Range Fixed Wing UAV with fully automated operation. It is auto-piloted with GPS waypoint navigation (for including auto take-off and auto land features). The UAV is equipped with integrated sensors and camera packages for target tracking with encrypted data links. Capable of both day and night missions with navigation lights for night flight. It has a dual station mode: Ground station mode and/or



wireless handheld remote. Range: 50m communication radius (upgradeable to 3000m). Endurance: 70mins (upgradeable to 300 mins). Flexible payloads and configuration: camera, HD video, FLIR and night vision, SAR, greenhouse gasses sensors, atmospheric parameters sensors for atmospheric profiling at 3000m above sea level which communicate via a laptop and a 10" display at the ground station. It has a high gain automatic antenna tracking system. One fully equipped airframe, an advanced control software with flight simulator/playback, Gyro-stabilised gimbal camera with digital zoom feature. It is suitable for basic drone/UAV pilot training. Aerial photography/video coverage of events mapping which in this case, is for atmospheric and greenhouse gas measurements at different altitudes.

### **Objectives of UAV**

The main objective of the facility is to focus on atmospheric data profiling to gather the first long-term, detailed measurements of aerosol/cloud interactions with particular emphasis on the indirect effect on our environment.

The use of UAVs for atmospheric research is rapidly growing both in developed and developing countries. Their ease of deployment and high manoeuvrability allows them to sample areas otherwise inaccessible with conventional platforms, particularly within the planetary boundary layer of the troposphere (0.1–1 km altitude). For example, suborbital research aircraft with onboard pilots do not fly over populated areas at low altitudes, volcanoes, or into severe weather for safety reasons. Remote sensing measurements from satellite do not have the vertical or horizontal spatial resolution to identify local sources, sinks, and distributions of air pollutants and trace gases within the Earth's boundary layer. Tethered balloons and kites can provide vertical resolution measurements but only over a single location, and their deployment is limited to specific weather conditions.

UAV platforms have also demonstrated promise for atmospheric chemistry field studies.



*Figure 14: CAR Technical Team and her Partners Assembling a UAV*



*Figure 15: Cross section of CAR technical team and partners preparing to launch the drone for a flight simulation test*



*Figure 16: Aerial view of UAV during flight simulation*

### Total Lunar Eclipse Occurrence

Nigeria experienced the longest total lunar eclipse on Friday, July 27<sup>th</sup> at approximately 9:30 pm Nigerian local time. The total lunar eclipse which was primarily visible from the world's eastern hemisphere was the century's longest total lunar eclipse with a whopping one hour and 43 minutes in totality. The event which got a considerable level of attention for its occurrence was witnessed across different regions in Nigeria.

Prof. Babatunde Rabi CE/Director of CAR explained that the event underscored the fact that planetary objects including the earth were in a state of defined continuous motion. He further mentioned that keeping tab on the dynamics will enable scientists sensitise the global community of any hazard associated with such occurrences.



*Figure 17: Total Lunar Eclipse*

## **INSTALLATION OF WORLD WIDE LIGHTING MONITOR (WWLLN) RECEIVER**

The Centre for Atmospheric Research, Anyigba, on 8<sup>th</sup> September 2018 acquired and hosted a new monitoring equipment named Worldwide Lighting Monitoring which is instrumental to lower atmospheric lighting observations in Nigeria. WWLLN is a project of the University of Washington, USA. The installation was carried out by the ICT and Engineering unit of the Centre on the 9<sup>th</sup> of September 2018.

## **ROUTINE CHECKS AND MAINTENANCE**

The IT unit conducted routine maintenance and troubleshooting of the Centre's available ICT facilities across all the units and sections on 15<sup>th</sup> - 17<sup>th</sup> October 2018.

## **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:

### **CAR AT NASA: National Aeronautics and Space Administration(NASA) - Aeronet Deployment in Africa**

Centre for Atmospheric Research added colour to its achievements in the esoteric area of Atmospheric Research under the amiable and charismatic leadership of its Director/Chief Executive; Prof. Babatunde Rabi (a renowned Space Physicist) by participating in the collaboration meeting on Aeronet deployment in Africa at the NASA Goddard Space Flight Centre and University of Maryland between 15<sup>th</sup> – 22<sup>nd</sup> February 2018 in the USA where he delivered a presentation titled: *“The Activities, Research Opportunities and Measurements in Nigeria with the CAR-NASRDA”*.





CAR is involved in the operation of the National Air Quality Research Laboratory, University of Ilorin, where the only functional AERONET in Sub-Saharan Africa is domiciled, CAR-NASRDA has approached NASA/GSFC for more units of this facility in Africa.



Figure 18: L-R: Dr. Brent Holben-NASA (PI, AERONET), Prof. Babatunde Rabi (Director/CE, CAR-NASRDA), Dr. Charles Ichoku (NASA)... extreme right: Prof. Rachel T. Pinker (University of Maryland, US) with other top Scientists at NASA

### Other Programs Attended by CAR Staff

- Prof. Babatunde Rabi attended the 55<sup>th</sup> session of the Scientific and Technical sub-committee of COPUOS held in Vienna, Austria from 29 January to 9 February 2018

- Mr Najib Yusuf attended the Community Earth System Model V. 2.0 Tutorial on 6<sup>th</sup> -10<sup>th</sup> August 2018 at the CGD, National Centre for Atmospheric Research. Mesa Lab. Boulder. USA
- Mr Najib Yusuf attended Fundamentals of Atmospheric Chemistry and Aerosol Modelling on 13<sup>th</sup> -15<sup>th</sup> August 2018 at the ACOM National Centre for Atmospheric Research. Foothills Lab. Boulder. CO. USA
- Prof. Babatunde Rabi and Engr. Adedoja Oluwaseye attended the African Space Weather Workshop on 10<sup>th</sup> - 16<sup>th</sup> June 2018 at College Court, University of Leicester, United Kingdom

### **ICTP Workshop on Space Weather Effects on GNSS Operations at Low Latitude 23<sup>rd</sup> April - 4<sup>th</sup> May 2018**

The workshop which was organised by the Abdul Salam International Centre for Theoretical Physics, Trieste, Italy drew participants from 29 countries with the aim of providing GNSS education at the university level, building a knowledgeable GNSS workforce, encouraging the use of GNSS for societal and economic development, building GNSS infrastructure, establishing space weather studies and international scientific collaborations. DCAR, Prof Babatunde Rabi and a Scientist, Mrs A. Obafaye participated in the workshop. CAR supported the organisation of this workshop.



*Figure 19: Group photo of participants at the ICTP Workshop on Space Weather Effects on GNSS Operations at Low Latitude 23<sup>rd</sup> April – 4<sup>th</sup> May, 2018.*



### **Nigeria Geophysical Society (NGS) 5<sup>th</sup> Annual International Conference**

The Nigerian Geophysical Society (NGS) held her 5<sup>th</sup> Annual International Conference themed *“Geophysical Sciences: Veritable tool for National Security and Economic Diversification”* on 19<sup>th</sup> - 22<sup>nd</sup> June 2018 at Federal University Dutse, Jigawa State. The 3-day programme which had Prof. Babatunde Rabiou of the Centre for Atmospheric Research as the keynote speaker was supported by Atmospheric and Space Environment Research Network (ASPERN), Centre for Atmospheric Research (CAR), National Space Research and Development Agency (NASRDA). Topics bordered on; Space weather, Solar Physics, Magnetosphere, geophysics, geodesy, survey, remote sensing, GIS, lower atmosphere. Also in attendance was Mr Najib Yusuf, head of the technical Division CAR and Mrs Aderonke Obafaye.

### **Nigerian Society of Engineers 2018 Week/Annual General Meeting Ajaokuta Branch 15<sup>th</sup> August 2018**

The Nigeria Society of Engineers (NSE) Ajaokuta branch held their 2018 engineering week/ AGM themed *“The Indispensability of the Engineering Profession in National Development”*. The public lecture was delivered by the keynote speaker in person of, Professor Babatunde Rabiou, Director/Chief Executive, Centre for Atmospheric Research, on Thursday 15<sup>th</sup> August 2018. The lecture which had a sizable number of CAR staff, NSE executives/members and Ajaokuta steel staff in attendance expounded on the role of indigenous engineering in achieving the 17 Sustainable Development Goals set by the United Nations General Assembly in 2015. He posited that engineers are problem solvers and the role of the engineering profession in the national development of any nation cannot be over-emphasised therefore, no nation can develop without infrastructural development. In driving home his point, he declared a catch phrase *“Show me the strength of your engineering as a nation, I will tell you the level of your development”*.



Figure 20: Prof. Rabiul Babatunde flanked on the high table by other dignitaries at the Ajaokuta Steel Corporation Limited AGM

### **Science and Technology and Innovation Expo 2018 (5<sup>th</sup> – 9<sup>th</sup>, March 2018)**

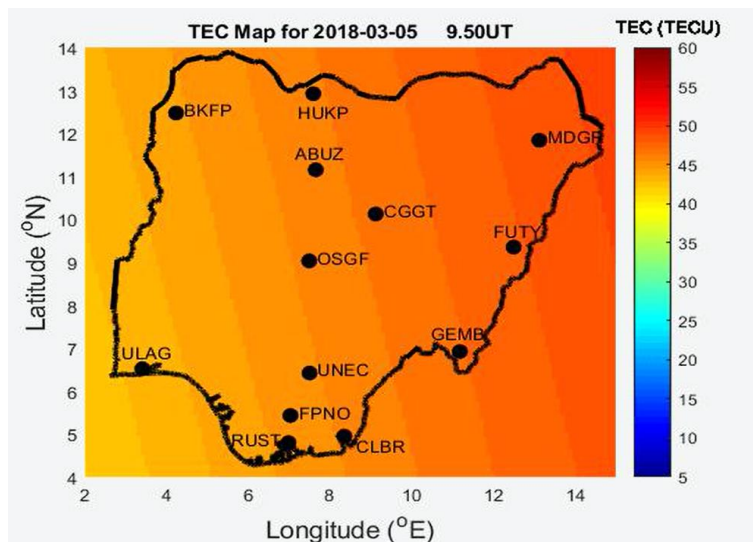
The event was themed “Fast Tracking Sustainable Development of Nigeria through Science & Technology”. The event is a popularisation programme of the Federal Ministry of Science and Technology aimed at commercialising research and development results, as well as products and services of research and tertiary institutions. Investors/innovators and the manufacturing sector also showcase their achievements and breakthroughs in the Science, Technology and Innovation (STI) sector.

#### **Objectives of the programme include:**

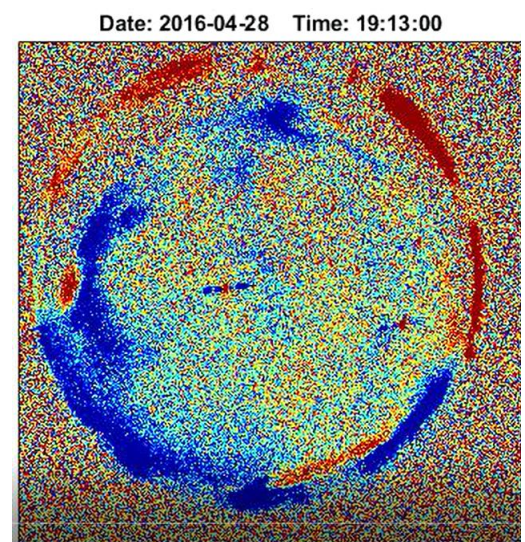
- Promotion of research and development (R&D) activities
- Commercialisation of R&D results/inventions and innovations
- Encouraging Nigerians to take up science professions
- Showcasing to the public, potentials of R&D institutions
- Building of partnerships between researchers and investors
- Encouraging and promoting creation of innovative enterprises utilising Nigeria’s indigenous knowledge and technology to produce marketable goods and service

Staffs of CAR-NASRDA were on ground to display their research equipment alongside her sister Centres from NASRDA under the tent made available for NASRDA to enable visiting delegates the privilege of familiarising themselves with the specifics and multipurpose use of the

instruments and demonstration displayed e.g. High Precision Telemetry Weather Monitoring Station (HPTWMS), video simulation of the ionosphere over Nigeria as at Monday – 5<sup>th</sup> March 2018, Demonstration of the Plasma burble observed with the All Sky Imager (ASI).



*Screenshot 1: Snapshot of TEC Map for 5th March, 2018*



*Screenshot 2: Snapshot for Plasma Bubbles*

*Figure 21: Screen shots of TEC Map for 5<sup>th</sup> March 2018 & Plasma Bubbles*

Amongst delegates that visited CAR-NASRDA stand at different intervals were the Honourable Minister of Youth and Sports, Barrister Solomon Lalong, Professors Aliyu Jauro and Madun Yalams of ATBU Bauchi, Representatives of the Nigerian Army School of Military Engineering (NASME), Makurdi, led by Captain Azubuike, Ambassador Emmanuel Mpfayokurera and Mr Miracle Ines Koriciza, Secretary of the Embassy of Burundi. Our Centre was represented by Mr Jatto Solomon, Engr. Saleh Umar, Mrs Bimbo Jamah, Mrs Joyce Onuh, and Mr Ezekiel Josiah. The attention received highlighted the need for continuous research towards building sustainable capacities for solutions in atmospheric challenges.

At the end of the 5-day program, NASRDA, the parent body of the Centre for Atmospheric Research (CAR) was awarded 1<sup>st</sup> position for research institution category. The award was received by the Director General of National Space Research & Development Agency, Prof. Seidu Onailo Mohammed.

### **African Leadership Conference on Space Science for Sustainable Development**

The National Space Research and Development Agency (NASRDA) hosted this year's 7<sup>th</sup> African Leadership Conference on Space Science for Sustainable Development from the 5<sup>th</sup> - 7<sup>th</sup> November 2018 at the NICON Luxury Hotel, ABUJA. The ALC is an African Regional Conference organised bi-annually to gather all expert and key players in Space Science and Technology in Africa with the view to promoting intra Africa cooperation in the use of space science and technology to support Africa's development. The Director/CE of CAR, Prof. Babatunde Rabiou and Mrs A. Obafaye were in attendance.

### **Basic Science National Conference (BASNAC) 2018**

The Department of Basic Science Babcock University hosted her 1<sup>st</sup> National Conference BASNAC 2018 from the 6<sup>th</sup> - 8<sup>th</sup> of November 2018 at the Sylvanus Chioma Lecture Theatre (SCLT), Babcock University Ilishan, Remo, Ogun State. The programme themed "Basic Sciences in a Dynamic and Technologically Driven World: Challenges and Opportunities." Prof. Babatunde Rabiou was a guest speaker on the sub theme "Physics: A Refining Tool in Novel Research and Technology."

### **Kogi State World Science Day and 21 Young Scientist Competition (KYSGA-21 Governor's Award)**

The KYSGA- 21 is a competition of science students in both private and public secondary schools across the 21 LGAs of Kogi state aimed at encouraging and developing their interest in science, technology and innovation. The competition which was organised on the 10<sup>th</sup> November 2018 by the Kogi State Ministry of Education, Science and Tech. in collaboration with Kogi Wide Academic Excellence Competition (K-WAEC) to mark "World Science Day 2018." Engineer Umar Saleh who represented the CAR Director, Prof. Rabiou Babatunde at the event commended the state government for giving the needed support for the competition, saying science and technology remains the backbone of the nation. He further spoke on the activities of the Centre and the readiness to partner with the state government in the area of research and other plausible area of science. Mr. Ali Abdul Danjuma of CAR was also in attendance.



### Mountain Top University MTU 4th University Distinguished Lecture

On the 19<sup>th</sup> of July 2018, the Director and Staffs of CAR were hosted at the Mountain Top University 4<sup>th</sup> University Distinguished Lecture, where the director spoke on “*Potency of Science and Technology in Sustainable National Development*”.

### 13th Mosobalaje Oyawoye Faculty of Science Endowed Lecture

The University of Ilorin Faculty of Life Sciences and Physical Sciences held her 13<sup>th</sup> Mosobalaje Oyawoye Lecture on the 22<sup>nd</sup> of November 2018 at the University of Ilorin auditorium. Prof. Rabiun Babatunde Director/CE CAR who was the guest speaker spoke extensively on: “Science and Technology, Town and Gown: A Viable Nexus for Sustainable Development”.

### CBSS Space Centre Week 2018. 3<sup>rd</sup> - 7<sup>th</sup> December 2018

On the 6<sup>th</sup> of December, the Centre for Basic Space Science held her Public Lecture on “Basic Space Science Equipment” at Ikenga Hotel, Nsukka. The programme which was geared towards marking the Centre’s Annual Space Week had notable keynote speakers in attendance such as Prof. P.N Okeke FAS and the pioneer Director of CAR, Professor Babatunde Rabiun.



Figure 22: Prof. Rabiun Babatunde as Keynote Speaker



Figure 23: Prof. Rabiun Babatunde flanked by other delegates

### Fall Meeting of the American Geophysical Union, Washington DC, USA, 10<sup>th</sup> – 14<sup>th</sup> December 2018.

Prof. Babatunde Rabiun (Director, CAR) presented an oral paper titled “First experimental investigation into the possible connections between the zonal neutral wind speeds and equatorial plasma bubble drift velocities over the African region” (Monday, 10 December 2018 16:00 - 16:12). Ms Aderonke Obafaye (CAR Scientist) gave a poster presentation titled:



“Performance analysis of a regional ionospheric model over Nigeria within equatorial ionospheric anomaly region” (Wednesday, 12 December 2018; 08:00 - 12:20).

## **ACTIVITIES SUPPORTED AND ORGANISED BY THE CENTRE**

In a steadfast approach toward achieving its mission statement via thoughtful leadership and research visibility, the Centre for Atmospheric Research (CAR) has been a support pillar in capacity building in space science through the following public programmes organised and attended by the Centre in 2018.

### **Annual CAR Staff Retreat 2018**

The 2018 staff retreat was organised under the amiable leadership of the Centre’s digital and seasoned director, Prof. Babatunde Rabiú who kickstarted the event with a welcome speech where he laid out the strategic focus for the Centre and charged members of staff in line with the Centre’s focus. The 2-day staff retreat took place on 10<sup>th</sup> - 12<sup>th</sup> January 2018 and was technically driven by series of presentation both from external guest speakers and in-house staff. The programme was well organised and attended as members of staff were availed the unique opportunity of undertaking capacity building programmes in the following areas:

- Skills and techniques of human relationship
- Team management and customer relationship
- Administrative procedure and process
- Scientific research and development
- Uses of new innovated software and through highly technological advancement which gear towards success recorded in the year 2018

### **1<sup>st</sup> National Workshop on Air Quality: Air Quality Research and Sustainable Development: The Nexus, Prospects & Challenges from the 13<sup>th</sup> -16<sup>th</sup> March 2018.**

The workshop was organised by the Centre for Atmospheric Research (CAR) in collaboration with the Federal Ministry of Environment and Nigerian Meteorological Agency NIMET which held at Seidu Onailo Conference Hall, Centre for Atmospheric Research, KSU Campus, Anyigba, with the aim of analysing the present air quality scenario in Nigeria by bringing together

researchers and policy makers from all professional cadres working on a wide spectrum bordering on air quality.

Present at the workshop were dignitaries and representative from the Nigerian Senate Committee on Environment under the Chairmanship of Senator Oluremi Tinubu OON, led by Mr Abdukadir Sarafadeen, Professor Clement Akoshile (President, Nigerian Meteorological Society), Drs Simone Tilmes and Forest Lacey of National Centre for Atmospheric Research NACR, Boulder, Colorado, USA, to mention a few. A welcome address was delivered by the Director/Chief Executive of CAR. In his address, the Director gave a detailed run down of the Centre's activities. He also told the audience that with CAR's observational laboratories littered across the country and international collaborative research, the Centre has attained the status of a world class research and development CoE in atmospheric research and CAR would continue to maintain her ways by engaging in field observations, promoting research and capacity building. In addition, Professor Rabiou mentioned that air quality has grown to become a global concern as it impacts on public health, agriculture, ecosystem and the climate. He alluded that two African countries (Egypt and South Africa) are taking the lead in air quality forecast today and the Centre for Atmospheric Research is ready to provide appropriate observations, data and products that can be utilised for effective forecast and appropriate metering for revenue generation through air quality data driven tax regime.

### **Prof. E.E Balogun 2<sup>nd</sup> National Symposium on Atmospheric Research. 16<sup>th</sup> August 2018**

The Professor Ekundayo E. Balogun 2<sup>nd</sup> national symposium on Atmospheric Research themed "*Atmospheric Research and Sustainable Development*" was held on 16<sup>th</sup> August 2018 at the Seidu Onailo Mohammed conference hall. Atmospheric scientists and researchers across Nigeria were invited to present papers and participate in the occasion to honour the renowned Atmospheric Professor and to commemorate his 82<sup>nd</sup> birthday.

Three invited papers and two other technical papers were presented from an assortment of relevant disciplines of atmospheric studies and institutions. The Paper Presentation came right after the celebrant's (Prof. Ekundayo Balogun) welcome address was listened to via a video call to the Director of the Centre. Thereafter, his biography was read to the participants to show the laudable contributions made to the field of atmospheric and meteorology in Nigeria. The invited

speakers that delivered lectures were Professor Solomon Agbo from the Institute for Energy and Climate Research (IEK-5), Forschungszentrum Jülich GmbH Germany, Dr (Mrs) Virginia Ugoyibo Okwu-Delunzu, Ag. Dean Faculty of Environmental Sciences, Enugu State University of Science and Technology, Enugu and Dr Olusegun Gabriel Fawole from Obafemi Awolowo University, Ile-Ife, Nigeria.

The title of the papers presented by the guest speakers were:

- I. Potentials of thin-film solar cells under artificial light conditions
- II. Impact of Meteorological/ Atmospheric observations in our society
- III. Charting a new course for effective atmospheric aerosol monitoring in Nigeria respectively

### **Commissioning of CAR Laboratory Complex and Engineering workshop**

The 23<sup>rd</sup> of April 2018 saw the auspicious occasion of the commissioning of Laboratory Complex and Engineering Workshop Building of the Centre for Atmospheric Research, Kogi State University Campus. This event was distinctively attended by the Honourable Minister of Science and Technology, Dr Ogbonnaya Onu, the Chief Host, His Excellency Alhaji Yahaya Bello; the Executive Governor of Kogi State, the Chairman of Kogi State Council of Chiefs, His Royal Highness, the Attah of Igala, Dr Idakwo M. Ameh Oboni, the Director General of NASRDA; Prof. Seidu Onailo Muhammed and many other royal fathers and special dignitaries. The primary purpose of the Laboratory complex and engineering workshop being commissioned is to provide a friendly working environment for technical personnel.

### **World Space Week themed: Space Unites the World. 10<sup>th</sup> October 2018**

The event which was organised by the National Space Research and Development Agency on the 10<sup>th</sup> October 2018 to mark the world Space Week in Nigeria was themed "Space Unites the World." The topic was delivered by the guest lecturer for the day, Professor Babatunde Rabi, Director/Chief Executive Centre for Atmospheric Research. The lecture started with the opening note "Today's world is not driven by wealth of nations in terms of natural resources but by technological advancement which has space technology as one of its drivers." Rabi (2006). The lecture touched on space dependent technology and products in relationship to the

following areas i.e. communication technology siting the Global System of Mobile communications 'GSM' and its efficiency in fostering unity amongst nations; space & information dissemination, highlighting satellite broadcasting platforms such as DSTV, GOTV, TSTV, as well as fostering strategic partnerships between satellite owning TV providers and TV stations that cannot afford to own satellite to hedge their survival in the business during the broadcast of live peak events such as the Olympic games, FIFA world cup, US open and most recently, the introduction of video assisted referee VAR technology in football; Global Navigation Satellite Systems (GNSS) and its application in Nigeria for land administration and boundary dispute resolution between neighbouring countries e.g. Nigeria and Cameroon, modern military defence system and peace-keeping missions enumerating enormous military gain via the use of drone for military surveillances and general operations amongst others, the establishment of the Defence Space Agency (DSA) via the DSA Act 2016 signed into law on 3<sup>rd</sup> February, 2017; Space & Financial Transactions with the prevailing wave of secured e-commerce bringing about the cashless economy through the use of tokens, ATMs and POS payment systems; Health care; GPS for tracking purposes to mention a few. Professor Rabiun also touched base on the topic of Nigeria and space technology where he informed the audience that the nation has been involved in elements of space science and research since 1950s and joined the space race in 1999 with the establishment of NASRDA as a parastatal of the Federal Ministry of Science and Technology. He then went on to highlight key benefits and contributions of Nigeria satellites/ other space assets. Thereafter, he chronicled projects carried out using NigerSat 1, 2 and X which are not limited to development of early warning systems for food security in Nigeria using NigeriaSat-1 and other satellite data; mapping of settlements and major roads in Nigeria; update of Nigerian 1:250,000 National Topographic Maps using images from NigeriaSat-1; development of real-time model for Road Safety Measures in Nigeria using Geographical Information Systems and Remote Sensing (NigeriaSat-2). The CAR director delved into some contributions of NASRDA's Centre for Atmospheric Research 'CAR'. In this segment, he listed the centre's current research activities on air quality, annexation of the solar energy, strengthening the accuracy of prediction of atmospheric and allied parameters for socioeconomic purpose, safety of space environment and the improvement of the earth satellite radio-communication systems which include tele-communication and all manners of ICT-

dependent systems. In addition, he stated that the Centre has over the years successfully established the following network of observations: National Air Quality Research Laboratory, University of Ilorin (2014); Space Environment Research Laboratory SERL, NASRDA, Abuja (June 2015); Space-Earth environment Research Laboratory SEERL, University of Benin (September, 2016); the Atmospheric and Space Weather Research Laboratory ASWeR Lab, Osun State University, Osogbo (February 2017); and the Space Weather and Atmospheric Physics Laboratory SWAP Lab, Bayero University, Kano , April 2017). The guest lecturer recommended that Nigeria should embrace space technology to solve her numerous socio-economic and national security challenges; review her existing laws to permit patronage of space dependent products at all levels of development, and review present budgetary systems and procurement laws to favour space science and technology amongst others. In conclusion, he reiterated that Nigeria has the critical mass of experts within her borders that can actively harness space technology and its products to solve her present numerous challenges.

### **SPACE WORKSHOP: Space Products as Tools for Socio-Economic Development & National Security.**

A public lecture organised by Centre for Atmospheric Research of the National Space Research and Development Agency in collaboration with the University of Benin on Monday 10<sup>th</sup> September – Thursday 13<sup>th</sup> September 2018 held at the University of Benin Main Campus, Ugbowo, Edo State, Nigeria.

The Global Navigation Satellite System (GNSS) Data Processing and Analysis staff training program was initiated by the University of Benin in collaboration with the Centre for Atmospheric Research of the National Space Research and Development Agency (NASRDA) in 2018 aimed at bridging the gap between theoretical and hands on tasks amongst Surveyors, Geometricians, Civil Engineers, Electrical & Electronic Engineers, Physicists, Geophysicists, Water Resources & Environmental Engineers, Agricultural Engineers, Geographers, Planners, Environmental Scientists, Lower and Upper Atmospheric Scientists. Part of the objectives of the workshop was to prepare participants for work situation they are likely to meet, thus giving them a competitive edge in their field of learning. The GNSS Data Processing & Analysis Workshop kicked off with a public lecture on “*Space Products as Tools for Socio-Economic*



*Development & National Security*” at the Akindeko Auditorium in the University. Thereafter, the workshop was held at the Faculty of Engineering Board Room, University of Benin. During the training on GNSS, the following topics were covered: GNSS Introduction, Applications, Operational Principles, Errors, Data Acquisition and Preparation, GPS TEC Processing, Data Processing for Positioning, Data Analysis and Case Study.

The four-day program commenced with an opening speech from the representative of the Vice Chancellor in person of Prof. Jacob O. Ehiorobo, the Deputy Vice Chancellor Administration. Thereafter, a keynote address was given by the Director and Chief Executive Centre for Atmospheric Research, National Space Research & Development Agency (CAR-NASRDA); Prof. Babatunde Rabiú who then went on to lecture his audience on Space Products as Tools for Socio-Economic Development & National Security.

Resource persons at the 4-days training programme were: Prof. Babatunde Rabiú, Dr (Surveyor) Joseph D. Dodo, Dr Daniel I. Okoh, and Aderonke A. Obafaye.

## STAFF WHO COMPLETED GRADUATE PROGRAMMES IN 2018

S/N	NAME	PROGRAMME	INSTITUTION	STATUS
1.	Musa I. A.	MSc Computer Science	Kogi State University, Anyigba	Completed
2.	Ikani Ojochenemi	MSc Ionospheric and Communication Physics	University of Ilorin	Completed
3.	Saleh Abubakar Umar	M.ENG. Electrical Engineering (Power Systems and Machines)	Abubakar Tafawa Balewa University	Completed
4.	Jibril Otu.	MSc Analytical Chemistry	Kogi State University, Anyigba.	Completed

Table 2: CAR Staff who successfully completed Post Graduate & Doctorate Programmes

## STAFF UNDERGOING GRADUATE PROGRAMMES

S/N	NAME	PROGRAMME	INSTITUTION	STATUS
1.	Adedoja Oluwaseye S.	PhD Engineering	Tshwane University of Technology, Pretoria. South Africa	In progress
2.	Yusuf Najib	PhD Atmospheric Physics	Bayero State University	In Progress
3.	Ogbeiwi Kenneth Osalumense CNA	PhD Accounting	Igbinedion University, Okada	In Progress

S/N	NAME	PROGRAMME	INSTITUTION	STATUS
4.	Shehu Sarafadeen A.	PhD	University of Ilorin	In Progress
5.	Johnson O. Omotayo	M.Tech Food Science Tech	Federal University of Technology Akure	In Progress
6.	Onuigbo Ifeanyi Francis	PGD in Electrical/ Electronic Engineering	Enugu state University of Technology	In Progress
7.	Obafaye Aderonke	MSc Environmental Physics	University of Agriculture Makurdi, Benue State	In Progress
8.	Eze Francis	MSc Information Technology	National Open University of Nigeria (NOUN)	In Progress
9.	Mathew Daniel E	MSc Computer Science (A.I)	University of Nigeria (UNN), Nsukka, Enugu State	In Progress
10.	Opeyemi Olalekan O.	MSc Electrical / Electronic Engineering (Communication ption).	Federal University of Technology Akure (FUTA	In Progress
11.	Hassan Sule	MSc Library and Information Science	Kogi State College of Education	In progress
12.	Timiyo T.J	MSc Physics	Kogi State University, Anyigba.	In Progress
13.	Omale R.	MPA	Kogi State University, Anyigba	In Progress
14.	Alfa Daniel	PGD Management	Kogi State University, Anyigba	In Progress
15.	Kumben Plangnan	MPA	Nasarawa State University, Keffi	In Progress
16.	Shehu Sarafadeen.A.	PhD Physics	University of Ilorin	In Progress
17.	Saleh Abubakar Umar	MSc Info Tech	NOUN	In Progress
18.	Eze Francis N.	MSc Info Tech	NOUN	In Progress
19.	Muawiya Sani	MSc Physics	University of Ilorin, Kwara State	In Progress
20.	Akolo John A.	MSc Info Tech	NOUN	In Progress
21.	Aghedo Jude	MBA	Kogi State University	In Progress
22.	Adamu Yusuf	MSc Public Admin	Kogi State University	In Progress
23.	Idah Ojoago	HND	Adekunle Ajasin Uni.	In Progress
24.	Orukpe A.Oseghale	MSc Plant Biochemistry	University of Benin	In Progress

Table 3: Staff whose graduate/ Post graduate programmes are in progress

## STUDENT INDUSTRIAL WORKS EXPERIENCE

In the 2018 Student Industrial Works Experience (SIWES), the Centre for Atmospheric Research offered 22 students from across different tertiary institutions in Nigeria the unique opportunity to undergo their compulsory SIWES Industrial training at the Centre thus familiarising them with modern equipment and research models currently applicable in the real world for observation and research operations.

Details of the academic institutions whose students had their internship with the Centre are illustrated in the table below:

S/N	Academic Institution	Number of Interns
1.	Kogi State University, Anyigba, Kogi State	10
2	Federal Polytechnic, Idah, Kogi State	3
3.	Federal University of Technology, Minna, Niger State	1
4.	Caritas University, Enugu State	1
5.	Michael and Cecil Ibru University, Delta State	4
6.	Benue State Polytechnic, Ugbokolo	1
7.	Kogi State College of Education Technical Kabba	1
8.	Ondo State University	1

*Table 4: 2018 SIWES Interns*

## MEMORANDUM OF UNDERSTANDING

The Centre for Atmospheric Research has continued to successfully broker partnerships with various local and foreign institutions through the signing of MOUs. This quest is in line with its mission statement "...to 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" In a quest to uphold its mission statement.



Figure 24: CIRCA 2018



Figure 25: Flags of CAR's International Collaborators.

The Centre successfully initiated Memorandum of Understanding between CAR/NASRDA and the following Institutions in 2018:

- iv. Michael and Cecilia Ibru University, Delta State.

- v. Taraba State University, Taraba State.
- vi. Bowen University, Owo, Ondo State.

### Signing of Memorandum of Understanding

The Centre for Atmospheric Research forged partnership with Bowen University via a detailed and duly signed NASRDA/BOWEN MOU on Thursday 15<sup>th</sup> November 2018 at a round table meeting in the Senator Borroffice Conference Centre of NASRDA, Abuja. The partnership was brokered against the backdrop of a working relationship between the Vice Chancellor of BOWEN University and the Director/ Chief Executive CAR-NASRDA (Prof. Rabiú Babatunde) with the aim of strengthening ties in research opportunities in space science, atmospheric research and linkages which shall be of mutual benefit to the counterpart institutions. The 7-man delegates of Bowen University led by her Vice chancellor; Prof. Joshua Ogunwale was received by Dr Femi Agboola; Director of Engineering and Space Science representing the DG Prof. Seidu Onailo Mohammed.



*Figure 26: BOWEN-NASRDA MOU signing in progress. L-R, Prof. Babatunde Rabiú (Director CAR), Dr F. Agboola (Director ESS), Prof. Joshua Ogunwale (VC Bowen University), Dr Kayode Ogunleye (Registrar Bowen University)*





Figure 27: sitting L-R , Dir. of Strategic Space Application; Dr H. Shaba, Dir. Of Admin & Finance; Dr D. Zoaka, Dir. Of Project & Procurement; Mr J. Angulu, Dir. Of Engineering & Space System; Dr F. Agboola, VC Bowen University; Prof. Joshua Ogunwale, Dean of faculty of science; Prof. I.O Osungbade, Dir. of Research & Strategic Partnership; Dr Bolanle Otegbayo, Registrar; Dr Kayode Ogunleye, Asst. Director/Special Assistant to the DG on Technical matters; Dr Mrs Baba-maaji Rakiya, Dir. of Centre for Atmospheric Research; Prof. Babatunde Rabi, Dir. Of Legal unit; Barr. Y. Issa, Dir. Of Special Duties; Dr Halidu Ibrahim, SA to the VC; Mr Toba Adaramola, HOD Physics & Solar Energy Bowen; Dr Adejumo.

## COLLABORATIVE OUTREACHES / COURTESY VISITS / RESEARCH

As is the practise of CAR to promote capacity building in the area of atmospheric science through working visits to renown academic and research institutions aimed at strengthening ties, the following activities ensued with the under-listed institutions.

### Osun State University, Osogbo, Osun State

CAR paid a collaboration/partnership visit to Osun State Polytechnic on the 4<sup>th</sup> of January 2018. The team of delegate led by Prof. Babatunde Rabi who delivered a presentation on Research and Educational activities of CAR. The Director also went on to enumerate the mutual benefits of the proposed partnership to both institutions.

### **Cecilia Ibru University, Delta State**

Following the ongoing talks geared towards collaboration between CAR-NASRDA and Cecilia Ibru University, a courtesy visit was made to the University on the 4<sup>th</sup> of February 2018 by delegates from CAR.

### **Kebbi State University**

A workshop on Practical Application of MATLAB for Research was organised by Kebbi State University in collaboration with CAR for the 23<sup>rd</sup> - 27<sup>th</sup> July 2018.

### **Familiarisation Visit by the Students of Nigerian Naval Secondary School Okura**

The visit was made to the Centre in company of naval instructors from the school. Pupils from the school were engaged in a lecture on atmospheric sciences during the visit. The lecture titled “Rocketry and Viewing of the Outer Space from the Earth” was delivered by Mr Sharafadeen and Jibril Otu of the Atmospheric Chemistry Unit of Centre for Atmospheric Research.

### **Two Months (1<sup>st</sup> August - 30<sup>th</sup> September 2018) Bench/Research visit to ACOM**

A visit was made to the Centre for Atmospheric Research, Boulder. CO. USA by Mr Najib Y. with the aim of broadening opportunities for special projects that focus on African National.

### **Courtesy Visit To The University Of Benin**

Delegates from CAR-NASRDA led by Prof. Babatunde Rabiou on Friday 10<sup>th</sup> September, 2018 visited the Vice Chancellor of the University of Benin, Prof. F. F. O. Orumwense. The CAR Director and his team were welcomed upon arrival by the DVC Admin of the University of Benin, Prof. J. O. Ehiorobo. Discussions at the meeting was geared towards strengthening existing working relationships between both institutions as well as assessing the prospect of near future project. Other members of staff in the delegate includes: Dr. Joseph Dodo (CGG, Toro), Dr. Daniel Okoh (Co-ordinator, SERL, Abuja), Mr. Kenneth Ogbeiwi, Engr. Yemi Alesinoye, Mr. Justice Timiyo Tie-bebi, Mrs. Aderonke Obafaye and Mr. Alex Orukpe.

### **Courtesy Visit to the Federal University of Petroleum Resources (FUPRE) Delta State**

The visit was made by the Centre for Atmospheric Research led by its Director/ Chief Executive Prof. Babatunde Rabiou. The courtesy visit took place on Friday - 14<sup>th</sup> September, 2018 at the Vice Chancellor’s conference room with delegates from counterpart institutions ably present. Among those on the Director’s entourage were Dr. Joseph Dodo (CGG, Toro), Dr. Daniel Okoh (Co-

ordinator, SERL, Abuja), and Mr Kenneth Ogbeiwi (Accountant). Others were Engr. Yemi Alesinloye, Mr Justice Timiyo Tie-bebi, Mrs Aderonke Obafaye, and Mr Alex Orukpe. Whilst the University's team was led by the Head of Linkages Dr (Mrs) Omo-Irabor, who welcomed the CAR-NASRDA team on behalf of the Vice Chancellor, Prof. Akiilbhadode, who was out of the country on an official assignment.

A comprehensive presentation on the activities of the Centre alongside its enormous value proposition where FUPRE stands to benefit was delivered by the Director/Chief Executive Prof. Babatunde Rabi. He also went further to showcase all the observatory laboratories operated by the Centre in different parts of the country. At the end of his lecture, Mrs. Omo-Irabor, on behalf of the Vice Chancellor, expressed gratitude to the delegates of CAR-NASRDA for the honour and gesture accorded them. Thereafter, both delegates embarked on a fleeting visit to the University's Department of Earth Science for a familiarisation tour. In course of the brief tour, Prof. Babatunde Rabi learnt that the department's mobile magnetometer was not functional. To this end, the Director, in his magnanimity and affinity for providing workable solutions, gave his word to assist them in getting the magnetometer back to the desired functional state.

### **Courtesy Visit of Delegates from Space-Earth Environment Research Laboratory to the Commissioner of Science & Technology Edo State**

The visit was led by Mr Alex Orukpe the Centre's Liaison Officer and accompanied by Mr Justice Timiyo and Surveyor Oliha on Thursday, 11<sup>th</sup> October 2018 with the aim to explore possible areas of collaboration in space science, research and technology, which could birth a Memorandum of Understanding (MoU) between the Centre for Atmospheric Research - National Space Research & Development Agency (CAR-NASRDA) and Edo State Government. The CAR-NASRDA delegates were welcomed by the Commissioner of Science and Technology for Edo State in company of the Permanent Secretary of State's Ministry of Science & Technology Mr A.L. Dania. During the course of the meeting, the following areas of discussion were touched on:

- Automatic Weather station with inbuilt sensors to measure greenhouse gases (Now-Cast)
- Acquisition of Drones and construction with Edo State Owned Technical Schools (Edo Poly and Technical Schools)

- Revision of Science and Technical Subjects to meet international best practices
- Provision of Satellite Imagery to set dump sites in the Benin metropolis at best suited positions in relation to development and or, urbanisation expansion
- Production of telescope for secondary schools and higher institutions owned by the Edo State.
- GNSS training of Edo Civil servants in related fields across the ministries

The Commissioner promptly appreciated the Centre for the initiative to work with the Edo State Government and assured the delegate of the State's readiness to collaborate in any area presented by the Centre. In this regard, he urged the Centre to write the State Government for a courtesy visit on a said date to which he can follow up on for its actualisation.

### **Visitors at the Accounting Unit of CAR during the course of the year 2018**

- Staff from the audit unit of the Accountant General of the federation,
- Inspectorate staff from Accountant General of the Federation
- Monitoring staff from the Budget and Planning office of the federation
- Asset Verification staff from Federal Ministry of Science and Technology and many other from the FCT

### **Special Administrative/ Technical Training**

Training on GIFMIS budget Preparation Subsystem: A 5-day training program for 2019 GIFMIS Budget Preparation Sub-system was conducted by the Budget Office of the Federation from 6<sup>th</sup> August to 10<sup>th</sup> August 2018. Members of staff who participated in the training are Mr. Kenneth Ogbeiwi, Dr Jatto Solomon, Mrs Onuh Joyce, Mrs Aderonke Obafaye, and Mr Gideon Eboseremhen. The training was aimed at syncing the budgeting and accounting task to manage accounts dimensions of the budget in order to efficiently budget plan for Personnel, Overhead and Capital for the Centre.



## **IN-House Seminar and Training**

1. Seminar: Presentation on *“Computer Viruses and their Implications in a workplace”* by Mr Suleiman Abdulrahman of ICT on the 31<sup>st</sup> January 2018. All CAR Staff were in attendance. Venue: Prof. Seidu Onailo Muhammed Conference Hall, Anyigba. Kogi State.
2. Computer Training: The ICT unit team embarked on 2-weeks Computer Training for all Industrial Training (IT) Students at the Centre from the 3<sup>rd</sup> – 17<sup>th</sup> of October 2018. The training which was facilitated by the Head of ICT Mr Suleiman Abdulrahman was scheduled to cover Computer Appreciation and Desktop Publishing, Microsoft Word, Microsoft Excel, Microsoft PowerPoint and Introduction to MATLAB.
3. *“The Impact of Computer Virus in a Workplace”* on the 31<sup>st</sup> January 2018 by Mathew Daniel.
4. *“An Overview of Medical Geography and the Role of the Centre for Atmospheric Research”* on 7<sup>th</sup> March 2018 by Musa I. A.
5. *“Impact of Ionosphere on Communication and Navigation Systems”* on 7<sup>th</sup> March 2018 by Ikani Ojochenemi.
6. *“Atmospheric Dynamics, Thunderstorms and Lightening Effect in Climate Fluctuations”* on 13<sup>th</sup> May 2018 by Shehu Sarafadeen A.
7. *“Computer Numerical Control Machine Operation and Principles”* on 13<sup>th</sup> June 2018 by Ezekiel Josiah.
8. *“Introducing UAVs at Centre for Atmospheric Research”* 27<sup>th</sup> June, 18 by Engr. Saleh A. U.
9. *“Stratospheric Ozone Layer Depletion by Atmospheric Activities”* on 30<sup>th</sup> May 2018 by Jibril Otu O.

## **PAPER PRESENTATIONS**

- I. Description and comparison of aerosol optical thickness and single scattering albedo using AERONET data and CESM CAM-chem in the tropics. Najib Yusuf, Simone Tilmes, Rabia, S. S. and Emiola G. Seminar paper presented at Physics Department, BUK, and ACOM National Centre for Atmospheric Research. Foothills Lab. Boulder CO.
- II. An Insight on the Climatology of Aircraft to and for LOS and Total Column Ozone Measurements as a Detriment on AQ and Ecosystem. Najib Yusuf and Rabia Said S.

Workshop paper presented at the 1<sup>st</sup> National Workshop on Air Quality 13<sup>th</sup> - 16<sup>th</sup> March 2018. Centre for Atmospheric Research ,NASRDA. Anyigba.

- III. Monitoring and Estimation of Aerosols and Air Pollutants Relations Using Multi-Sensor Satellite and Ground Remote Sensing over Ilorin a Sub-Sahara” by Aladodo S. S. *et al.* 1<sup>st</sup> National Workshop on Air Quality March 2018.
- IV. Paper presentation titled “Spatio-Temporal Variability of Gaseous Pollutants over Nigeria Using Satellite Observations” by Otu Jibril O *et al.* 1<sup>st</sup> National Workshop on Air Quality March 2018.
- V. An awareness and Review on the Use of Satellite Equipment for Monitoring Air Quality by Mathew E. *et al.* 1<sup>st</sup> National Workshop on Air Quality March 2018.

## PUBLICATIONS 2018

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

1. Hammed A. Lawal, Mark Lester, Stanley W.H. Cowley, S.E. Milan, T.K. Yeoman, Gabby Provan, Suzie Imber, **A. Babatunde Rabi**, 2018. Understanding the global dynamics of the equatorial ionosphere in Africa for space weather capabilities: A science case for AfrequaMARN. Journal of Atmospheric and Solar-Terrestrial Physics. <https://doi.org/10.1016/j.jastp.2018.01.008>.
2. Adebessin, B. O., **Rabi**, **A. B.**, Obrou, O. K., & Adeniyi, J. O (2018). Ionospheric peak electron density and performance evaluation of IRI-CCIR near magnetic equator in Africa during two extreme solar activities. Space Weather, 16. <https://doi.org/10.1002/2017SW001729>.
3. Adebessin, B.O., **Rabi**, **A. B.**, Bolaji, O. S. Adeniyi, J. O., Amory-Mazaudier, C. 2018. Ionospheric climatology at Africa EIA trough stations during descending phase of sunspot cycle 22. Journal of Atmospheric and Solar-Terrestrial Physics 172 (2018) 83–99.
4. **Saleh**, **U. A.**, Haruna Y. S, Gwaram U. A and Abu, U. A. (2018). Evaluation of Solar Energy Potentials for Optimised Electricity Generation at Anyigba, North Central Nigeria. Global Scientific Journals. ISSN: 2220-9186, Volume 6 Issues 2, 2018.
5. Adamu, Muhammad K., **Saleh**, **U. A.**, Faruk I. Gaya and Muazu, Zanuwa (2018). Monitoring of air pollution using earth observation ground stations and GIS in TRNC. Global Scientific Journals. ISSN: 2220-9186, Volume 6 Issues 2, 2018.

6. **Yusuf, N., Okoh, D. I., Musa, I., Adedaja, S.,** Said, R. (2018). A Study of the Surface Air Temperature Variations in Nigeria, The Open Atmospheric Science Journal, DOI: 10.2174/1874282301711010054, volume 12.
7. Lilian, N., **Okoh, D. I.,** Joseph, O. (2018). Modeling the Solar Radiation parameter over Abuja using Neural Networks, Research & Reviews: Journal of Space Science & Technology, 6 (3), 40-48.
8. **Okoh, D. I.** (2018). MATLAB Programming. Createspace, North Charleston, USA, ISBN: 978-1539360957.
9. **Aladodo, S. S., Mathew, D. E., Otu, J. O., Najib Yusuf.** Akoshile, C. O., (2018). Diurnal and Interannual Variability of Rainfall in Nigeria Climatic Zones as Seen From In-Situ and Satellite Measurements. Journal of Environment and Earth Science, Vol.8, No.2. ISSN (Paper) 2224-3216 ISSN (Online)2225-0948.
10. **Daniel Okoh,** Gopi Seemala, **Babatunde Rabi**u, Jean Uwamahoro, John Bosco Habarulema, Malini Aggarwal (2018). A Hybrid Regression-Neural Network (HR-NN) Method for Forecasting the Solar Activity, Space Weather, 16 (9), pp. 1424-1436, <https://doi.org/10.1029/2018SW001907>
11. Ekpa, I. D., Udo, S. O., Obu, J. A., **Okoh, D. I.** (2018). Modeling of Flood in Lagos using Artificial Neural Network. Research & Reviews: Journal of Space Science & Technology, 7 (2), pp. 50-57 **Daniel Okoh** (2018). GPS Modelling of the Ionosphere using Computer Neural Networks in Multifunctional Operation and Application of GPS, edited by Rustam Rustamov, IntechOpen, London (ISBN: 978-1-78923-215-8), <http://dx.doi.org/10.5772/intechopen.75087>
12. **Daniel Okoh,** Sylvester Onwuneme, Gopi Seemala, Shuanggen Jin, Babatunde Rabiu, Bruno Nava, Jean Uwamahoro (2018). Assessment of the NeQuick-2 and IRI-Plas 2017 models using global and long-term GNSS measurements. Journal of Atmospheric and Solar-Terrestrial Physics, 170, pp. 1-10, <https://doi.org/10.1016/j.jastp.2018.02.006>
13. **Iloanus**i, N., **Okoh, D.,** Obi, J. (2018). Modeling the Solar Radiation Parameter over Abuja using Neural Networks. Research & Reviews: Journal of Space Science & Technology, 6 (3), pp. 40-48

14. **Daniel Okoh** (2018). GPS Modelling of the Ionosphere using Computer Neural Networks, in: Multifunctional Operation and Application of GPS, edited by Rustam Rustamov, IntechOpen, London (ISBN: 978-1-78923-215-8), <http://dx.doi.org/10.5772/intechopen.75087>
15. **Adedoja, O.S**, Yskandar Hamam, Baset Khalaf and Rotimi Sadiku (2018). Towards Development of an Optimization Model to Identify Contamination Source in a Water Distribution Network. *Water* 2018, 10(5), 579. <https://doi.org/10.3390/w10050579>
16. Sikirica, N., Špoljar, D., Lawon, B., **Rabiu, A.B.**, 2018. Impact of Geomagnetic Storm on GPS Positioning Performance. *IEEE 2018 International Symposium ELMARP*, 179 – 181, DOI: 10.23919/ELMAR.2018.8534673
17. Owolabi O. P., O. S. Bolaji , J. O. Adeniyi , E. O. Oyeyemi, **A. B. Rabiu**, J. B. Habarulema, 2018. Excursions of Interhemispheric Field-Aligned Currents in Africa. *Journal of Geophysical Research: Space Physics*, 123 (7), 6042-6053. <https://doi.org/10.1029/2017JA025083>
18. Ogunjo, S., Fuwape, I., Oluyamo, S., **Rabiu, A. B.**, 2018. Spatial dynamical complexity of precipitation and temperature extremes over Africa and South America. *Asia Pacific Journal of Atmospheric Sciences*, *Asia-Pacific Journal of Atmospheric Sciences*. <https://doi.org/10.1007/s13143-019-00131-y>
19. Fuwape, I., Oluyamo, S., **Rabiu, A. B.**, Ogunjo, S., 2018. Chaotic signature of climate extremes. *arXiv preprint arXiv:1901.02065*.
20. Ojo, J. S., **Rabiu, A. B.**, Radicella, S. M., Obiyemi, O. O., 2018. Experimental analysis and comparison of tropospheric scintillation prediction models using eutelsat-36b satellite in a tropical Nigeria. *International Journal of Basic and Applied Sciences*, 7 (1), 8-14, DOI: 10.14419/ijbas.v7i1.8257
21. **Aladodo, S. S.**, Akoshile, C. O., Ajibola, T.B., Falaiye, O. A., and **Sani M. (2018)** Monitoring and Estimation of Aerosols and Air Pollutants Relations Using Multi-Sensor Satellite and Ground Remote Sensing over Ilorin a Sub Sahel. *Monograph of Atmospheric Research 2018* Edited by A. B. Rabiu and O. E. Abiye, Centre for Atmospheric Research, Anyigba, Nigeria, pp. 24-32
22. Ighravwe D.E, Babatunde, O.M., **Adedoja, O.S** and Okharedia, T.E. Evaluation

and Selection of Hybrid Renewable Energy Systems for Healthcare Centres in Rural Areas: A Techno-economic Approach. *IEEE 7<sup>th</sup> International Conference on Adaptive Science & Technology (ICAST)*, 2018.

## E-MEDIA PUBLICATIONS

NASRDA calls for Policy Planning on Air Quality: <https://independent.ngnasrda-calls-for-policy-planning-on-air-quality/amp/> Independent 10<sup>th</sup> March 2018.

Atmospheric Centre expresses readiness to deploy facilities to forecast air quality: <http://www.environewsnigeria.com/atmospheric-centre-expresses-readiness-to-deploy-facilities-to-forecast-air-quality/> Enviro New Nigeria 19<sup>th</sup> March 2018.

Senate commits to legislate on Air quality <https://legiswatch.com.ng/senate-commits-to-legislate-on-air-quality/> Legiswatch.com.ng 19<sup>th</sup> March 2018.

Air Quality: NiMET says inhaling of Particulate Matters can cause cancer: <https://theeaglesonline.com.ng/air-quality-nimet-says-inhaling-of-particulate-matters-can-cause-cancer/> News: The Eagle Online 16<sup>th</sup> March 2018.

Nigeria to experience longest total lunar eclipse on Friday-Scientist: <http://punchng.com/nigeria-to-experience-longest-total-lunar-eclipse-on-friday-scientist/> Punch Newspaper: July 26 2018.

Some Nigerian communities face radiation risk, says CAR's director: <https://www.vanguardngr.com/2018/08/some-nigerian-communities-face-radiation-risk-says-cars-director/> Vanguard Newspaper 10<sup>th</sup> August 2018.

FCT Earth Tremor: Scientist Urges implement laws against illegal mining, borehole digging <https://www.vanguardngr.com/2018/09/fct-earth-tremor-scientist-urges-implements-laws-against-illegal-minning-borehole-digging/> Vanguard News 7<sup>th</sup> December 2018.

Presentation made by CAR Director/CE @ the **International steering committee meeting** of ISWI in Vienna. [http://newserver.stil.bas.bg/ISWI/Organization/Annexure\\_VI.pdf](http://newserver.stil.bas.bg/ISWI/Organization/Annexure_VI.pdf).



Space Physicist, Prof. Rabi, hails Obaseki on Edo-GIS, Innovation Hub  
<https://leadership.ng/2018/12/26/space-physict-pro-rabi-hails-obaseki-on-edo-gis-innovation-hub/> Leadership News 26<sup>th</sup> December 2018.

## **CAR CONGRATULATORIES**

- The family of Mr Sharafadeen Aladodo on the 6<sup>th</sup> of Feb 2018 announced the birth of a new baby boy into the family.
- The family of Mrs Adenike Akinola on the 15<sup>th</sup> of March 2018 announced the birth of a new baby boy into the family.
- The family of Mr Suleiman Abdulrahman on the 2<sup>nd</sup> of July 2018 welcomed a new born baby girl to the fold.
- The family of Mrs Bimbo Jamah on the 18<sup>th</sup> of April 2018 welcomed a new born baby boy.
- Miss Omotayo Johnson of SERL-CAR got married on the 3<sup>rd</sup> of March 2018 to Mr Oyinda Oyewole.
- Francis I. Onuigbo was joined in holy matrimony to his heartthrob on the 4<sup>th</sup> of April 2018.
- Mr Michael Inah got married to his heartthrob on the 28<sup>th</sup> of July 2018.



Figure 28: Mr & Mrs Oyewole



Figure 29: Mr & Mrs Francis Onuigbo



*Figure 30: Prince & Princess Michael Inah*

## PHOTO PANORAMA

Installation of National Grid to the Mechatronics Workshop and Electronics Laboratory of the Centre in March 2018.



*Figure 31: Three phase connection at the change-over*



*Figure 32: Rolling of the underground armoured cable for the supply of national grid to the mechatronics workshop and Electronics Lab of the Centre in Anyigba, March 2019*





*Figure 33: Engr. Saleh connecting the workshop to the national grid*



*Figure 34: Mr Ezekiel, Mr Godwin Sadat (IT Student) and Engr. Saleh conducting the cable laying*

## Kogi State World Science Day Celebration & 21 Young Scientists Competition (GOVERNORS AWARD) 2018.



Figure 35: From left Hon. Commissioner Education, Science and Technology Kogi State: Mrs Rosemary Osikoya, Engr. Saleh A. U representing the CE/Director; Prof. Babatunde Rabiou and the Permanent Secretary Ministry of Education Kogi State



Figure 36: Engr. Saleh A. U Presenting the award to the runner up of the 21 young scientists competition.



Figure 37: From left, Engr. Saleh A. U representing the CE/Director; Prof. Babatunde Rabiou, Hon. Commissioner Education, Science and Technology Kogi State. Mrs Rosemary Osikoya and the Permanent Secretary, Ministry of Education, Kogi State.



## Nigerian Society of Engineers 2018 Week/AGM Ajaokuta Branch. 15<sup>th</sup> August 2018



Figure 38: Director of CAR; Prof. Babatunde Rabi flanked by members of the Nigeria Society of Engineers at the 2018 Engineering Week/AGM



Figure 39: Arrival of Keynote Speaker; Director of CAR- Prof. Babatunde Rabi at the Nigeria Society of Engineers 2018 Week/AGM



Figure 40: Cross section of NSE Executive



*Figure 41: Director of CAR- Prof. Babatunde Rabi with staff of CAR touring Ajaokuta Steel Rolling Complex*



*Figure 42: Director/CE of CAR in a photo session with the Management of Ajaokuta Steel Company*





Figure 43: Cross Section of Participants at the Nigeria Society of Engineers 2018 week/AGM



Figure 44: Visit to Steel Engines at the Ajaokuta Factory

## E.E Balogun National Symposium on Atmospheric Research on the 16th August 2018



Figure 45: Dr Ogah presenting a book (Autobiography of Prof E. E. Balogun) to Dr (Mrs) Virginia Ugoyibo Okwu-Delunzu during the E.E Balogun National Symposium on Atmospheric Research on the 16<sup>th</sup> August 2018



Figure 46: Dr Ogah presenting a book (Autobiography of Prof E. E. Balogun) to Dr. Olusegun Gabriel Fawole from Obafemi Awolowo University, Ile-Ife, during the E.E Balogun National Symposium on Atmospheric Research on the 16<sup>th</sup> August 2018



## Air Quality Workshop



*Figure 47: Registration of participants upon arrival for the Air Quality workshop in Anyigba*



*Figure 48: Engr. Saleh A. showing guests the weather station data analysis on the system during the air quality workshop*

## CAR Staff Retreat 2018



*Figure 49: Cross section of attendees at the 2018 Annual Staff retreat in Anyigba, Kogi State*



*Figure 50: CAR Retreat Resource Personnel, Mr Toyé Akingbola speaking on Effective Service Delivery*



*Figure 51: Cross section of attendees of the 2018 Annual Staff retreat in Anyigba, Kogi State*





Figure 52: Cross section of members of staff at the 2018 Staff Annual Retreat

## Photos From CAR Staff Retreat Dinner



Figure 53: DCAR, Prof. Babatunde Rabiufanked by Mr Ogbeiw Kenneth. O Head of Account and Store (L) and Mr Najib Yusuf, Head of R&D at the CAR Retreat Dinner



Figure 54: Deputy Director; Dr. James Ogah giving the vote of thanks at the CAR Retreat Dinner

### Cross Section of CAR Family at the CAR dinner



Figure 55: DCAR, Prof. Babatunde Rabiufanked by Mrs Ramatu Omale, Mrs Kumben Plangnan and Mr Matthew Daniel at the CAR Retreat Dinner



Figure 56: Cross Section of CAR Family at the CAR dinner





Figure 57: Cross Section of CAR Family at the CAR dinner

.....Continued, Photos from CAR Staff Retreat Dinner



Figure 58: Head of Account & Finance, Mr Kenneth Ogbewi acknowledging the joyous occasion



Figure 59: Its Celebration time at CAR



Figure 60: Head of Planning and Budget, Mrs Joyce Onuh giving a brief appreciation speech



Figure 61: Time to Dine



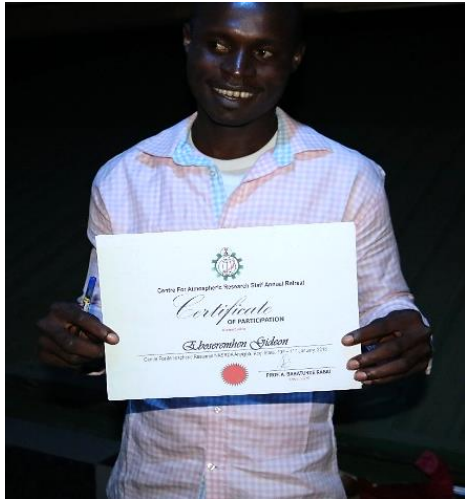


Figure 62: Mr Eboseremhen Gideon of Planning and Budget displaying his certificate of attendance



Figure 63: Staff in joyous mood with the Director

## Bowen Courtesy Visit/MOU Signing To CAR\_NASRDA



Figure 64: Dr. F Agboola presenting copies of signed MoU between NASRDA and Bowen University to Bowen University VC; Prof. Joshua Ogunwole. Far left, Director of CAR; Prof. Babatunde Rabi, far right, Registrar of Bowen Univ



Figure 65: Prof. Ogunwale, VC Bowen University in a warm handshake with Prof. Babatunde Rabi, Director/CE CAR after a successful collaboration meeting



Figure 66: Delegates from BOWEN University Signing the CAR-BOWEN MOU ment Research Laboratory.



Figure 67: L-R, Head of Department Physics & Solar Energy; Dr Adejumo , SA to the V.C; Mr Toba Adaramola, Director of CAR; Prof. Babatunde Rabi, V.C Bowen University; Prof. Joshua Ogunwale, Dir. of Research & Strategic Partnership; Dr. Bolanle Otegbayo , Dean of faculty of science; Prof. I.O Osungade at the Space Environment and Research Laboratory.





*Figure 68: Director Centre for Atmospheric Research; Prof. Babatunde Rabi showing the Bowen University delegates led by the V.C Bowen University; Prof. Joshua Ogunwale round the SERL facility.*

## Visits To Serl Laboratory In 2018



*Figure 69: Students from Federal University, Dutsinma Katsina on field trip to Space Environment Research Laboratory, Abuja. with CAR Staff, Mrs Abimbola Onijamo and Miss Priscilla Bako on 31<sup>st</sup> Jan. 2018*





Figure 70: Teachers and pupils of Abundant Life Primary School, Kuje on excursion to Space Environment Research Laboratory, Abuja with CAR Staff, Miss Priscilla Bako on 7th Feb. 2018

## Okura Navy Secondary School Visit To CAR Anyigba



Figure 71: Students of Okura Navy Secondary School visits CAR Anyigba.





*Figure 72: A pupil of Okura Navy Secondary School asking questions*



*Figure 73: Mr Aladodo explaining the function of GPS to students from Okura Navy Secondary School.*



*Figure 74: Mr Mathew Daniel in practical display of CAR in-house built drone.*



Figure 75: Mr Ezekiel Joisah engrossed in explanation and tour of the Engineering workshop with students from Okura Navy Secondary School



Figure 76: Mr Ikanni Ojochenemi explaining how the home made atmospheric weather station works to students from Okura Navy Secondary School

## SPACE WORKSHOP at the University of Benin Main Campus, Ugbowo, Edo State, Nigeria.

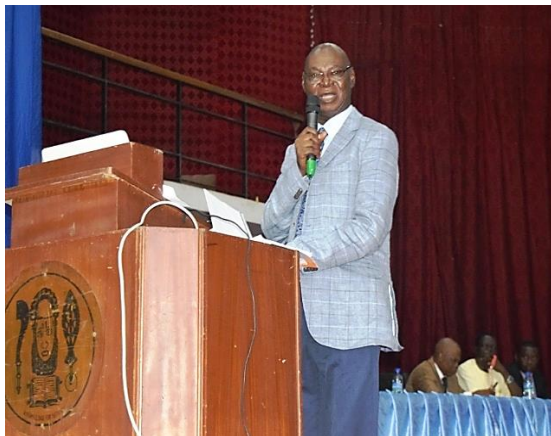


Fig. 77: Prof. J. O. Ehiorobo, DVC Admin Uniben, VC Rep and LOC Chairman giving the opening speech at the at the Space Products as Tools for Social Economic Development and National Security.



Figure 78: Prof Babatunde Rabi, Director/CEO, Keynote Speaker at the Space Products as Tools for Social Economic Development and National Security.





Figure 79: Dr. C.I. Adesotu, Commissioner Of Science & Tech., Edo State.



Figure 80: Senator R. S. Owie, KSJI, JP, Former Chief Whip Of The Senate representing The Governor Of Edo State Mr Godwin Obaseki Speaker at the Space Products as Tools for Social Economic Development and National Security

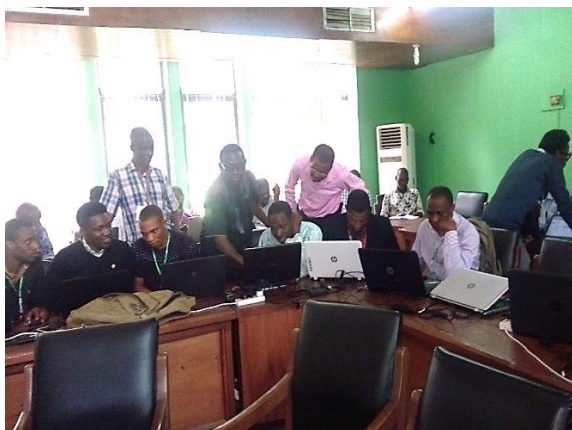


Figure 81: (GNSS) Data Processing and software installation training ongoing at the Space lecture and workshop initiated by the University of Benin in collaboration with the Centre for Atmospheric Research on the 10<sup>th</sup> of September – 13<sup>th</sup> of September, 2018



Figure 82: Dr Joseph Dodo teaching the participants on the field during the GNSS installation.



Figure 83: Participants on the field during the GNSS installation.



Figure 84: Participants and the resource persons during the field work on GNSS installation.

## Pictures From The Science And Technology 2018 EXPO



Figure 85: Mr Solomon Jato putting the Chief of SA and some DSA officials through the centres facilities





Figure 86: Mr Ezekiel Josiah of the Engineering unit explaining how the indigenously made weather station works to some innivation enthusiasts at the Science and Tech exhibition 2018.

.....continued



Figure 87: Prof. Seidu Onailo Muhammed; DG of NASRDA showing some equipments on display to the Honorable Minister of Science and Tech. Dr. Ogbonnaya Onu at the NASRDA Peach



Figure 88: Engr. Umar Saleh showcasing CAR indigenously built weather station technology to Ambassador Emmanuel from Burundi embassy at the CAR exhibition stand 2018.



Figure 89: DG of NASRDA; Prof. Seidu Onailo Muhammed talking the press through our CAR indigenously built weather station at the Science and Technology exhibition 2018.





Figure 90: Staff of CAR & NASRDA in joyful display of the NASRDA award of 1st Position under the science and Tech category 2018

.....continued2



Figure 91: Visitors at CAR exhibition



Figure 92: DG of NASRDA; Prof. Seidu Onailo Muhammad taking international visitors on a tour round the NASRI facilities at the Science and Technology exhibition



Figure 93: Nigeria in Space; NASRDA at the Science and Technology exhibition 2018



Figure 94: L-R Prof. Ibiyinka Fuwape; VC Michael and Cecilia Ibru University, Prof. Babatunde Rabi CE/Director of CAR and Chief Mrs Cecilia Ibru during a Custersy visit to the Universit on 2nd April, 2018.



Figure 95: L-R Prince Kola Oyawoye appreciating Prof. Babatunde Rabi CE/Director CAR during the 13th Mosobalaje Oyawoye Faculty of Science Endowed Lecture held at the University of Ilorin, on the 22nd Nov, 2018.



Figure 96: Prof. Babatunde Rabi of CAR receiving an award of Excellence during the Edo State Polytechnic 1st convocation ceremony where he was also the guest speaker



## COMMISSIONING OF CAR LABORATORY COMPLEX AND ENGINEERING WORKSHOP



Figure 97: Front View of CAR-NASRDA building about to be commissioned



Figure 98: The Director-General and Chief Executive of the National Space Research & Development Agency, NASRDA Prof. Seidu Onailo Mohammed with the Director/Chief Executive of Centre for Atmospheric Research Prof. Babatunde Rabi during arrival and welcome of guests at the Center for Atmospheric Research (CAR) Laboratory Complex and Engineering Workshop on Monday, 23rd April 2018





Figure 99: Honourable Minister of Science and Technology, Dr. Ogbonnaya Onu (M), Director-General of the National Space Research & Development Agency, NASRDA Prof. Seidu Onailo Mohammed (Back-Middle), His Royal Highness, the Attah of Igala, Dr. Idakwo M. Ameh Oboni (Middle-L), Current President Kogi State Council of ULAMAS Alhaji Suleiman Adamu (Middle-R) and other Royal fathers at the Centre for Atmospheric Research (CAR) Laboratory Complex and Engineering Workshop on Monday, 23rd April 2018



Figure 100: The Pioneering Director/CE of Centre for Atmospheric Research, Prof. Babatunde Rabi presenting a gift to the Honourable Minister of Science and Technology, Dr. Ogbonnaya Onu, with the Director-General of the National Space Research & Development Agency, NASRDA Prof. Seidu Onailo Mohammed during the commissioning of the Laboratory Complex and Engineering Workshop on Monday, 23rd April 2018.





Figure 101: The Honourable Minister of Science and Technology, Dr. Ogonnaya Onu (M), Director-General of the National Space Research & Development Agency, NASRDA Prof. Seidu Onailo Mohammed (L) taking a tour of the Laboratory Complex and Engineering Workshop with the Pioneering Director of CAR, Prof. Babatunde Rabiou and HoD of the Engineering unit, Engr. Umar Saleh and Mr Ezekiel Josiah on Monday, 23rd April 2018



Figure 102: L-R, The Honourable Minister of Science and Technology, Dr. Ogonnaya Onu & his Amiable Spouse in a photo session with His Royal Highness, The Attah of Igala, Dr. Idakwo M. Ameh Oboni II along with the DG NASRDA, Prof. Seidu Onailo Mohammed, Director/ CEO CAR, Prof. Babatunde Rabiou and other dignitaries during the official commissioning of the Laboratory Complex and Engineering Workshop, on Monday, 23rd April 2018

## LIST OF ABBREVIATIONS AND ACRONYMS

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
NASRDA	-	National Space Research and Development Agency
CAR	-	Centre for Atmospheric Research
STP	-	Solar Terrestrial Physics
SGAC	-	Space General Advisory Council
ISELLI	-	International School on Equatorial and Low-Latitude Ionosphere
SERL	-	Space Environment Research Laboratory
SEERL	-	Space Earth-Environment Research Laboratory
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
MoU	-	Memorandum of Understanding
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
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
BSRN	-	Baseline Surface Radiation Network
ICE14	-	International Conference and Exhibition on Environmental Issues
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
NDA	-	Nigerian Defence Academy
CNA	-	Certified National Accountant
ESS	-	Engineering and Space Systems
SWONOA	-	Space Weather Observation Network over Africa
KSU	-	Kogi State University
CE	-	Chief Executive
DG	-	Director General
R&D	-	Research & Development
ARCSSTE	-	Africa Regional Centre for Space Science and Technology Education
CGG	-	Centre for Geodesy and Geodynamics
CSTP	-	Centre for Space Transport and Propulsion
NCRS	-	National Centre for Remote Sensing
ZASTAL	-	Zonal Advanced Space Technology Applications Laboratory



ASTAL	-	Advanced Space Technology Applications Laboratory
CSTP	-	Centre for Space Transport and Propulsion
HR	-	Human Resource
RR	-	Records and Registry
GPS	-	Global Positioning System
MHST	-	Microgravity and Human Space Technology
AQRL	-	National Air Quality Research Laboratory
ASWeRL	-	Atmospheric and Space Weather Research Laboratory
AERONET	-	Aerosol Robotic Network
SPARTAN	-	The Surface PARTiculate mAtter Network
AOD	-	Aerosol Optical Depth
AOT	-	Aerosol Optical Thickness
PSP	-	Particle Size Parameter
PIR	-	Precision Infrared Radiometer
NIP	-	Normal Incidence Pyrheliometer
FPI	-	Fabry Perot Interferometer
MAGDAS	-	Magnetic Data Acquisition System
AMBER	-	African Mediterranean B-Field Education and Research
SOFIE	-	Solar Flares detected by Ionospheric Effects
GPS SW Monitor	-	Global Positioning System
ISEE	-	Institute for Space-Earth Environmental Research
USA	-	United States of America
UNIBEN	-	University of Benin
BUK	-	Bayero University Kano
VLF	-	Very Low Frequency
WWLLN	-	Worldwide lightening Location Network
AMEN	-	Atmospheric Monitoring Equipment Network

IUCAR	-	Inter-University Corporation for Atmospheric Research
WASCAL	-	West African Science Service Centre on Climate Change and Adapted Land Use
JSPS	-	Japan Society for the Promotion of Science
CICR	-	Centre for International Collaborative Research
IUGONET	-	Inter-university Upper atmosphere Global Observation Network
PSTEP	-	Project for Solar-Terrestrial Environment Prediction
MEXT	-	Ministry of Education Culture Sports Science and Technology
SCOSTEP	-	Scientific Committee on Solar Terrestrial Physics
COPINE	-	Cooperative Information Network
OAU	-	Obafemi Awolowo University
PI	-	Principal Investigator
ISS	-	International space station
NRDF	-	National Research and Development Fund
NASS	-	National Assembly
ICTP	-	International Centre for Theoretical Physics
NMetS	-	Nigeria Meteorological Society
ESUT	-	Enugu State University of Science and Technology
ASN	-	Astronomical Society of Nigeria
UNIMED	-	University of Medical sciences
UNICAL	-	University of Calabar
NCAR	-	National Centre for Atmospheric Research

