United Nations African Regional Centre for Space Science and Technology Education - English, (UN-ARCSSTE-E), Obafemi Awolowo University Campus, Ile Ife, Nigeria

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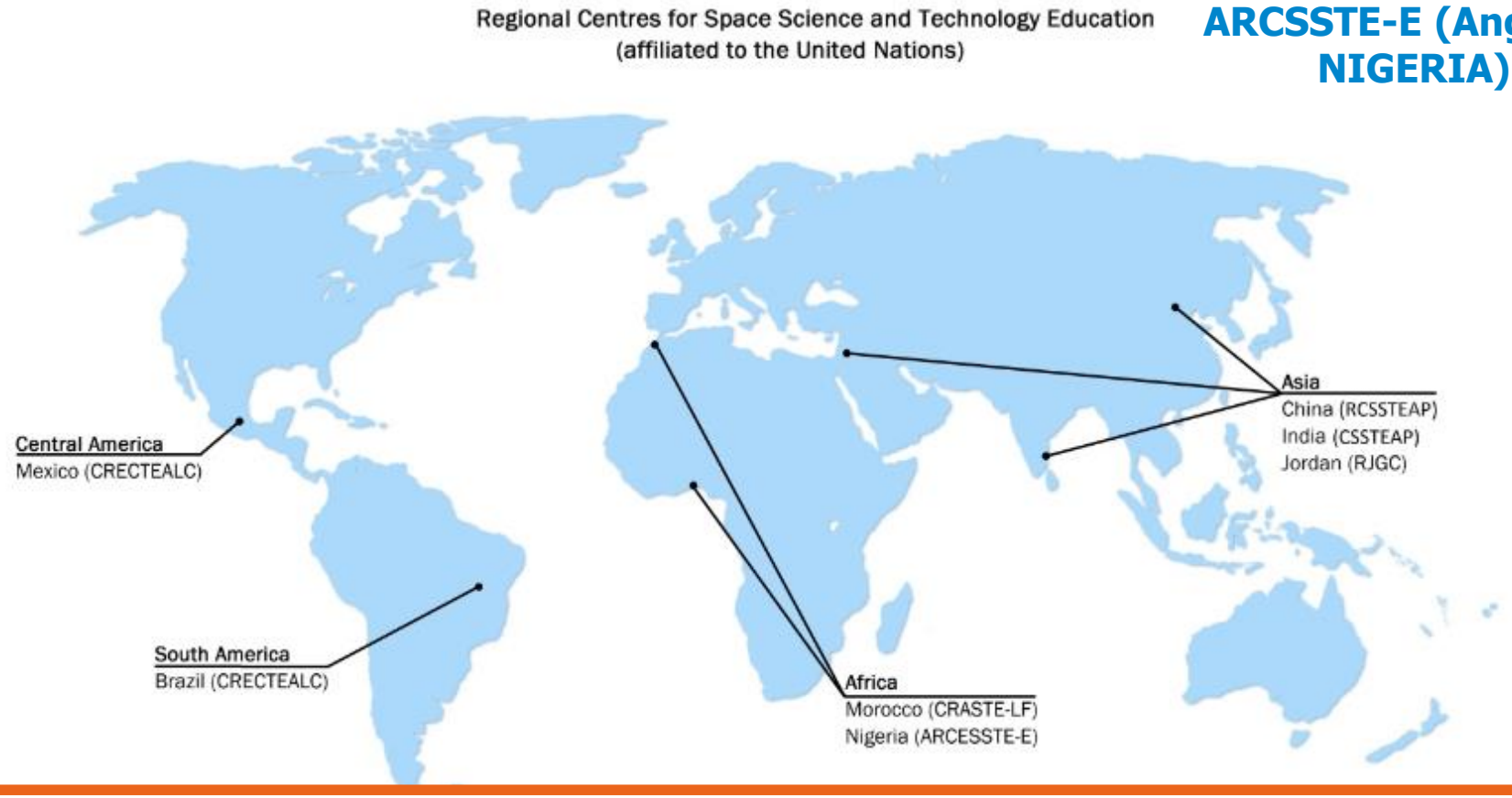
https://www.unoosa.org/oosa/en/ourwork/psa/regional-centres/index.html

CONTENT

1. Background on ARCSSTE-E and its Activities
2. Academic Programmes
3. Space Education Outreach
4. Research and Development
5. International Workshops /Trainings
6. Collaborations / Partnerships

Regional Centres for Space Science and Technology Education (affiliated to the United Nations)

LOCATION OF THE CENTRES



ARCSSTE-E (Anglophone – NIGERIA) was inaugurated in 1998

https://www.unoosa.org/oosa/en/ourwork/psa/regional-centres/index.html

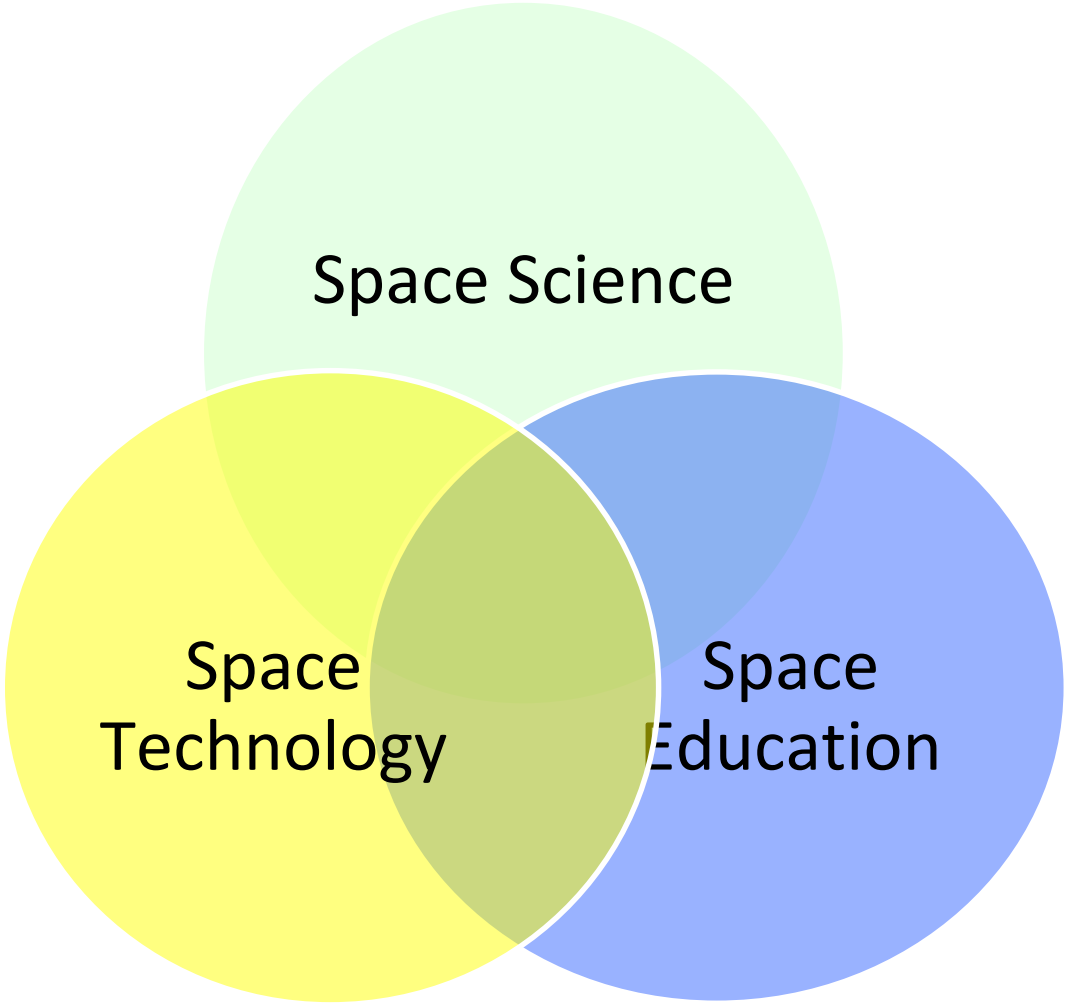
ARCSSTE-E

Mandate: "Develop, through in-depth education, indigenous capability in the core areas of SST

Core Activities

1. Academic Programmes
   - Post Graduate Diploma (PGD) programme
   - M.Sc programme
   - Short term courses/Training
2. Space Education and Outreach Programme (SEOP)
3. Research & Development

ARCSSTE-E
The Regional Space Science & Technology Building Partner



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ACADEMIC PROGRAMMES

Postgraduate Diploma Programmes

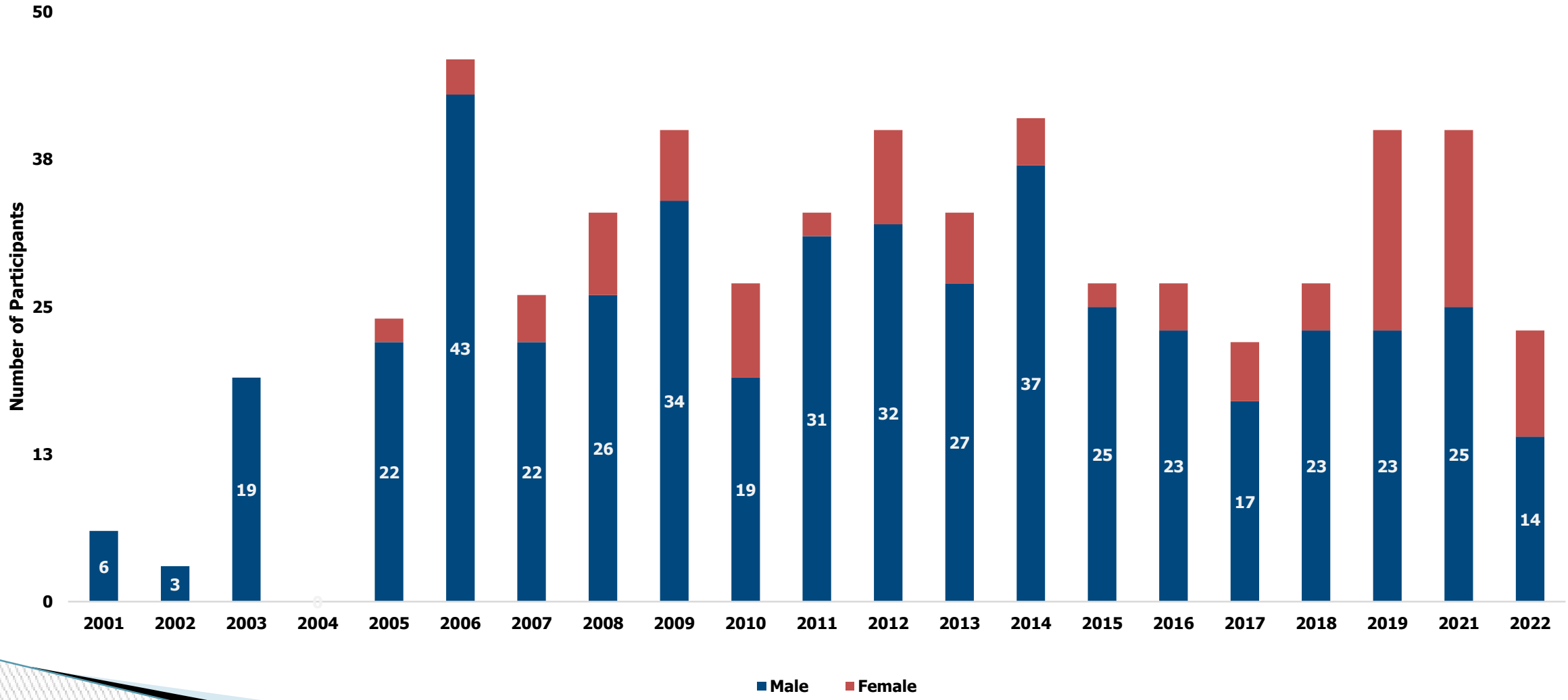
The PGD programme at ARCSSTE-E is divided into three phases:

- ➢ Common Modules
- ➢ Core Modules with Practical sessions
- ➢ Project

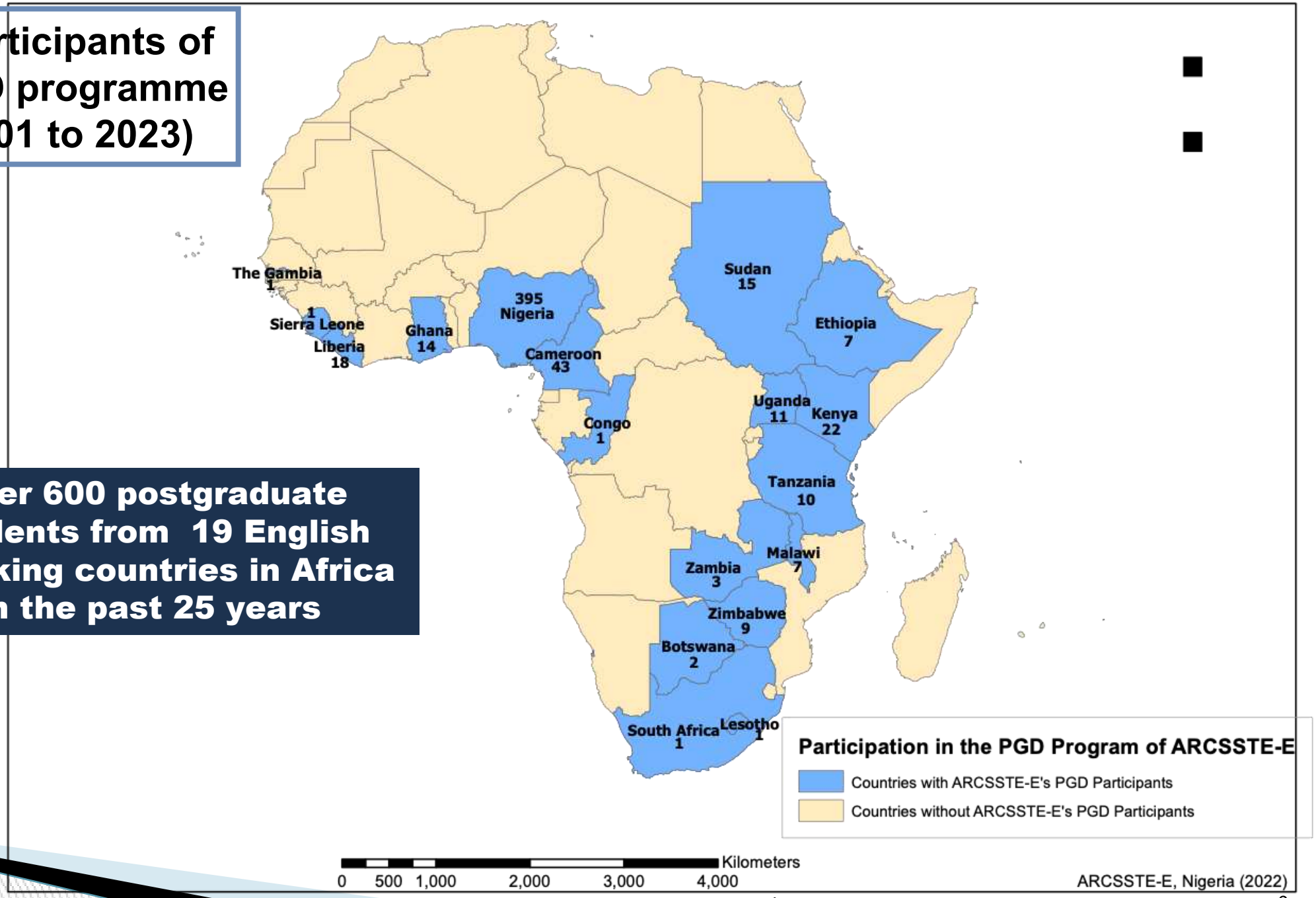
6 Thematic Areas of Space Science and Technology

- Remote Sensing/Geographic Information Systems (GIS)
- Satellite Communication
- Satellite Meteorology/Global Climate
- Space Science/Space Weather/Atmospheric Physics/Air Quality
- Global Navigation Satellite Systems (GNSS)
- Space Law

Annual Distribution of PGD Participants (2001 - 2022)

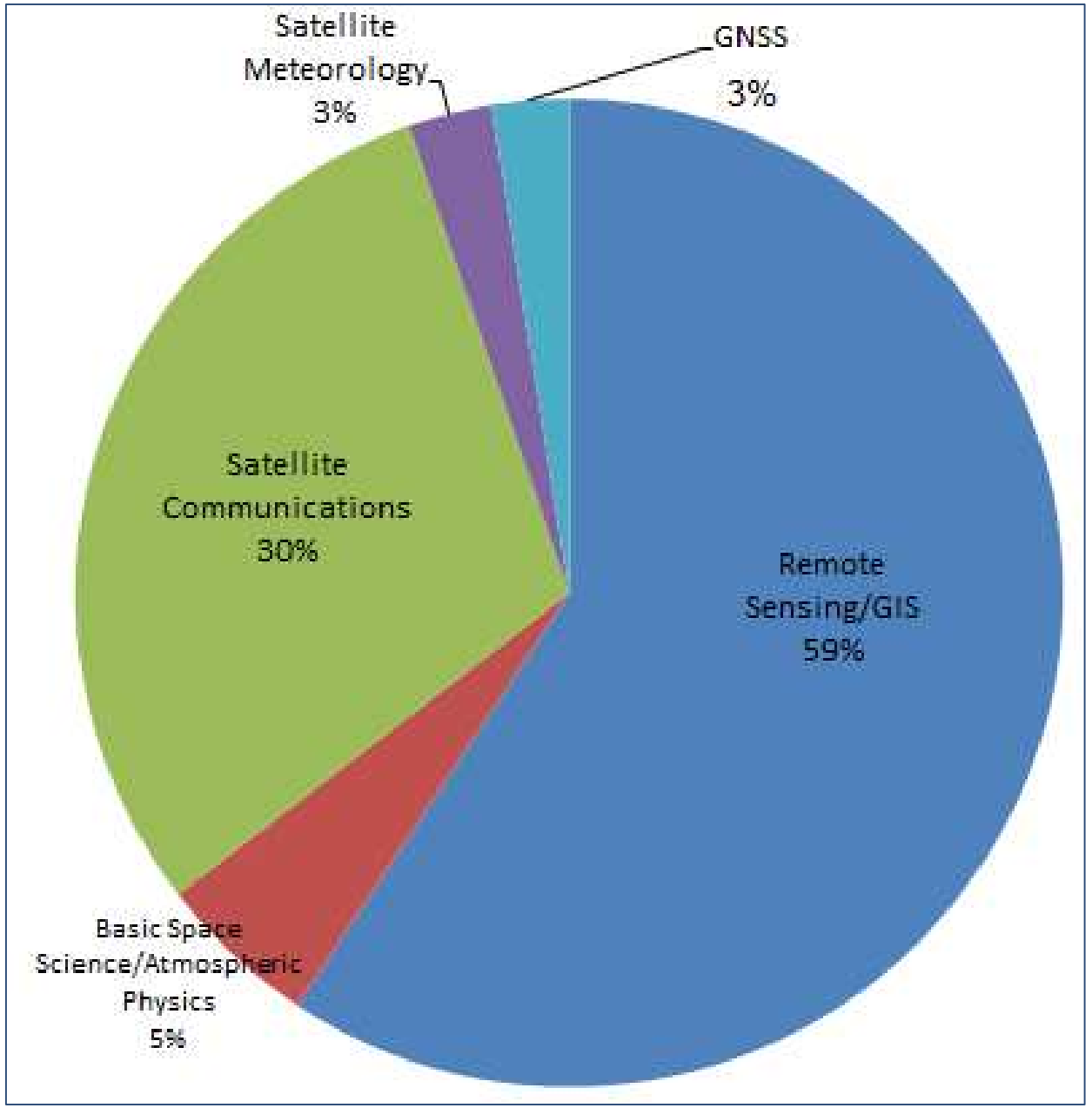


Distribution of Participants of ARCSSTE-E's PGD programme by Countries (2001 to 2023)



Over 600 postgraduate students from 19 English Speaking countries in Africa in the past 25 years

Participants distribution according to course options (2001 to 2022)



PGD Graduation / Closing Ceremony

Masters Programmes (MTech & MSc.)

MTech

- **Duration :**18-month MTech. (SSTA) in RS/GIS and Satellite Communication

- **Collaborating University:** Federal University of Technology, Akure (FUTA)

MSc.

- **Duration :**18-month MSc. In 'Disaster Monitoring and Management' and 'Space Population Studies'

- **Collaborating University:** Obafemi Awolowo University (OAU)

ARCSSTE-E in 2020 signed an MoU with its host University (OAU) to implement two (2) joint Master of Science degree (MSc.) Programmes in 'Disaster Monitoring and Management' and 'Space Population Studies' (M.Sc. DMM; & M.Sc. SPS) by the two institutions.

Short Term Courses/Training (Certificate)

SN	MODULE	DURATION	ADMISSION REQUIREMENTS
1.	Beginners Certificate Course (GIS)	4 Weeks	WASCE, ND/HND, NCE, Undergraduates, Postgraduates, Applicants
2.	Intermediate Professionals Certificate Course (Spatial Analysis with GIS)	4 Weeks	Must have Beginners Certificate Course; Previous experience of GIS at ND/HND, NCE, Undergraduates, Postgraduates levels
3.	Intermediate Professionals Certificate Course (Geospatial Intelligence and Crime Analysis)	4 Weeks	Previous experience of GIS at ND/HND, NCE, Undergraduates, Postgraduates levels
4.	Space Law	4 Weeks	Undergraduates, Postgraduates levels
5.	Global Navigation Satellite Systems	4 Weeks	Undergraduates, Postgraduates levels

Short Courses (Advanced Diploma)

SN	MODULE	DURATION
6. Advanced Diploma Course in Remote Sensing/ GIS: 3 Months		
a.	Remote Sensing: Earth Observing Systems and Applications	3 Weeks
b.	Geospatial Data Modelling	3 Weeks
c.	Development and Management of GIS Projects	2 Weeks
d.	Advanced Geo-intelligence	2 Weeks
e.	Project Design, Implementation and Presentation	2 Weeks

SPACE EDUCATION OUTREACH

Space Education Outreach Programme

The Centre carries out Space Education Outreach programmes through various educational activities as a **'Catch Them Young Initiative'**

The activities are:

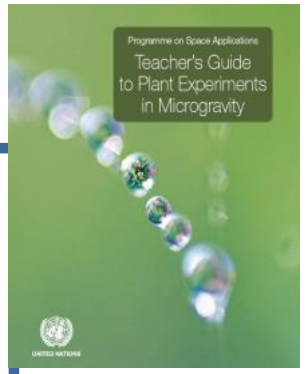
- Space Education Outreach Workshops
- Debate Competitions
- Quiz competitions
- Robotics
- Water Rocketry
- Exhibitions
- Educational tours to the Centre
- Celebrating International events like 'World Space Week' and 'Yuri's Night'

The Outreach programme has reached over 20,000 pupils across the six (6) Geopolitical Zones in Nigeria

The School Teachers' capacities are also enhanced through the 'Train the Trainer' Teachers' Workshops

Space Education Outreach Programme - Schools' Workshop

- Schools' Workshop
- Robotics
- Microgravity Studies



- **Participants** - students and teachers are drawn from public and private Primary/Secondary Schools.
- ARCSSTE-E technical staff carry out presentations, hands-on activities in robotics, drone technology and other fields of space science and technology.

Space Education Outreach Programme - ZERONAUT

Stella Felix
ARCSSTE-E's 1st Zeronaut 2006

Adeolu Akano
ARCSSTE-E's 2nd Zeronaut 2007

Omolola Ibrahim
ARCSSTE-E's 3rd Zeronaut 2008

- The Zeronaut Programme was established to inspire the young ones.
- It takes place annually at the Kennedy Space Center, Florida, USA in collaboration with Space Week International Association (SIA).
- Three Nigerian secondary school students selected by ARCSSTE-E have been privileged to participate in the Zero-G flight, and experience the floating conditions associated with space flights.

Space Tech Innovation at OAU Space Club

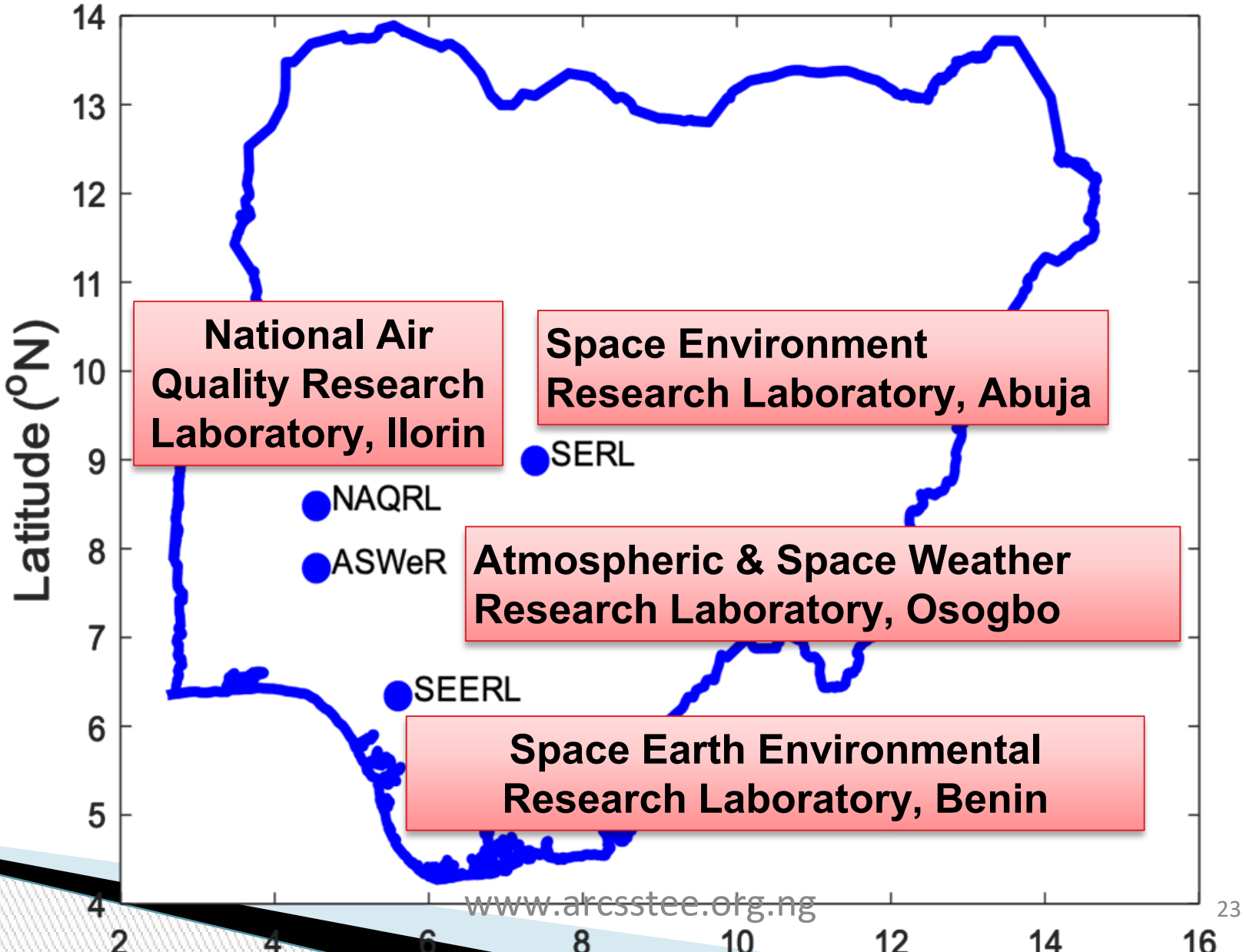
Space Education Outreach Programme - Joint Outreach Workshop

RESEARCH AND DEVELOPMENT

Areas of Research Interest

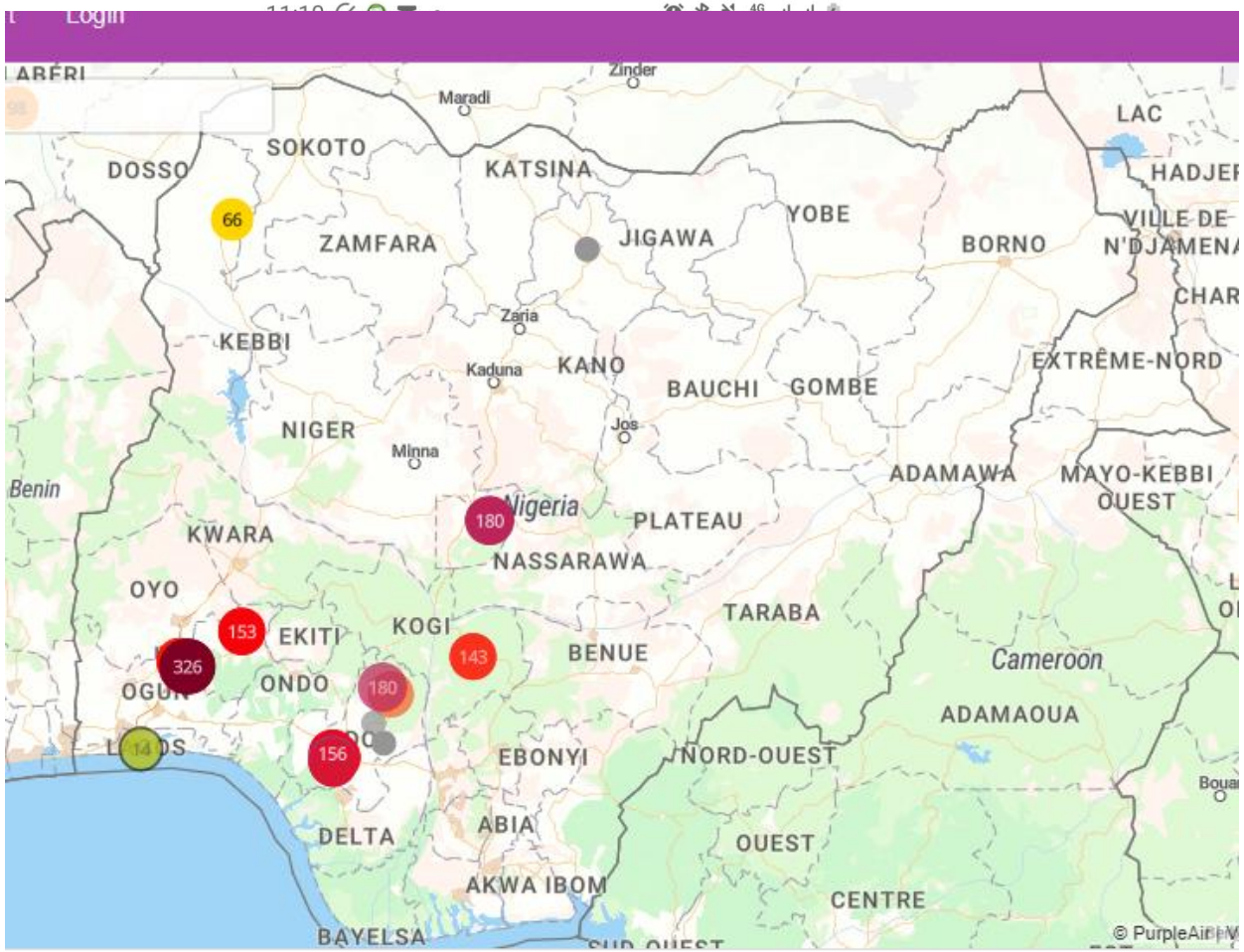
- 6 Remote Sensing/Geographic Information Systems (GIS)
- Satellite Communication
- Satellite Meteorology/Global Climate
- Space Science/Space Weather/Atmospheric Physics
- Global Navigation Satellite Systems (GNSS)
- Space Law

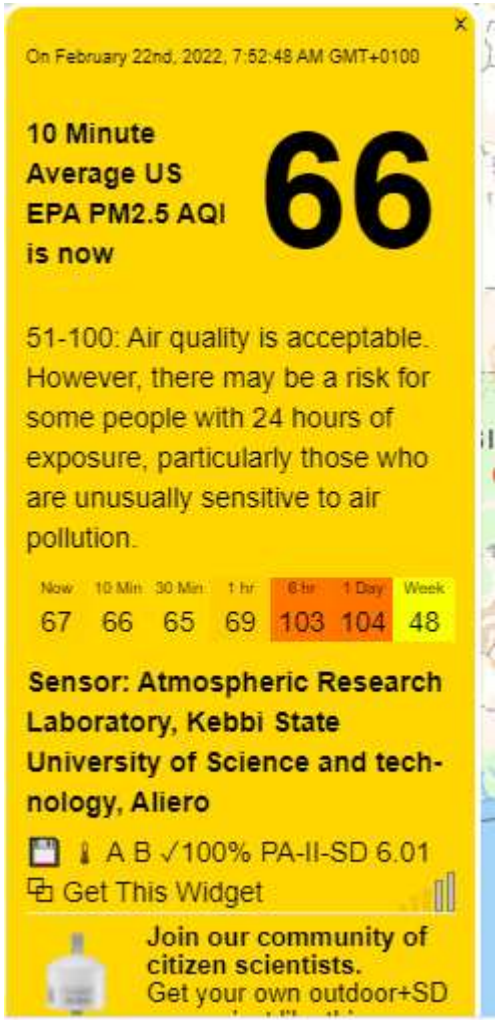
UN-ARCSSTE-E Space Research Laboratories

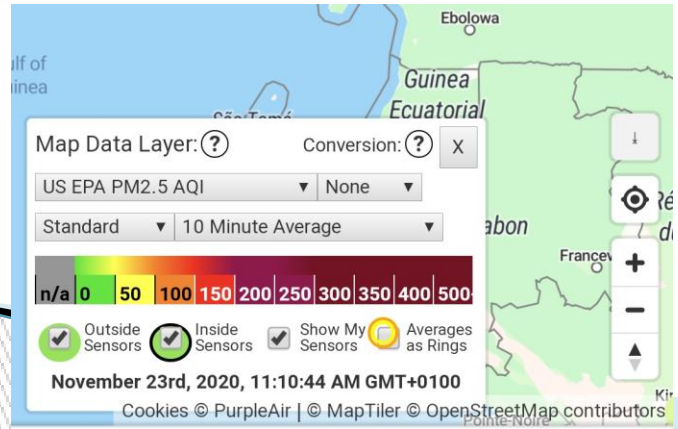


Space weather monitoring facilities

- 18 GPS stations for Space Weather monitoring
- I all-sky Optical Imager,
- I scintillation monitor,
- 1 Fabry Perot Interferometer,
- HF radio signal monitor
- low cost GNSS receiver (2 new devices)







- Penn State University & UN-ARCSSTE-E

www.purpleair.com

Locations: Abuja, Anyigba, Ile-Ife, Lagos, Osogbo, Kano, Benin, MCIU (Aghara Otor) Ibadan, Aliero, Ilorin

INTERNATIONAL WORKSHOPS AND TRAININGS

Space Weather Training

- Hybrid event
- 16 Instructors
- Over 100 participants
- 24 countries
- 8 countries were physically represented with 55 participants

Conferences & Workshops – Forthcoming

- International workshop on Air Quality 8 – 10 July 2024
- 7th Prof. E.E. Balogun National Symposium on Space Science 29th July 2024
- International Colloquium on Equatorial and Low Latitude Ionosphere (ICELLI) 29 July – 2 August 2024
- China-BeiDou/ARCSSTE-E Nigeria GNSS Training Workshop 5-9 August 2024

https://arcsstee.org.ng/

COLLABORATIONS/PARTNERSHIPS

Collaborations

1. **GEO,** Geneva, Switzerland

   - Participating Organisation (PO) status

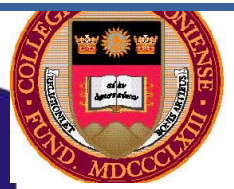
2. **International Committee on GNSS**, UN-OOSA, Vienna

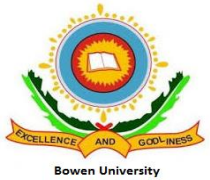
3. **RCSSTEAP**, China

4. **EUMETSAT on GEONetCast**
   - establishment of

5. **Samara State Aerospace University , Russia**

Collaborations -2





MoU with several Institutions & Universities

UNIVERSITY OF BENIN

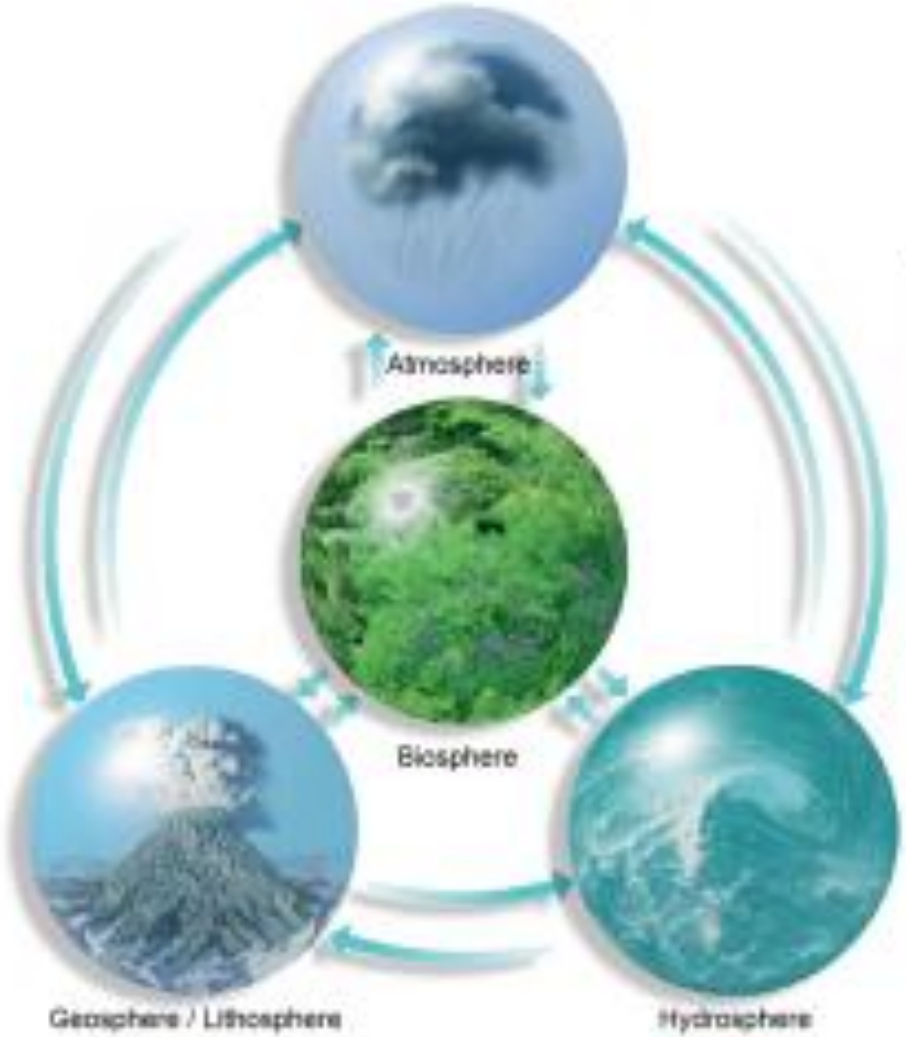
Atmosphere as a complex system

"Characterizing the equatorial ionosphere is of utmost interest due to the numerous complexities associated with the region"

Rabiu et al., (2007)

Rabiu, A. B., Mamukuyomi, A. I., and Joshua, E. O., 2007. Variability of equatorial ionosphere inferred from geomagnetic field measurements. Bulletin of the Astronomical Society of India, 35, 607 – 618.

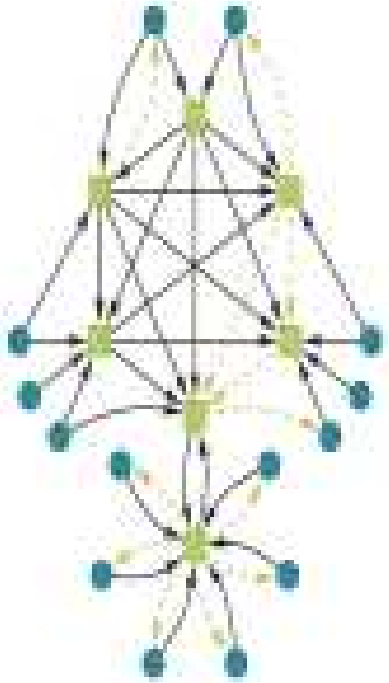
The Earth System



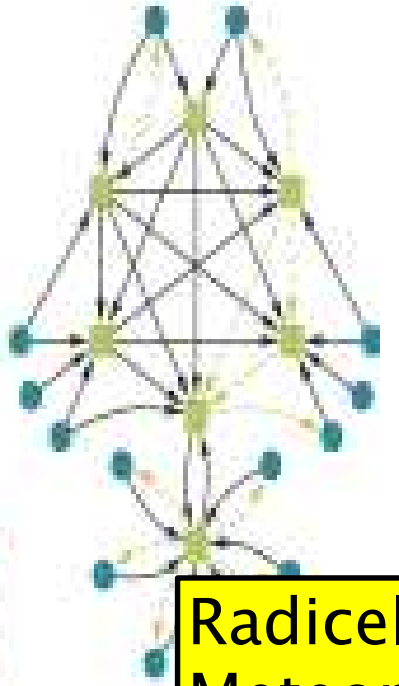
A System of *Interacting* Systems

Radicella, S. M., 2022. Meteorological phenomena effects in the ionosphere. ICELLI, Abuja

What is the Earth System?



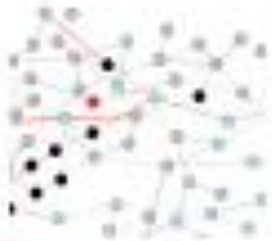
The Earth system as a whole is what we would call a really complex system.



General features of complex systems are the large numbers of characteristics, which are not easily accessible, which develop individually in a very dynamical way and which mutually interact.

Radicella, S. M., 2022. Meteorological phenomena effects in the ionosphere. ICELLI, Abuja

More about Complex Systems

Another property of complex systems is a time delay between cause and effect.
From their evolution human beings are not suited to handle complex systems.
Humans usually think and act in a linear way and, thus, to solve problems systematically, one step after the other, assuming that one problem has only one solution.


Radicella, S. M., 2022. Meteorological phenomena effects in the ionosphere. ICELLI, Abuja

Scientific Research

- Modelling
  - Machine language, AI etc
- Complexities of various atmospheric regions
  - Quantification
  - Variability – spatial, temporal
- Inter-relationships between drivers and phenomena
- Assorted scientific investigations

Some published works

https://scholar.google.com/citations?hl=en&user=iA2vTicAAAAJ

- Fuwape, I., Ogunjo, S., Akinsusi, J., Rabiu, B., & Jenkins, G. (2023). Multifractal detrended fluctuation analysis of particulate matter and atmospheric variables at different time scales. Meteorology and Atmospheric Physics, 135(3), 27.
- Ogunjo, S. T., Fuwape, I. A., and Rabiu, A. B. (2022). Predicting COVID-19 cases from atmospheric parameters using machine learning approach. GeoHealth, 6, e2021GH000509. https://doi.org/10.1029/2021GH000509
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- Owolabi, O., Okoh, D., **Rabiu**, B., Obafaye, A. Dauda, K. 2021. A Median Absolute Deviation-Neural Network (MAD-NN) Method for Atmospheric Temperature Data Cleaning. MethodsX, 8(11): 101533. https://doi.org/10.1016/j.mex.2021.101533.
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- Otugo, V., Okoh, D., Okujagu, C., Onwuneme, S., Rabiu, B., Uwamahoro, J., Habarulema, J. B., Tshisaphungo, M., Ssessanga, N., 2019. Estimation of ionospheric critical plasma frequencies from GNSS-TEC measurements using artificial neural networks. Space Weather, 17, 1329–1340. https://doi.org/10.1029/ 2019SW002257
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MDPI

Article

Complexity and nonlinear dependence of ionospheric electron content and doppler frequency shift in propagating HF radio signals within equatorial region

Aderonke Akerele [1,2*], Babatunde Rabiu [1,2], Samuel Ogunjo [3], Daniel Okoh

https://www.mdpi.com/journal/atmosphere

Just accepted yesterday

Come with us

- You are welcome to join our research team:

- Dr Samuel Ogunjo
- adekunlesam77@gmail.com

Thanks

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