CALIBRATE 2026

May 21-23, 2026

Ghana-India Kofi Annan Centre of Excellence in ICT (GI-KACE), Accra

2026

theme

Scaling Climate Solutions: From Innovation to Implementation

CALIBRATE 2026

Climate Action Leaders In Business
Raising African Talent & Enterprise

CONFERENCE BOOK

Agenda • Abstracts of Presentations

21–23 May 2026

Ghana-India Kofi Annan ICT Centre (GI-KACE), Accra, Ghana

An initiative of the University of Water Science and Engineering (UWSE)
In partnership with ESRI West Africa, GEO, GSSTI, WACREN, RCMRD, and GDNR

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WELCOME MESSAGE FROM THE CONVENER

Dear Colleagues, Partners, and Friends,

It is with immense joy and a deep sense of purpose that I welcome you to CALIBRATE 2026: Climate Action Leaders In Business: Raising African Talent & Enterprise. This summit represents a bold and necessary convergence of science, enterprise, and leadership at a defining moment for Africa's climate future.

Africa stands at a crossroads. Our continent contributes least to global greenhouse gas emissions, yet bears the heaviest burden of climate change impacts through droughts, floods, food insecurity, and displacement. But within this challenge lies an extraordinary opportunity: the opportunity for African entrepreneurs, researchers, scientists, and young innovators to shape the solutions the world urgently needs.

CALIBRATE 2026 was conceived not merely as a conference, but as a launching pad for ideas, for enterprises, for partnerships, and for careers. Over three days, we will hear from climate finance leaders, geospatial innovators, digital infrastructure builders, and entrepreneurship pioneers. We will witness the launch of the GEO Knowledge Hub Challenge, the inaugural CALIBRATE Magazine, and the unveiling of the Journal of Nature-Based Solutions and Innovations (JNSI).

To our workshop partners: GI-KACE, GSSTI, WACREN, RCMRD, GDNR, ESRI, Digital Earth Africa, and Dagawie Intelligence, I extend sincere gratitude for bringing your expertise and commitment to this platform. To our presenters and abstract contributors, your work is the intellectual backbone of this summit. To every participant: you are not here merely as an audience, you are co-creators of what CALIBRATE stands for.

As Co-Chair of the GEO Programme Board and Convener of this summit, I invite you to engage fully, connect deeply, and leave here transformed — ready to be the climate action leaders Africa and the world so urgently need.

Prof. Amos Tiereyangn Kabo-Bah
Convener, CALIBRATE 2026
Co-Chair, GEO Programme Board
Accra, Ghana • May 2026

ABOUT CALIBRATE 2026

CALIBRATE — Climate Action Leaders In Business: Raising African Talent & Enterprise: is an annual international summit dedicated to accelerating climate entrepreneurship, knowledge exchange, and capacity building across Africa. CALIBRATE 2026 is the inaugural edition, convened by the University of Water Science and Engineering (UWSE) in partnership with leading national, regional and global organisations.

Summit Objectives

- Strengthen the capacity of African climate entrepreneurs, researchers, and innovators
- Showcase cutting-edge research on climate finance, Earth observation, and sustainable enterprise
- Launch and connect African entrepreneurs to global climate finance mechanisms
- Provide a platform for abstract presentations, peer interaction, and publication pathways
- Foster institutional partnerships that advance Africa's climate action agenda

Summit Themes

Day 1: Climate Finance, Entrepreneurship & Technology Innovation

Day 2: Capacity Building, GEO Knowledge Hub Challenge & Innovation Showcase

Day 3: Departures & Optional Cultural Tours

ABOUT THE UNIVERSITY OF WATER SCIENCE AND ENGINEERING (UWSE) & PARTNERS

The University of Water Science and Engineering (UWSE) is a Pan-African tertiary institution established to provide world-class education and research in water science, engineering, environmental management, and related fields. UWSE is committed to producing graduates equipped to address Africa's most pressing resource challenges through innovation, entrepreneurship, and evidence-based practice.

UWSE operates interdisciplinary programmes at undergraduate and postgraduate levels, with strong linkages to international research networks including the Group on Earth Observations (GEO), the Digital Earth Africa (DEA) initiative, the West and Central African Research and Education Network (WACREN), and the Regional Centre for Mapping of Resources for Development (RCMRD). CALIBRATE 2026 is a flagship initiative of UWSE's mandate to drive climate knowledge and enterprise across Africa. The Ecoyouth African Initiative, launched in 2011 by Green WaterHut and Nature Today, has grown into this flagship programme. UWSE remains deeply grateful to both partners for their steadfast and continuing support.

Amatus Gyilbag (PhD)

Ag. Registrar, UWSE

CONFERENCE VENUE & LOGISTICS

Primary Venue

Ghana-India Kofi Annan ICT Centre of Excellence (GI-KACE)

PMB CT 114, Cantonments, Accra, Ghana

Tel: +233 302 760 445 • Web: www.gi-kace.gov.gh

Conference Dates & Format

21 May 2026 (Thursday) — Day 1: Plenary Sessions, Keynotes, Abstract Presentations

22 May 2026 (Friday) — Day 2: Capacity Workshops, GEO Challenge, Magazine & Journal Launch

23 May 2026 (Saturday) — Day 3: Departures & Optional Cultural Tours

Registration Desk

The conference registration desk will be open from 8:00 AM on Day 1 and from 8:00 AM on Day 2 for new arrivals.

Optional Cultural Tours (Day 3)

Option A — Accra Heritage & Innovation Tour

Option B — Cape Coast Historical Tour

Option C — Aburi Nature & Botanical Gardens Tour

Pre-registration required by 22 May 2026. Transport is provided from the conference venue.

General Conference Information

Language: English is the official language of the conference.

Photography: Photography is permitted in session halls unless stated otherwise by a speaker. Please be respectful of presenters.

Certificates: Certificates of participation will be distributed during the Day 2 closing session.

Wi-Fi: Conference venue Wi-Fi is available. Access credentials will be provided at registration.

Conference Secretariat Contacts

Moses (Logistics Coordinator): +233 557 121 531

Henrieta (MC & Communications): +233 559 673 103

Email: info@uwse.edu.gh • Website: https://uwse.edu.gh/calibrate-2026/

PARTNER INSTITUTIONS & SPONSORS

CALIBRATE 2026 is made possible through the generous support and active partnership of the following institutions. We express our sincere gratitude to each partner for their commitment to advancing climate action and innovation across Africa.

Workshop Partners & Co-Organisers

Ghana-India Kofi Annan ICT Centre of Excellence (GI-KACE)
Primary conference venue and co-organising partner.

Ghana Space Science and Technology Institute (GSSTI)
National partner for space science and Earth observation research.

West and Central African Research and Education Network (WACREN)
Regional partner providing digital infrastructure, connectivity, and workshop support.

Regional Centre for Mapping of Resources for Development (RCMRD)
Regional geospatial and mapping institution, delivering the geospatial data workshop.

Ghana Domain Name Registry (GDNR)
Partner for digital trust, domain governance, and online presence for climate enterprises.

ESRI West Africa
Global leader in GIS technology, delivering the ArcGIS Tools for Climate Entrepreneurs workshop.

Digital Earth Africa (DEA)
Open Earth observation data partner for sustainable development.

Dagawie Intelligence
AI-powered geospatial intelligence partner for climate and development solutions.

Little Bee Community (United Kingdom)
Social enterprise partner delivering the Social Enterprise for Climate Action workshop.

Group on Earth Observations (GEO)
Global co-ordinating body for Earth observation; partner for GEO Knowledge Hub Challenge.

DAAD — German Academic Exchange Service
Presenting scholarship and funding opportunities for African researchers and professionals.

Supporting Institutions

Green Climate Fund (GCF)
University of Energy and Natural Resources (UENR), Ghana
University of Ghana - ECOWAS Coastal and Marine Resources Management Centre
Ghana Meteorological Agency (GMET)
Sir Padampat Singhania University, India
University of Environment and Sustainable Development (UESD)
Ho Technical University

LIST OF ABBREVIATIONS

The following abbreviations are used throughout this Conference Book.

AI Artificial Intelligence
ArcGIS ESRI's Geographic Information System platform
BOD Biochemical Oxygen Demand
CALIBRATE Climate Action Leaders In Business — Raising African Talent & Enterprise
CFD Computational Fluid Dynamics
CHIRPS Climate Hazards Group InfraRed Precipitation with Station data
CLTS Community-Led Total Sanitation
CMIP6 Coupled Model Intercomparison Project Phase 6
COD Chemical Oxygen Demand
DAAD German Academic Exchange Service (Deutscher Akademischer Austauschdienst)
DBAR Digital Belt and Road Programme
DEA Digital Earth Africa
DO Dissolved Oxygen
ECOWAS Economic Community of West African States
ESA European Space Agency
ESRI Environmental Systems Research Institute
GCF Green Climate Fund
GEE Google Earth Engine
GEO Group on Earth Observations
GI-KACE Ghana-India Kofi Annan ICT Centre of Excellence
GIS Geographic Information System
GMET Ghana Meteorological Agency
GDNR Ghana Domain Name Registry
GSSTI Ghana Space Science and Technology Institute
HFC Hydrofluorocarbons
IoT Internet of Things
IRS Indoor Residual Spraying
ITN Insecticide-Treated Net
JNSI Journal of Nature-Based Solutions and Innovations
LoRaWAN Long Range Wide Area Network
LPWAN Low Power Wide Area Network
LULCC Land Use / Land Cover Change
MC Master of Ceremonies
NbS Nature-Based Solutions
NH4-N Ammonium-Nitrogen
ODF Open Defecation Free
PCB Printed Circuit Board
RCMRD Regional Centre for Mapping of Resources for Development
RUSLE Revised Universal Soil Loss Equation
RWH Rainwater Harvesting
SDG Sustainable Development Goal
SMR Small Modular Reactor
SSP Shared Socioeconomic Pathway

TN Total Nitrogen
TP Total Phosphorus
UENR University of Energy and Natural Resources
UESD University of Environment and Sustainable Development
UWSE University of Water Science and Engineering
WACREN West and Central African Research and Education Network
WEF Nexus Water-Energy-Food Nexus

AT-A-GLANCE PROGRAMME SCHEDULE

All times are in Ghana Standard Time (GMT+0). Full session details are provided in the Conference Agenda section.

DAY 1 — THURSDAY, 21 MAY 2026 THEME: Climate Finance, Entrepreneurship & Technology Innovation

8:00 – 9:00 AM Registration, Accreditation & Welcome Networking
9:00 – 9:30 AM Opening Ceremony (National Anthem, Prayer)
9:30 – 10:10 AM Opening Remarks & Address
10:10 – 10:50 AM Keynote: Climate Finance for African Entrepreneurs (GCF Representative)
10:50 – 11:20 AM Keynote: The Ghana Climate Atlas (GMET Representative)
11:20 – 12:00 PM Keynote: Technically Enhanced Natural Toxicity, Mining, and Climate Risk (Prof. Emmanuel Daanoba Sunkari, Sir Padampat Singhania University, India)
12:00 – 12:30 PM Networking Break & Exhibition Viewing
11:50 AM – 12:30 PM Workshop: Social Enterprise for Climate Action (Little Bee Community UK)
12:30 – 12:55 PM Workshop: Geospatial Technology for Climate Entrepreneurship (ESRI)
1:20 – 1:30 PM Official Group Photograph
1:30 – 2:30 PM Lunch Break
2:00 – 2:40 PM Workshop: ArcGIS Tools for Climate Entrepreneurs (ESRI West Africa)
2:40 – 3:50 PM Abstract Presentations — Sub-Session 1 (Chair: Prof. Sedegah, UESD)
3:50 – 4:10 PM JNSI Journal Presentation (Prof. Emmanuel Sunkari)
4:10 – 5:30 PM Abstract Presentations — Sub-Session 2 (Chair: Ho Technical University Rep.)
5:30 PM Day 1 Close

DAY 2 — FRIDAY, 22 MAY 2026 THEME: Capacity Building, GEO Knowledge Hub Challenge & Innovation Showcase

8:00 – 8:30 AM Participant Arrival, Registration & Morning Refreshments
9:00 – 9:10 AM Day 2 Opening & Day 1 Recap (MC)
9:10 – 9:20 AM Special Address: STEM Education and Sustainability (Berthy Buah, NASA GLOBE)
9:20 – 9:50 AM Workshop: Geospatial Data for Climate Decision Making (RCMRD)
9:50 – 10:30 AM Invited Talk: CTO, WACREN: Digital Infrastructure for Climate Innovation
10:30 – 11:10 AM Workshop: Building Digital Trust & Online Presence for Climate Enterprises (GDNR)
11:10 – 11:50 AM Workshop: AI-Powered Geospatial Intelligence for Climate & Development (Dagawie Intelligence)
11:50 AM – 12:15 PM Workshop: Climate Data Analysis and Modelling (Dr. Kwame Agyekum, ECOWAS Coastal and Marine Centre)
12:45 – 1:30 PM Panel Discussion: Digital Innovation, Open Data & Geospatial Intelligence for Climate Action
12:15 – 12:45 PM Workshop: Open Earth Observation Data for Sustainable Development (Digital Earth Africa)
1:30 – 2:00 PM Lunch Break
2:00 – 2:35 PM GEO Knowledge Hub Challenge — Official Launch & Winners Announcement
2:35 – 3:00 PM Magazine — Inaugural Edition Launch
3:00 – 3:20 PM DAAD Scholarships & Funding Opportunities (Mr. Felix Barnes, DAAD)
3:20 – 3:50 PM Short Break & Exhibition Viewing

3:50 – 4:30 PM Abstract Presentations (Continued) — Chair: Dr. Benjamin Dekowmen, Ho Technical University

4:30 – 5:00 PM Conference Wrap-Up, Awards, Certificates & Closing

DAY 3 — SATURDAY, 23 MAY 2026 Departures & Optional Cultural Tours

6:00 AM onwards Departures & Hotel Check-Out

8:00 AM – 5:00 PM Optional Guided Cultural Tours (Accra, Cape Coast, or Aburi)

CALIBRATE 2026

Climate Action Leaders In Business — Raising African Talent & Enterprise

CONFERENCE AGENDA

May 21–23, 2026	Ghana-India Kofi Annan ICT Centre (GI-KACE), Accra

An initiative of the University of Water Science and Engineering (UWSE)

DAY 1 — THURSDAY, MAY 21, 2026

Thursday, 21 May 2026

THEME: Climate Finance, Entrepreneurship & Technology Innovation

▸ PRE-CONFERENCE REGISTRATION | 8:00 AM – 9:00 AM · Master of Ceremonies: Henrieta

8:00 – 8:45 AM	**REGISTRATION & ACCREDITATION** Participant check-in and badge collection at the registration desk Conference materials, programme booklet, and abstract compendium distribution Exhibition hall opens **Rapporteur:** Conference documentation team on duty throughout
8:45 – 9:00 AM	**WELCOME COFFEE & NETWORKING** Informal networking and exhibition viewing before the formal opening

▸ MORNING SESSION | 9:00 AM – 1:00 PM

9:00 – 9:30 AM	**OPENING CEREMONY** **MC:** Henrieta National Anthem of Ghana Recitation / Opening Prayer MC acknowledges institutional workshop partners: Ghana Space Science and Technology Institute (GSSTI), West and Central African Research and Education Network (WACREN), Regional Centre for Mapping of Resources for Development (RCMRD), and Ghana Domain Name Registry (GDNR)
9:30 – 10:10 AM	**OPENING REMARKS & ADDRESS SESSION**

	› Welcome Address — Director, Ghana-India Kofi Annan Centre of Excellence in ICT (GI-KACE) › Purpose of CALIBRATE — Ag. Registrar, University of Water Science and Engineering (UWSE) › Goodwill Message — Nana Obrempong Toku Dum VIII, Assin Asamankese, Assin Apimanim Paramountcy › Convener's Keynote Address — Co-Chair, Group on Earth Observations (GEO) Programme Board
10:10 – 10:50 AM	**KEYNOTE ADDRESS: Climate Finance for African Entrepreneurs** **Speaker:** Representative, Green Climate Fund (GCF) **Topic:** *"Unlocking Climate Finance: Pathways for African Climate Ventures"* Accessing GCF resources and requirements Success stories from Africa Q&A (10 minutes)
10:50 – 11:20 AM	**KEYNOTE ADDRESS 2: The Ghana Climate Atlas** **Speaker:** Representative, Ghana Meteorological Agency (GMET) **Topic:** *"The Ghana Climate Atlas: Understanding Ghana's Climate for Informed Decision-Making and Enterprise"* Overview of the Ghana Climate Atlas — scope, data, and accessibility Climate trends, projections, and regional variability across Ghana Applications of the Atlas for climate-smart agriculture, water resources, and enterprise planning Opportunities for entrepreneurs and researchers to leverage GMET climate data services Q&A (5 minutes)
11:20 – 12:00 PM	**KEYNOTE ADDRESS: Technically Enhanced Natural Toxicity, Mining, and Climate Risk Across Global Soil–Water–Food Value Chains** **Speaker:** Prof. Emmanuel Daanoba Sunkari **Institution:** *Director, Centre of Excellence in Environmental Science and Sustainability, Sir Padampat Singhania University, Udaipur, Rajasthan, India* This keynote examines the intersection of geogenic and anthropogenically enhanced natural toxicity with mining activities and climate-driven risks across soil–water–food value chains globally, exploring evidence-based governance, geospatial monitoring, and nature-based remediation strategies. Q&A (10 minutes)
12:00 – 12:30 PM	**NETWORKING BREAK & EXHIBITION VIEWING**
11:50 AM – 12:30 PM	**WORKSHOP › Social Enterprise for Climate Action** **Chair:** Ms. Abigail Bulley, Founder & CEO *Little Bee Community, United Kingdom* **Organisation intro:** *5-minute introduction to Little Bee Community UK and its social enterprise model in the climate space*
12:30 – 12:55 PM	**SPECIAL ADDRESS: Geospatial Technology for Climate Entrepreneurship** **Speaker:** Representative, ESRI **Topic:** *"Geospatial Technology and Digital Innovation for Climate Entrepreneurship in Africa"* Role of GIS and spatial analytics in climate decision-making ArcGIS platforms and tools enabling climate enterprise solutions
12:55 – 1:20 PM	

1:20 – 1:30 PM	**OFFICIAL GROUP PHOTOGRAPH** All speakers, chairs, workshop facilitators, and participants Venue: Main conference hall / designated photo point
1:30 – 2:30 PM	**LUNCH BREAK**

▸ AFTERNOON SESSION | 2:30 PM – 5:00 PM

2:30 – 2:40 PM	**WORKSHOP › ArcGIS Tools for Climate Entrepreneurs** **Chair:** ESRI West Africa Team *ESRI West Africa* **Organisation intro:** *5-minute introduction to ESRI and its work across Africa in geospatial innovation*
2:30 – 2:40 PM	**SHORT BREAK**
2:40 – 3:50 PM	**ABSTRACTS PRESENTATION — SUB-SESSION 1** **Chair:** Prof. Daniel Sedegah, University of Environment and Sustainable Development (UESD) and Prof Chukwuemeka Jude Diji, Nigeria Up to 6 selected abstracts × 10 minutes each
3:50 – 4:10 PM	**JNSI JOURNAL PRESENTATION** **Presenter:** Prof. Emmanuel Sunkari, Managing Editor, JNSI, Sir Padampat Singhania University, India Scope, aims, and vision of JNSI. Current and upcoming special issues including the special issue on climate entrepreneurship. Submission process, peer review, and indexing. Call for submissions open to all CALIBRATE 2026 participants.
4:10 – 5:30 PM	**ABSTRACTS PRESENTATION — SUB-SESSION 2** **Chair:** Representative, Ho Technical University, Prof Comfort Akwonda Adadu - Nigeria Up to 6 selected abstracts × 10 minutes each
5:30 PM	**DAY 1 CLOSE** Day 1 summary and Day 2 preview — MC: Henrieta Welcome reception and networking from 6:00 PM

DAY 2 — FRIDAY, MAY 22, 2026

Friday, 22 May 2026

THEME: Capacity Building, GEO Knowledge Hub Challenge & Innovation Showcase

▸ ARRIVAL & REGISTRATION | 8:00 AM – 9:00 AM · Master of Ceremonies: Cobbina

8:00 – 8:30 AM	**PARTICIPANT ARRIVAL & REGISTRATION** Day 2 registration for new arrivals Morning refreshments Exhibition viewing

▸ MORNING SESSION — CAPACITY BUILDING WORKSHOPS | 9:00 AM – 12:30 PM

9:00 – 9:10 AM	**Day 2 Opening & Recap** **MC** Summary of Day 1 highlights & Day 2 programme overview
9:10 – 9:20 AM	**Special Address: STEM Education and Sustainability: An Urgent Call for Partnership** Berthy Buah, Regional STEM Coordinator/ NASA GLOBE Country Coordinator /Co-founder Africa Green STEM and Innovation Fund Foundation
9:20 – 9:50 AM	**WORKSHOP › Geospatial Data for Climate Decision Making** **Chair:** Director, Regional Centre for Mapping of Resources for Development (RCMRD)
9:50 – 10:30 AM	**Invited Talk: Digital Infrastructure for Climate Innovation** **CTO, WACREN**
10:30 – 11:10 AM	**WORKSHOP › Building Digital Trust & Online Presence for Climate Enterprises** **Director,** Ghana Domain Name Registry (GDNR)
11:10 – 11:50 AM	**WORKSHOP › AI-Powered Geospatial Intelligence for Climate & Development Solutions** **Chair:** Dagawie Intelligence Team
11.50Am – 12: 15pm	**Workshop: Climate Data Analysis and Modelling** **Speaker:** Dr. Kwame Agyekum, ECOWAS Coastal and Marine Resources Management Centre
12:15 – 12:45 PM	**WORKSHOP › Open Earth Observation Data for Sustainable Development** **Chair:** Mr. Edward Boamah *Digital Earth Africa*
12:45 – 1:30 PM	**PANEL DISCUSSION: Digital Innovation, Open Data & Geospatial Intelligence for Climate Action in Africa**

	Moderator: Dr. Kwame Agyekum, University of Ghana **Panelists:** Director, Ghana Domain Name Registry (GDNR) Director/Representative, WACREN Representative, Dagawie Intelligence Mr. Edward Boamah, Digital Earth Africa **Format:** Moderator's introduction & framing (5 min) Panelist opening statements — 3 minutes each × 4 (12 min) Moderated discussion: How can digital innovation, open geospatial data, and AI-powered intelligence accelerate climate entrepreneurship across Africa? (15 min) Open Q&A from the floor (10 min) Moderator's closing synthesis and key takeaways (3 min)
1:30 – 2:00 PM	**LUNCH BREAK**

▸ AFTERNOON SESSION | 2:30 PM – 5:00 PM

2:00 – 2:35 PM	**GEO KNOWLEDGE HUB CHALLENGE — OFFICIAL LAUNCH** **Presenter:** Representative, GEO Secretariat Introduction to the GEO Knowledge Hub Challenge framework Screening of winners' pitch videos Announcement of winners and recognition Next steps and pathway to the GEO Knowledge Hub
2:35 – 3:00 PM	**CALIBRATE MAGAZINE LAUNCH** **Presenters:** Dr. Amatus Gyilbag & Ms. Deborah Awuni Unveiling of the inaugural edition of CALIBRATE Magazine Overview of scope, vision, and distribution
3:00 – 3:20 PM	**DAAD OPPORTUNITIES PRESENTATION** **Speaker:** Mr. Felix Barnes, Senior Programme Officer, DAAD Regional Office, Accra **Topic:** *"DAAD Scholarships & Funding Opportunities for African Researchers and Professionals"* Overview of DAAD scholarship programmes for Sub-Saharan Africa. Application pathways and eligibility criteria. Q&A.
3:20 – 3:50 PM	**SHORT BREAK**
3:50 – 4:30 PM	**ABSTRACTS PRESENTATION SESSION (CONTINUED)** Chair: Dr Benjamin Dekowmen, Ho Technical University Format: 4 selected abstracts × 10 minutes (7 min presentation + 3 min Q&A) Topics: Climate Innovation, Technology, Finance, Earth Observation, Agriculture, Water, Energy
4:30 – 5:00 PM	**CONFERENCE WRAP-UP, AWARDS & CLOSE** **Best Presentation Award:** Announcement of best abstract presentation across both days **Certificates:** Distribution of certificates of participation to all registered participants and workshop facilitators **Evaluation:** Conference feedback and evaluation forms collected from all participants **Closing Remarks:** Co-Chair, GEO Programme Board (Convener) **Vote of Thanks:** Ag. Registrar, University of Water Science and Engineering (UWSE) **Rapporteur's Note:** Conference documentation team presents a brief summary of proceedings

DAY 3 — SATURDAY, MAY 23, 2026

Saturday, 23 May 2026

THEME: Departures & Optional Cultural Tours

Day 3 is dedicated to participant departures and optional guided cultural excursions across Ghana. Guided tours are available as an optional activity — registration is required by 22 May 2026.

6:00 AM onwards	**DEPARTURES & CHECK-OUT** Hotel check-out assistance Airport shuttle transfers — hourly departures from conference venue Conference secretariat available for logistical support
8:00 AM – 5:00 PM	**OPTIONAL GUIDED CULTURAL TOURS** **Option A:** Accra Heritage & Innovation Tour — GHS 300 per person **Option B:** Cape Coast Historical Tour — GHS 400 per person **Option C:** Aburi Nature & Botanical Gardens Tour — GHS 200 per person Pre-registration required by 22 May 2026 Transport provided from conference venue

Contact
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Optional tours registration deadline: 22 May 2026
CALIBRATE 2026 — An initiative of UWSE

PART TWO

ABSTRACTS OF PRESENTATIONS

19 Oral Presentations • 6 Poster Presentations

21–23 May 2026 · Accra, Ghana

CALIBRATE 2026 · An initiative of UWSE

CALIBRATE 2026

Climate Action Leaders In Business — Raising African Talent & Enterprise

Editor's Note

This compendium presents 19 oral abstracts and 6 poster abstracts for CALIBRATE 2026, updated 19 May 2026. Author lists reflect final submitted versions. Three new oral presentations have been added: Phytoremediation (Dery), Satellite Collision Prediction (Salifu), and VLEO Constellation (Fadlan & Chen). STEM Education and Sustainability (Dekongmen, #19) is scheduled for Day 2 — Friday, 22 May 2026.

ORAL PRESENTATIONS (19)

1. Mustapha Farihan Chentiba

[ORAL PRESENTATION] Farhanchentiba@gmail.com

Research Assistant · KaboResearchLab / ICoE Ghana · Ghana

Design, Fabrication and Validation of a Low-Cost LoRaWAN-Enabled Weather Station for Climate-Resilient Environmental Monitoring

Accurate and continuous atmospheric monitoring is foundational to climate-resilient decision-making across agriculture, disaster management, and environmental governance. Yet conventional automated weather stations remain prohibitively expensive and heavily dependent on infrastructure that is largely absent across rural sub-Saharan Africa. This reality creates a critical observational gap: vast swathes of land produce no usable meteorological data, undermining both local agricultural planning and continental climate modelling efforts. Bridging this gap demands not merely cheaper hardware, but a fundamentally different engineering approach — one that prioritises long-range low-power communication, open standards, hardware integration, and community-deployable design. This paper presents the design, fabrication, and field validation of a low-cost, ultra-low-power IoT weather station built entirely on open hardware and the LoRaWAN communication standard. The system integrates a multi-parameter sensor suite capable of measuring air temperature, relative humidity, barometric pressure, rainfall intensity, wind speed, UV index, and ambient light intensity (lux). Rather than integrating commercial off-the-shelf sensor breakout boards, the sensing circuits for temperature, humidity, pressure, UV index, and light intensity have been designed and laid out directly on the station's custom printed circuit board (PCB). This tight hardware integration eliminates inter-board wiring overhead, reduces power draw, improves mechanical robustness, and ensures that all sensing components fit within the designed enclosure without compromise. Mechanical components including a tipping-bucket rain gauge and a cup anemometer have been fully 3D-modelled and are ready to be printed, with reed switches or Hall-effect sensors used to generate countable pulses proportional to rainfall and wind speed respectively. The core processing and communication unit is the RAK3172 WisDuo LPWAN System-on-Chip, which integrates an ARM Cortex-M processor and a certified LoRaWAN v1.0.4 radio in a single ultra-low-power package. The custom PCB supports dual power inputs alongside solar energy harvesting through a compact 135 × 110 mm panel and a USB-C backup charging port, enabling autonomous multi-year field operation without manual intervention. Sensor data is transmitted over LoRaWAN using Over-the-Air Activation (OTAA) with AES-128 end-to-end encryption. A custom web application provides a purpose-built dashboard for real-time visualisation and historical analysis of decoded meteorological data. By combining custom PCB-integrated sensing, 3D-fabricated mechanical components, long-range LoRaWAN telemetry, and a self-hosted visualisation platform into a

single reproducible and affordable system, this work demonstrates a clear and actionable pathway from grassroots engineering innovation to field-deployable Earth observation infrastructure.

Keywords: *LoRaWAN, Custom PCB Design, IoT Weather Station, RAK3172, 3D Printing, Earth Observation, Low-Power Sensing, Climate Resilience, Custom Web Application, Embedded Systems*

2. Abdul Kadir Alhassan; Amos T. Kabo-Bah; Benedicta Asantewaa (UENR)

[ORAL PRESENTATION] abdulkadiralhassan117@gmail.com

Teaching Assistant · University of Energy and Natural Resources, Sunyani · Ghana

Application of H2O Toolkit for Modeling Biochemical Oxygen Demand and Ammonium-Nitrogen Dynamics in the Tano River

The Tano River is a vital source of freshwater in Ghana, but it faces serious threats from anthropogenic activities such as illegal mining, agricultural runoff, and industrial discharge. These activities are causing an increase in biochemical oxygen demand (BOD) and ammonium-nitrogen (NH4-N) levels, which are key indicators of pollution. In this study, the H2O Toolkit — an open-source machine learning platform — was utilised to model and predict variations in BOD and NH4-N in the Tano River, aiming to enhance water quality assessment and management. Water samples were collected from selected sites along the Tano River basin from June to August 2025. Laboratory analyses measured parameters such as pH, temperature, dissolved oxygen (DO), chemical oxygen demand (COD), total nitrogen (TN), and total phosphorus (TP) using standard laboratory procedures. Predictive models were developed and validated using AutoML and regression techniques in the H2O Toolkit. The results revealed strong relationships between BOD and NH4-N and factors like COD, DO, and TN, with models successfully capturing these complex interactions. Scenario analyses revealed that both BOD and NH4-N were sensitive to changes in temperature and nutrient levels. The findings demonstrate the potential of AI-driven tools in water resource management. Regular monitoring and adoption of mitigation strategies such as buffer zones and improved wastewater treatment systems are recommended.

Keywords: *H2O Toolkit, Biological Oxygen Demand (BOD), Ammonium-Nitrogen (NH4-N), Tano River*

3. Deborah Awuni; Nana Asirifi Cobbina; Amos T. Kabo-Bah (UENR)

[ORAL PRESENTATION] debawuni16@gmail.com

Research Assistant · University of Energy and Natural Resources · Ghana

Enhancing Climate-Resilient Agro-Processing in Ghana Using Nuclear-Assisted Thermal Systems

Post-harvest losses remain a significant challenge to food security and agricultural enterprise development in Ghana, particularly in staple crops such as maize, cassava, and cocoa, where inadequate drying and storage infrastructure contribute to substantial economic losses. Solar crop dryers have been introduced in Ghana as a sustainable alternative to open-sun drying; however, their performance is highly dependent on weather variability and seasonal solar intensity, limiting their reliability during rainy and humid periods. This paper investigates the potential of integrating nuclear-derived thermal energy into agro-processing systems to improve drying consistency and support climate-resilient agricultural enterprises in Ghana. The study proposes a conceptual hybrid thermal system that combines solar energy with a stable heat supply derived from advanced nuclear technologies such as small modular reactors (SMRs) or microreactors. The system is designed to provide continuous thermal energy for crop drying chambers, reducing dependence on weather conditions while maintaining low-carbon energy objectives aligned with Ghana's energy transition

goals. Emphasis is placed on mechanical engineering design considerations, including heat transfer efficiency, airflow dynamics, thermal storage integration, and dryer chamber optimisation. The paper further explores how such systems could support Ghanaian agro-processing enterprises by reducing post-harvest losses, improving product quality, and enhancing income stability for small and medium-scale farmers. The findings suggest that integrating nuclear thermal energy into agro-processing systems presents a novel pathway for strengthening climate resilience, improving food security, and supporting sustainable enterprise development within Ghana's agricultural sector.

4. Benjamin Wullobayi Dekongmen

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Lecturer · Ho Technical University · Ghana

STEM Education and Sustainability: An Urgent Call for Partnership This presentation makes an urgent case for strategic partnership between educational institutions, government bodies, civil society, and the private sector to mainstream STEM education as a direct driver of climate sustainability and environmental resilience across Africa. Drawing on practical examples from Ho Technical University and allied institutions, the address highlights how STEM curricula grounded in real-world climate challenges and entrepreneurship can equip graduates to design and implement scalable climate solutions. The presenter calls on conference delegates, policymakers, and funders to commit to transformative STEM education partnerships as a foundational pillar of Africa's climate action agenda. Note: This presentation is scheduled for Day 2 — Friday, 22 May 2026, Abstract Session (Continued).

5. Caleb Yenti

[ORAL PRESENTATION]

— · Ho Technical University · Ghana

Climate Change

Climate change refers to long-term alterations in temperature, precipitation, and weather patterns, largely driven by human activities such as the burning of fossil fuels, deforestation, and industrial processes. This presentation examines the causes, impacts, and possible solutions to climate change, highlighting its global and local significance. Key issues discussed include rising global temperatures, melting polar ice, sea-level rise, extreme weather events, and their effects on ecosystems, agriculture, and human health. The presentation also explores mitigation and adaptation strategies, such as transitioning to renewable energy, promoting sustainable practices, and implementing effective environmental policies. Addressing climate change requires urgent, collective action from governments, organisations, and individuals to ensure a sustainable future for coming generations.

6. Sarah Elikplim Siabi; Amos T. Kabo-Bah; Ebenezer Kwadwo Siabi (UENR)

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Student · University of Energy and Natural Resources · Ghana

Simulating Future Climate Changes Under the Shared Socioeconomic Pathway Scenarios: A Case of the Black Volta Basin of Ghana

This study assessed the potential future impacts of climate change on Ghana's Black Volta Basin (BVB) using projections from 14 models under four CMIP6 scenarios (SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5). The ensemble bias-corrected data consistently outperformed both individual bias-corrected and raw GCM data, particularly for precipitation, where the coefficient of determination (R^2) improved significantly from as low as 0.001 in raw data to between 0.87 and 0.99 after correction. Bias-corrected temperature projections — both minimum and maximum — were even more reliable than those for precipitation. By 2050, the BVB is expected to experience substantial warming and declining rainfall, with precipitation projected to fall in most months except August and September across all scenarios. Temperature increases are especially notable under SSP2, SSP3, and SSP5, with monthly averages for maximum and minimum temperatures rising between 1°C and 7.5°C. These changes pose serious risks to livelihoods, particularly affecting agriculture, water resources, and energy production. The hydroelectric sector, including the Bui and Akosombo dams, is projected to face reduced water inflows, potentially leading to widespread power outages. Northern parts of the basin may see annual rainfall decline from historical norms of 1,000–1,400 mm to 800–900 mm under SSP5-8.5, worsening water scarcity. The study highlights the urgent need for adaptive measures including drought-resistant crops, improved water management strategies, revised energy policies, and investments in climate-resilient infrastructure.

7. Mohammed Fareed; Asim Zubair; R. Saikia (Global Tea Consulting; Tea Research Association, Kolkata)

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CEO · Global Tea Consulting Ltd · India

Climate Change and Future of the Tea Industry in India and Bangladesh: Modelling Satellite Images and Simulating Patterns to Assess the Impact of Brahmaputra Floods on Tea Plantations

Flood is the most devastating and recurring natural disaster of Assam, a state in North East India, and Bangladesh. The river Brahmaputra — the seventh largest river in the world — along with its north bank tributaries and the river Barak regularly inundates and erodes the flood plains, damaging tea plantations. Tea is the major cash crop in Assam and generates huge revenue besides employing around 400,000 workers. More than 35,000 ha of tea-growing plains have been lost due to Brahmaputra flooding over a 30-year period, and approximately 250,000 ha of tea-growing area are damaged by water logging when the river is in flood. Identification of cost-effective ways to capture recurrent flood events, mapping areas vulnerable to flooding, and understanding the flooding problem are critical for prioritising appropriate flood control measures. Real-time monitored data such as precipitation level, flow, or water level are essential to forecast rainfall and track storm paths from satellite images, enabling reasonable decisions on flood prevention. Advanced technologies such as Remote Sensing and Geographical Information Systems (GIS) can enhance the efficiency of flood prevention by supporting flood monitoring and assisting emergency response activities.

8. Abdulai Rafiu

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Student · University of Energy and Natural Resources · Ghana

The Smart Dehydration Fridge: Reimagining Food Preservation at the Intersection of Food Security and Climate Action

In off-grid areas, 30–50% of harvests rot because farmers lack the means to preserve produce — a direct consequence of energy poverty. Traditional refrigeration relies on grid electricity and HFC refrigerants with extreme Global Warming Potential, making them major drivers of climate change. This project presents the

Smart Dehydration Fridge, a solar-powered vertical dehydration cabinet built from 100% renewable materials — reclaimed wood and hemp insulation — for a fully carbon-neutral structure. An ESP32 microcontroller with PWM logic manages battery-stored solar energy, maintaining the ideal 45°C–60°C dehydration temperature range day, night, and through rainy seasons. Removing fluid from produce extends shelf life to over two weeks. The system operates continuously — even during overcast conditions — by drawing on stored battery energy. Unlike standard fridges that fight the environment to stay cold, this system harnesses environmental heat, eliminating chemical refrigerants entirely. The project directly addresses SDG 2 (Zero Hunger), SDG 7 (Clean Energy), SDG 12 (Responsible Consumption), and SDG 13 (Climate Action) simultaneously, demonstrating how sustainable food preservation can be made possible for communities that need it most.

9. Rafiatu Ziblim

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Student · University for Development Studies · Ghana

Enabling Conditions for Scaling Nature-Based Solutions for Urban Climate Resilience

Nature-based Solutions (NbS) provide viable pathways to decrease climate change impacts and enhance the resilience of cities. With growing evidence of the potential of NbS, it is imperative to explore the enabling conditions needed to actualise this potential. This study identifies and categorises enabling conditions for scaling NbS in urban areas through the review of relevant documents and interviews with key informants engaged in climate action and urban planning in Ghana. Findings revealed that barriers to the implementation of NbS for climate resilience include a deficit in strategic foresight for urban development, a lack of accessible and relevant resources, absence from national policy frameworks (which undermines legitimacy and limits meaningful engagement from municipal authorities and other stakeholders), and high cost requirements. Enabling conditions that together form the foundational governance ecosystem for NbS adoption in urban areas include polycentric decision-making, stakeholder engagement in education, support for innovation in technology, coherence in policy development, resource availability, and institutional framework. The study contributes by identifying and organising enabling conditions for scaling NbS adoption, helping actors build an effective governance ecosystem for urban resilience.

10. Comfort Oppong Asamoah

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Student · University of Energy and Natural Resources · Ghana

Spatiotemporal Analysis of Mining Footprints in Ghana Using Satellite Imagery

Artisanal and small-scale mining (galamsey) has significantly altered Ghana's landscape, particularly in the Ashanti Region, causing deforestation, water contamination, and illegal encroachment into protected forest reserves. Existing monitoring approaches are limited by manual digitisation, restricted spectral inputs, and single-date analysis, making them unscalable and unable to capture the full spatiotemporal extent of mining dynamics. This thesis proposes a satellite imagery-based deep learning methodology for spatiotemporal analysis and mapping of mining footprints across Ghana's Ashanti Region from 2019 to 2025 using Sentinel-2 imagery. A 113-configuration ablation study crossing three decoder architectures (U-Net, DeepLabV3+, FPN), two attention mechanisms (SE blocks, CBAM), and eight channel configurations confirms decoder architecture and channel configuration as the two significant performance drivers. The optimal FPN+CBAM+DenseNet-121 architecture achieves 63.5% validation mean IoU and 65.0% mining-class IoU, exceeding West African benchmarks by 3 to 7 percentage points. Multi-temporal analysis achieves a mean mining IoU of 62.4%, with best-year performance of 70.5% IoU and 82.7% F1-score in 2020. An integrated change detection methodology identifies three temporal phases: a COVID-19-driven

contraction of 109.96 km², a post-pandemic expansion of 193.20 km², and a regulatory-driven fluctuation yielding a compound annual growth rate of +4.70%. The methodology detects 214.01 km² of forest-to-mining conversion and 123.17 km² of illegal forest reserve encroachment, providing spatially explicit evidence for environmental governance and enforcement targeting.

11. Titus Adeyemi Alonge; Amos T. Kabo-Bah; Lily Lisa Yevugah; Abdul-Karim Iddrisu

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Evaluating Soil Erosion Response to CMIP6 Climate Scenarios and Land Use Cover Changes in Kampe Omi Dam Basin, Nigeria

Soil erosion remains a critical environmental challenge in Nigeria, driven by the combined effects of climate variability and land use/land cover change (LULCC). This study evaluated the future response of soil erosion in the Kampe Omi Dam Basin using the Revised Universal Soil Loss Equation (RUSLE) integrated with CMIP6 climate projections and simulated LULC scenarios. A multi-model ensemble mean of four CMIP6 models was developed under SSP2-4.5 and SSP5-8.5 scenarios for the near-term (2021–2040) and mid-century (2041–2060) periods, relative to a 1995–2014 baseline. Future land use was projected using a Multi-Layer Perceptron–Markov Chain model. Results indicate no statistically significant trends in annual precipitation, although interannual variability persists. Rainfall erosivity shows spatial variability with a general declining tendency across most scenarios. In contrast, cropland expansion and vegetation loss increase the cover management (C) factor, while improvements in conservation practices reduce the P-factor. Despite increasing land-use pressure, mean soil loss is projected to decline by over 50% in 2021–2040 and more than 40% in 2041–2060 compared to the 1995–2015 baseline of 33.71 t/ha/yr. Sensitivity analysis indicates that soil loss is most responsive to changes in the C-factor under perturbation conditions, although temporal erosion reductions are primarily driven by improvements in the P-factor.

Keywords: *Climate change, LULCC, RUSLE, erosivity, CMIP6 models, Soil loss*

12. Gomasi Wonder

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Student · University of Energy and Natural Resources · Ghana

SKY-CROP: Next-Generation Atmospheric Water Harvesting for Village Resilience

Rising temperatures and irregular rain cycles have depleted traditional village aquifers, leaving many small-scale farmers facing "Zero-Water" scenarios as groundwater levels drop beyond the reach of manual pumps. Deep-well drilling costs often exceed $5,000 — over 500% of the annual income for a village farmer — while current renewable solutions fail to address the fundamental lack of a reliable water source. SKY-CROP presents a low-cost atmospheric water harvesting system built around three core innovations: bi-facial solar film that wraps the chimney to generate power from direct sunlight and ambient reflection while heating internal air; a passive chimney-effect airflow system that draws humid air across high-efficiency solid-state cooling plates; and Peltier arrays that drop the internal temperature rapidly, forcing atmospheric moisture to condense into pure distilled water. The system achieves a 30% reduction in energy input compared to traditional mechanical condensers, with a capital cost of $400–$600 versus $3,000–$5,000 for standard solar pump systems. SKY-CROP enables farmers to operate precision nursery micro-climates for year-round production of hybrid seedlings that are 40% more resilient than local varieties, supporting estimated annual revenues of $8,400 per farm hub. The system provides water sovereignty, zero-emission operation, and a scalable micro-franchise business model ("Seedling Kings") for community resilience.

13. Kodie Amo Kwame

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Student · Beihang University of Aeronautics and Astronautics · China

Projected Precipitation Patterns in the White Volta Basin Under Shared Socioeconomic Pathways: A Bias-Corrected Approach with Statistical Validation of Anthropogenic Climate Influence

The White Volta Basin is subject to increasing climate change risks, including water security and agricultural productivity risks linked to rainfall variability. This study used bias correction and statistical hypothesis testing to project precipitation variability under Shared Socioeconomic Pathways and to evaluate the anthropogenic contribution to projected precipitation outcomes. The CMhyd distribution mapping method was used to correct bias in sixteen Global Climate Models from the CMIP6 dataset against CHIRPS precipitation observations for the baseline period 1981–2014. Ensemble projections were generated for SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5, with a corrected framework covering 18 stations (15 virtual and 3 in-situ: Tamale, Zuarungu, and Garu). Validation showed strong performance, with a Pearson Correlation Coefficient of 0.90, Nash-Sutcliffe Efficiency of 0.82, and Percent Bias of 0.1%. Basin-mean F-statistics increased from 4.1 in the near-term to 11.0 in the mid-term and 26.4 in the long-term, indicating that anthropogenic forcing becomes increasingly dominant in long-term projections. Spatiotemporal assessment indicates a drying tendency that intensifies toward late-century horizons, with stronger deficits under SSP3-7.0 and SSP5-8.5. Rainfall Anomaly Index results also indicate increasing dry-anomaly frequency in future periods.

14. Sylvia Adipah

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Lecturer · University of Energy and Natural Resources · Ghana

Anaerobic Co-Digestion of Tropical Fruit Wastes for Biogas Production and Greenhouse Gas Mitigation

The management of biodegradable fruit processing wastes represents a growing environmental challenge in many developing regions, where inadequate disposal practices contribute to greenhouse gas emissions, pollution, and resource loss. Anaerobic digestion offers a sustainable pathway for converting organic wastes into renewable energy. However, the digestion of fruit wastes is often constrained by acidity, nutrient imbalance, and process instability. This study investigates anaerobic co-digestion of tropical fruit wastes — including orange, pineapple, banana, and mango — as a climate-smart waste management strategy to enhance biogas production while mitigating greenhouse gas emissions. Mono- and co-digestion experiments were conducted using a low-cost, mesophilic drum digester under controlled operational conditions, including pH, moisture content, carbon-to-nitrogen (C:N) ratio, hydraulic retention time, and temperature. Results showed that optimised co-digestion significantly improved digestion stability, achieving methane concentrations above 60% and maximum biogas yields of up to 1.7 $m^3\ day^{-1}$. Balanced substrate combinations reduced carbon losses as CO_2 and trace gases, indicating more efficient methanogenesis and lower secondary emissions. Kinetic modelling further revealed shortened lag phases and enhanced methane production rates under balanced conditions. The findings demonstrate that strategic co-digestion transforms fruit waste from environmental liability into valuable bioenergy and nutrient resources.

Keywords: *Anaerobic co-digestion; Tropical fruit waste; Biogas production; Greenhouse gas mitigation; Circular bioeconomy; Renewable energy; Sustainable waste management*

15. Dr. Beata Awinpoka Akanyani

[ORAL PRESENTATION]

· · *Ghana*

Scaling Sanitation Solutions Beyond Innovation: Understanding Open Defecation Free (ODF) Relapse in Northern Ghana

Relapse from Open Defecation Free (ODF) status to Open Defecation (OD) in Northern Ghana is an unexpected outcome of the Community-Led Total Sanitation (CLTS) initiative. This study sought to unravel the drivers of this relapse using a mixed-methods approach, gathering both qualitative and quantitative data from 158 respondents across two districts — Kpandai and Zabzugu — in the Northern Region of Ghana. The analysis revealed that 75 percent of communities relapsed into open defecation, with only 25 percent maintaining their ODF status for up to six years. Key factors sustaining ODF status were economic capacity, personal intention for change, regulation from traditional chiefs, external support from NGOs, and media campaigns. Challenges including latrine collapse, economic constraints, and lack of follow-up support were found to hinder long-term sustainability. The study recommends strategic planning, innovative financing, and community empowerment as measures to enhance sustainable sanitation practices.

Keywords: *Community Led Total Sanitation, Slippage, Open Defecation Free, community leadership, behavior, Northern Ghana*

16. Faasinma Dominic Dery

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Phytoremediation Techniques for Water, Soil, and Air Pollution: Both Prophylactic and Therapeutic

Current intensive agriculture practices, illegal mining, and industrialization have led to the pollution of natural resources with heavy metals, organic pollutants, radionuclides, pesticides, and fertilizers. Water pollution is a major issue in Ghana, with 60% of surface waters contaminated by mining, industrial, and municipal waste. The 2021 average water quality index was 58.2, mainly of poor quality. Mercury and lead concentrations in major rivers exceed acceptable limits by more than 10,000%, posing significant cancer risk and organ damage. Phytoremediation is a cost-effective and environmentally friendly biotechnology technique that exploits plants to immobilize, uptake, reduce toxicity, stabilize, or degrade environmental contaminants through mechanisms including phytoextraction, rhizofiltration, phytovolatilization, and phytostabilization. Jatropha curcas, Vigna unguiculata, and Nicotiana tabacum were investigated as phytoremediation agents. Additionally, water hyacinth, Imperata cylindrica, and Poplar trees have proven outstanding for remediating heavy metal-contaminated water.

Keywords: *Phytoremediation, Heavy Metals, Water Pollution, Jatropha, Phytoextraction, Ghana*

17. Sumara Alfred Salifu

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Predicting Risk of Satellite Collisions Using Machine Learning and Artificial Intelligence

Active collision avoidance is an essential component of safe satellite operations, with satellites in Low Earth Orbit receiving hundreds of close-encounter alerts each week in the form of conjunction data messages (CDMs). Automated risk-prediction techniques offer a practical route to reducing operational cost by suppressing false positives. This work presents a range of machine learning methods for predicting satellite collision risk, developed for the European Space Agency Collision Avoidance Challenge. Both deep learning and conventional machine learning approaches were evaluated on a dataset of 103 features per CDM, with 13,154 training events and 2,167 test events. Deep learning models include RNN regressors based on LSTM and GRU cells, as well as a sequence-to-sequence encoder-decoder architecture. A two-stage classical pipeline combining a classifier with a dedicated regressor using random forests and multilayer perceptrons significantly outperformed deep learning models, achieving the fewest false negatives among the top-ten algorithms on the Pareto front.

Keywords: *Satellite Collision Avoidance, Machine Learning, CDM, LSTM, Random Forest, ESA, Space Safety*

18. Abu-Safian Fadlan; Song Chen

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Alarm System Design and Analyses of Orbital Performance and Collision Avoidance for VLEO Constellation

With growing demand for commercial space activities, very low Earth orbit (VLEO) has emerged as a preferred region for deploying next-generation mega-constellations due to lower launch costs, improved telecommunication performance, and reduced space debris risk. As VLEO becomes increasingly congested, frequent station-keeping and collision-avoidance manoeuvres are required. This work detects and analyses the precise start time, duration, and altitude change of these manoeuvres using ephemerides of 780 VLEO Starlink satellites at 240–360 km throughout 2025. The maximum orbital decay compensable by existing electric thrusters is characterised as a function of altitude gradient, providing a baseline for designing air-breathing electric propulsion (ABEP) systems.

Building on the Walker-Delta constellation framework, dynamic safety-clearances between satellite fleets are standardised according to collision probability. Collision events serve as inputs for a combined vehicle routing problem (VRP) and Lossless Convexification (LCvx) framework to generate fuel-efficient manoeuvre trajectories, extending mission lifetime.

Keywords: *VLEO, Constellation Management, Collision Avoidance, Station-Keeping, Space Traffic Management, Air-Breathing Electric Propulsion*

POSTER PRESENTATIONS (6)

1. Abdul Kadir Alhassan

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Teaching and Research Assistant · University of Energy and Natural Resources · Ghana

Application of H2O Toolkit for Modeling Biochemical Oxygen Demand and Ammonium-Nitrogen Dynamics in the Tano River

The Tano River is a vital source of freshwater in Ghana, but it faces serious threats from anthropogenic activities such as illegal mining, agricultural runoff, and industrial discharge. These activities are causing an increase in biochemical oxygen demand (BOD) and ammonium-nitrogen (NH4-N) levels, which are key indicators of pollution. In this study, the H2O Toolkit — an open-source machine learning platform — was utilised to model and predict variations in BOD and NH4-N in the Tano River. Water samples were collected from selected sites along the Tano River basin from June to August 2025. Laboratory analyses measured parameters such as pH, temperature, dissolved oxygen (DO), chemical oxygen demand (COD), total nitrogen (TN), and total phosphorus (TP) using standard laboratory procedures. Predictive models were developed and validated using AutoML and regression techniques. The results revealed strong relationships between BOD and NH4-N and factors like COD, DO, and TN, with models successfully capturing these complex interactions. Scenario analyses revealed sensitivity of both BOD and NH4-N to changes in temperature and nutrient levels. The findings demonstrate the potential of AI-driven tools in water resource management, providing a robust baseline for future research and policy formulation.

Keywords: *H2O Toolkit, Biological Oxygen Demand (BOD), Ammonium-Nitrogen (NH4-N), Tano River*

2. Christian Amponsah; Amos T. Kabo-Bah (UENR)

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Research Assistant · University of Energy and Natural Resources · Ghana

An Interactive Web Platform for Groundwater Vulnerability Mapping Integrating F-Hydra and Cloud-Based Geospatial Processing

Groundwater resources are increasingly vulnerable to contamination from land-use change and surface activities. Conventional assessments often require GIS expertise, limiting access for non-specialists. This short communication presents F-Hydra Web, a lightweight, browser-based platform that automates groundwater vulnerability mapping using flow accumulation, slope, land use/land cover, and hydraulic conductivity. Users upload a boundary shapefile and receive an interactive map, vulnerability statistics, and downloadable raster output. Built with Python, Streamlit, and Google Earth Engine (GEE), the system performs fast geospatial processing and integrates optional user-information logging and feedback submission. The platform enables researchers, students, and agencies to conduct scientifically robust groundwater vulnerability assessments without specialised GIS installations or skills.

Keywords: *groundwater vulnerability, F-Hydra, web-based GIS, Google Earth Engine, environmental mapping*

3. Rhodaline Afriyie Appiah

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The Advances of CFD for Rainwater Harvesting System Design for Africa

Rainwater harvesting (RWH) has emerged as a critical strategy for enhancing water security across Africa, where challenges such as climate variability, rapid population growth, and outdated water infrastructure threaten access to safe water. Traditional methods of designing RWH systems often rely on empirical approaches that do not fully account for the complex dynamics of fluid movement and rain patterns. Computational Fluid Dynamics (CFD) provides a more nuanced analysis of fluid behaviour, pollutant transport, and system performance under varied conditions. Recent advances in CFD applications — including first flush modelling, tank design optimisation, and contamination prediction — show great promise in revolutionising RWH systems. By simulating rainfall events and their interactions with different catchment materials, stakeholders can better understand how to optimise capture rates and minimise contamination risks. However, the transition from conventional methods to sophisticated computational approaches comes with challenges, particularly in resource-limited settings. Balancing technical sophistication with local realities — computational costs, need for local expertise, and validation with field data — is essential. Integrating CFD with traditional knowledge and focusing on open-source tools and capacity building can help harness this transformative technology to create more resilient and effective rainwater harvesting solutions across the continent.

Keywords: *Rainwater Harvesting, Computational Fluid Dynamics, Water Scarcity, Climate Variability, System Design Optimisation, Community Engagement*

4. Godwin Ebo Fosu

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Research Assistant · Ho Technical University · Ghana

Analysis of Rainfall Patterns in the Volta Region Using Climate Infrared Data

Rainfall plays a crucial part in the hydrological system. Globally, rainfall has increased by two percent. Climate change has caused variation in rainfall at local scales. In Ghana, the high reliance on rain-fed agriculture has led to decreased crop production. It is therefore imperative to assess the rainfall patterns in the Volta Region, due to the region's significant contribution to agriculture and perennial floods. The study analyses rainfall patterns using climate infrared data. Results from yearly analysis revealed rainfall ranging from 765.3 mm to 1,794.1 mm per annum. On seasonal analysis, December–January–February (DJF) recorded 29.0 mm to 91.7 mm per season, March–April–May (MAM) recorded 293.8 mm to 466.6 mm per season, June–July–August (JJA) recorded 232.6 mm to 699.5 mm per season, and September–October–November (SON) recorded 200.9 mm to 519.0 mm per season. Trend analysis using the Mann-Kendall test found no statistically significant trend at the 95% confidence level. These findings serve as grounds for agricultural revamping projects and improvement of existing projects, and support further studies at the district scale to examine the correlation between rainfall and crop yield.

5. Jackson Nyarko; Francis Agyei; Samuel A. Yeboah (University of Ghana)

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PhD Researcher · University of Ghana · Ghana

ECO REPELLANT: Developing a Climate-Smart, Plant-Based Mosquito Spatial Repellent Emanator for Malaria Prevention and Green Enterprise Development in West Africa

Malaria remains one of the leading public health and climate-sensitive diseases in Sub-Saharan Africa, with transmission increasingly influenced by environmental change, urbanisation, and adaptive mosquito behaviours. Conventional interventions such as insecticide-treated nets (ITNs) and indoor residual spraying (IRS) leave important protection gaps, particularly against outdoor and early-evening mosquito biting. Emerging invasive vectors such as Anopheles stephensi further threaten malaria elimination gains in Africa by adapting to urban environments and evading traditional indoor-focused interventions. The Eco Repellant Project is a climate-smart public health innovation initiative seeking to develop a locally manufactured, plant-based mosquito spatial repellent emanator designed specifically for African households. The project combines reusable low-energy emanator technology with locally sourced botanical repellents extracted from plants such as neem, lemongrass, eucalyptus, basil, and mango. The project adopts a phased translational development model involving prototype development, botanical extraction and formulation optimisation, laboratory and semi-field efficacy evaluation, community pilot testing in malaria-endemic communities in Ghana, and market scale-up. Expected impacts include reduced indoor and outdoor mosquito-human contact, complementary support to existing malaria prevention interventions, and creation of green jobs and local manufacturing opportunities.

Keywords: *Malaria; Climate Action; Spatial Repellents; Green Enterprise; Botanical Insect Repellents; Public Health Innovation; Vector Control; Sustainability; Ghana; African Entrepreneurship*

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To every participant who travelled near or far to be part of this summit: from across Ghana, Africa, and beyond — thank you. CALIBRATE is yours. Take what you have learned here, build what Africa needs, and return next year with more.

CALIBRATE 2027

Watch our website and social channels for the Call for Abstracts and registration for CALIBRATE 2027.

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