

Dr Aletha de Witt

Director: Radio Astronomy Projects
Department of Science, Technology
and Innovation (DSTI)

Dr Jack Radcliffe

Research Scientist
University of Manchester

**Charting the Course for
GGOS Africa:** Integrating
Pan-African Geodetic
Efforts for Global Impact

Making \leq sure $\left(\frac{\text{it's}}{\text{possible}} \right)$



science, technology
& innovation

Department:
Science, Technology and Innovation
REPUBLIC OF SOUTH AFRICA

**UN-GGCE Geodesy Capacity Development
Workshop for Africa**
19–23 May 2025, Nairobi



Charting the Course for GGOS Africa

**Do we need a
GGOS Africa?**



Charting the Course for GGOS Africa

Yes, we do!!!

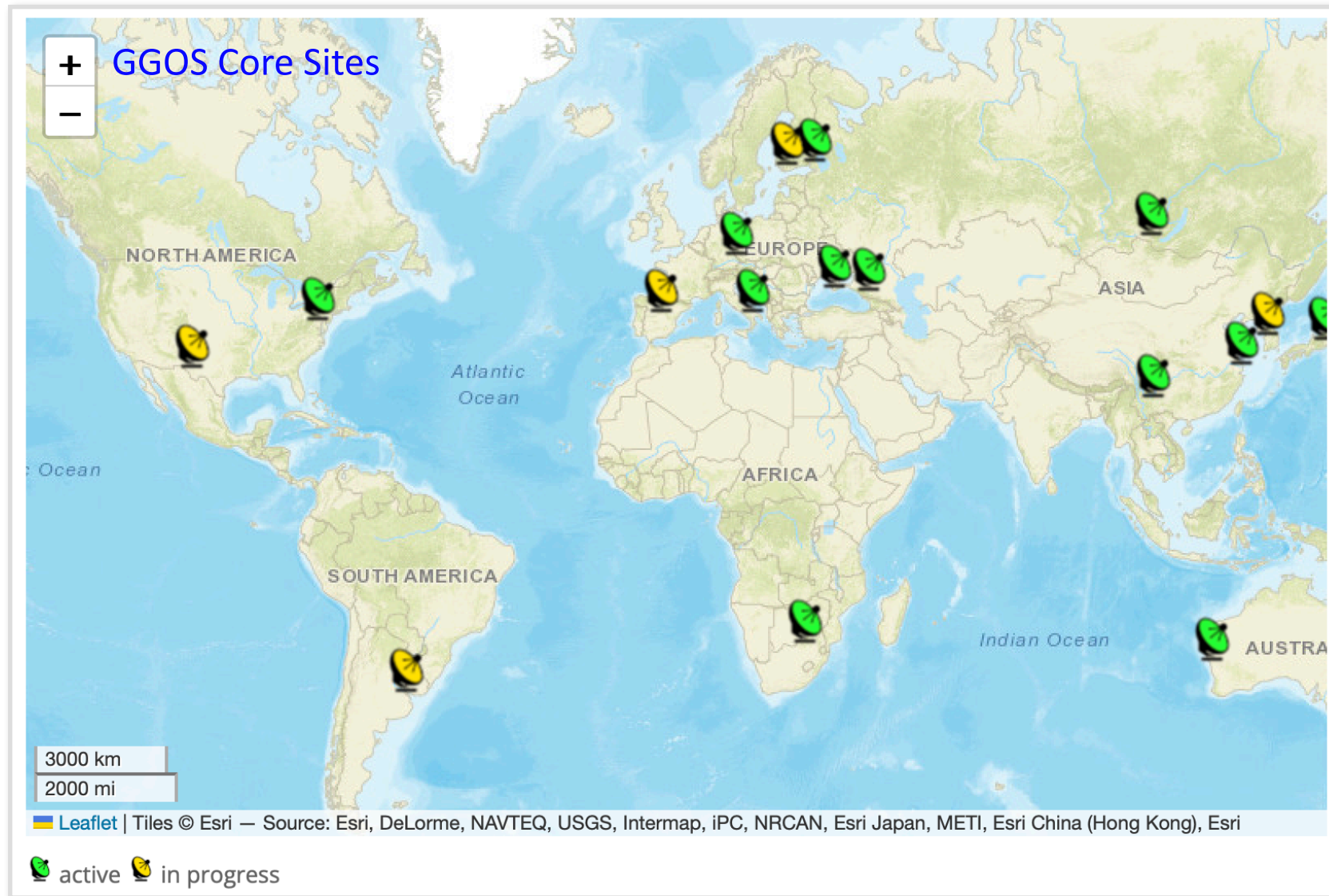
**It's time for
Africa!!**



andscape in Africa



The Current Geodetic Landscape in Africa

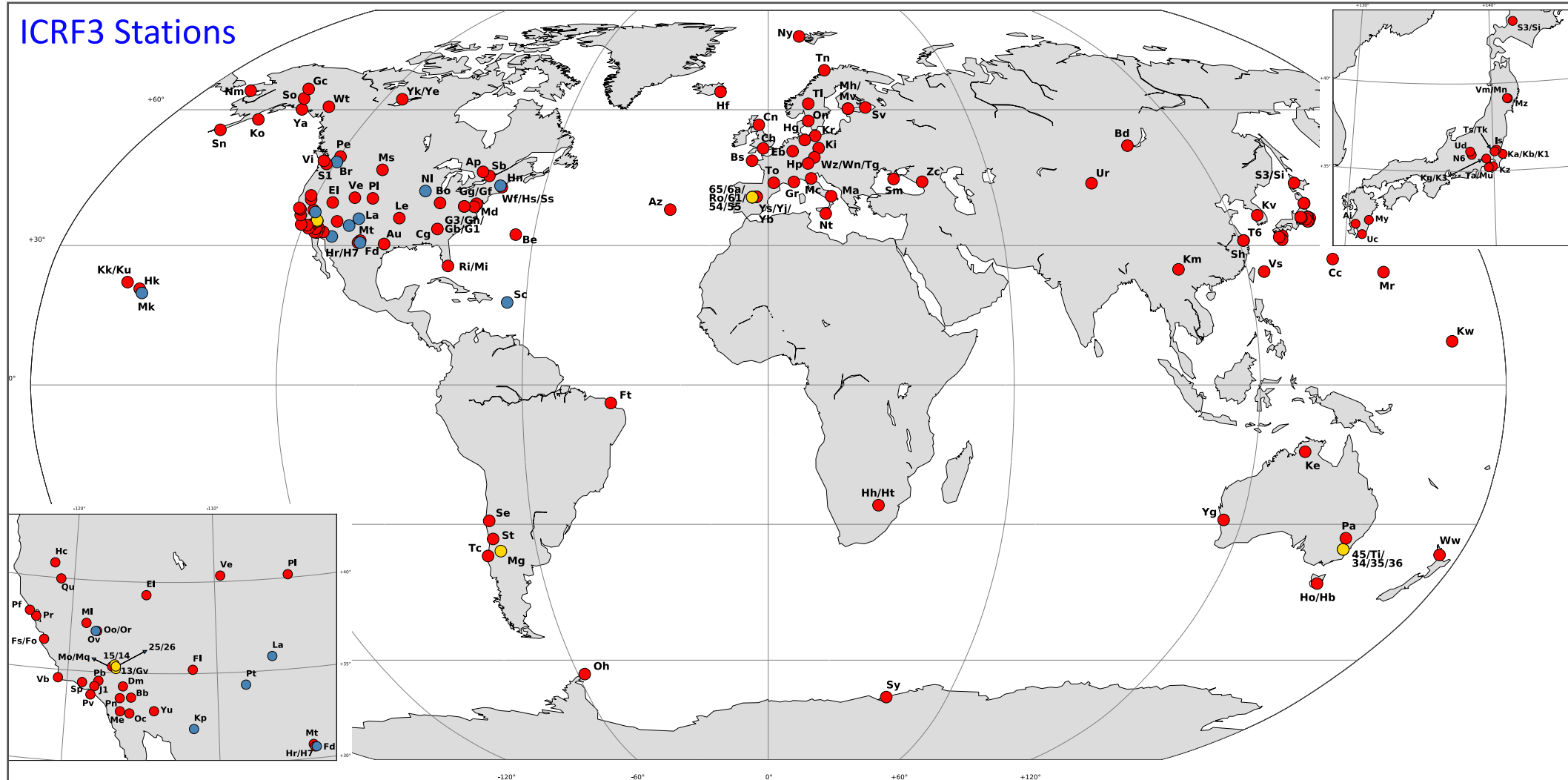


The Current Geodetic Landscape in Africa

Hartebeesthoek Site, South Africa



The Current Geodetic Landscape in Africa



The 167 antennas (situated on 126 different sites) that participated in the observations used for ICRF3

Africa: A Key to Global and Local Solutions

Lack of Geodetic Infrastructure in Africa

The Global Geodesy Supply Chain Needs Africa

- **Geographic Coverage:** balancing global ground station distribution and improving accuracy
- **Unique Geophysical data:** Africa's diverse landscape provides critical environmental and geophysical data
- **Improving Global Models:** Improving global satellite systems, Earth observations, and climate models



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Africa's Own Need for Geodetic Data

- **Climate change, environmental monitoring, and disaster response**
- **Navigation, surveying, and mapping**
- **Infrastructure development**
- **Urban planning and sustainable development**
- **Economic growth**

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Challenges in Geodesy in Africa



SUSTAINABLE DEVELOPMENT GOALS



Science Summit at UNGA79
10 - 27 September 2024

Africa Rising: Shaping Our Common Future Through Geodesy

Implementing the UN General Assembly Resolution A/RES/69/266
“Global Geodetic Reference Frame for Sustainable Development”

Friday, 27 September 2024 | 8:30 am – 3:00 pm ET (UTC-4) | on-site and online event
Location: CURE, 345 Park Avenue South, New York, NY 10010, United States

join us at

<https://sciencesummitunga.com/science-summit-unga79/>



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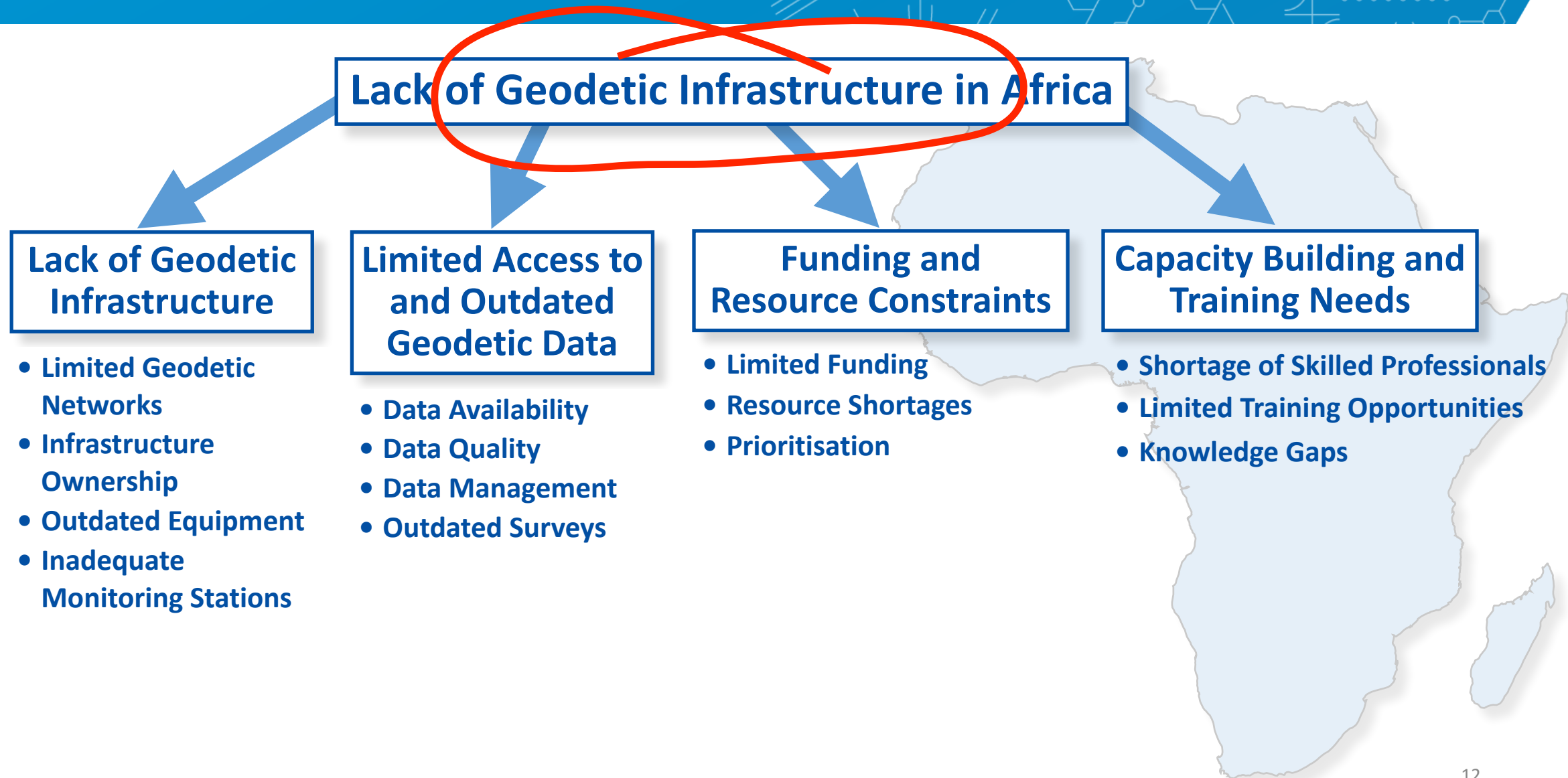


United Nations
Global Geodetic
Centre of Excellence

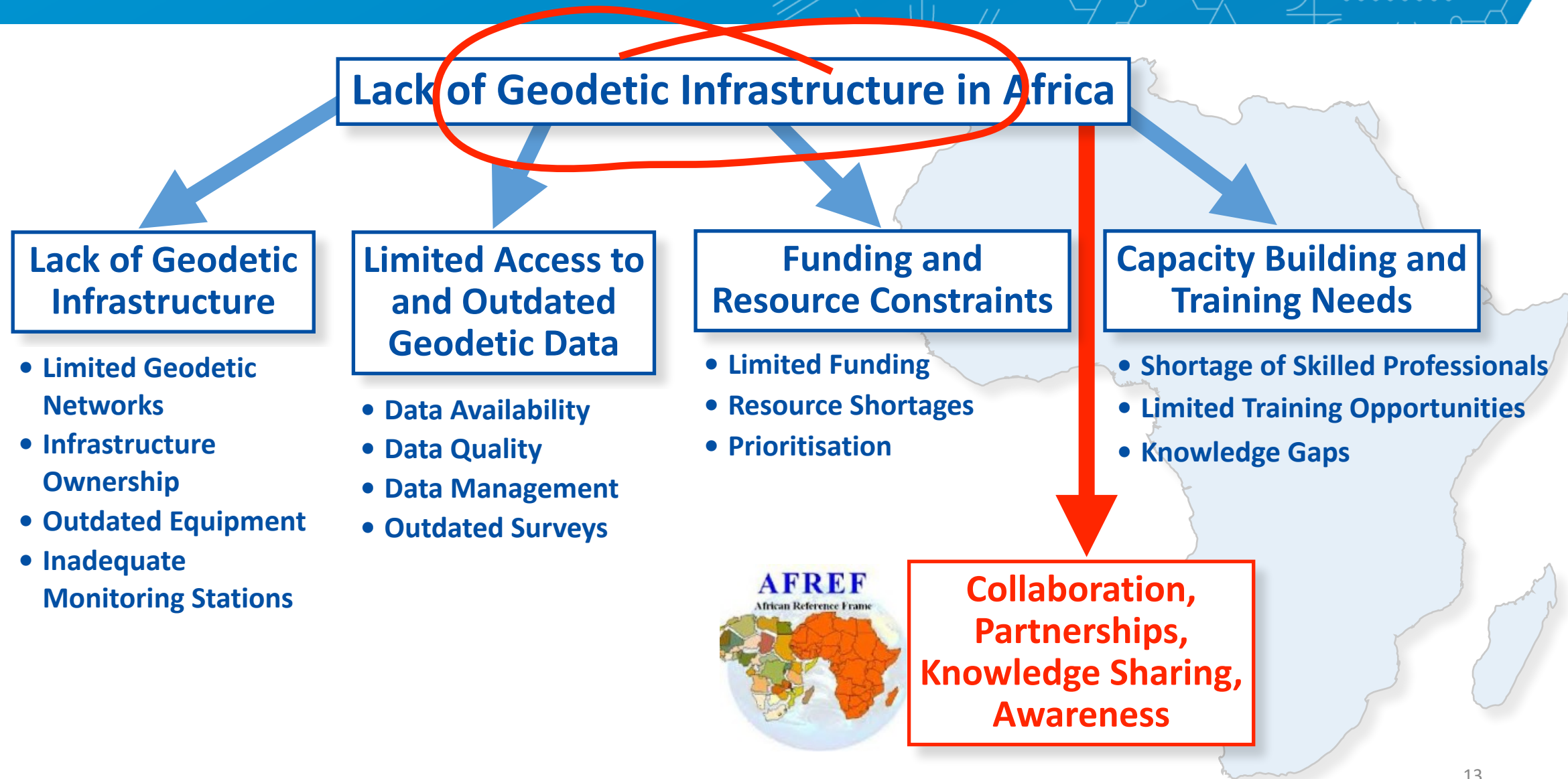


GGOS
Global Geodetic
Observing System

Challenges in Geodesy in Africa



Challenges in Geodesy in Africa



Progress to Date: GGOS Africa



Identification of Need:

Recognition of the need for a Pan-African Institute or Organisation for Geodesy

- **Starting with South Africa:**

Establishment of a Geodesy Committee in South Africa led by DSTI (In Progress)

- **GGOS Implementation Plan 2024:**

Promote the establishment of GGOS Africa

- Diagnose current situation and explore possibilities for implementation (2024)
- Establishment of GGOS Africa Affiliate (2025)

- **Key Events:**

Geodesy Day at the UN Science Summit (September 2024) and AfAS Conference (March 2025)

- **Collaboration and Lessons Learned:**

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- Insights from SKA implementation and the rollout of high-performance computing in Africa

- **Secured Funding:**

Africa-UK Physics Partnership application for funding (approved March 2025)



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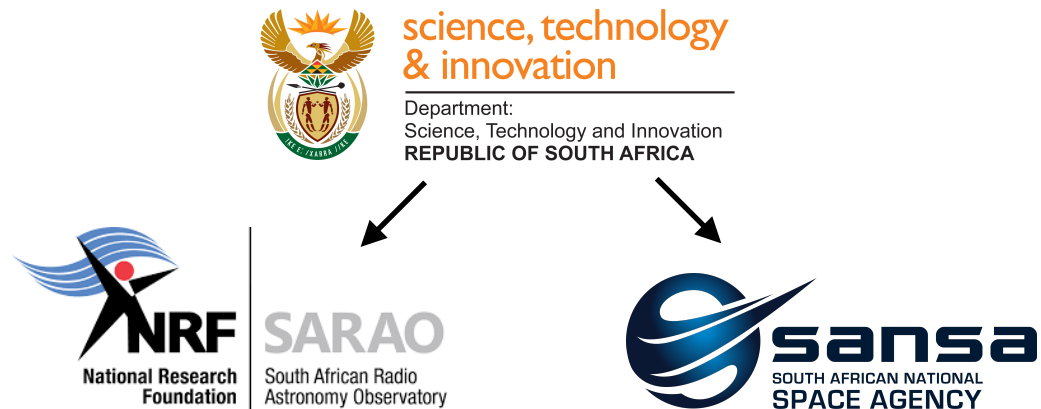
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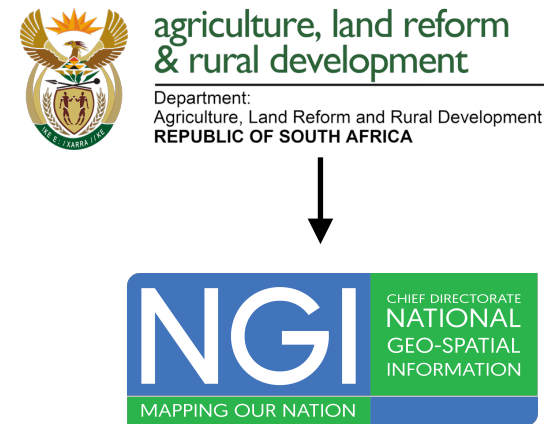
Progress to Date: GGOS Africa

Discussions between DSTI, SARAO, SANSA, DALRRD, and NGI to establish a South African 'Geodesy Working Group'



SARAO Space Geodesy Programme participates in global space geodetic networks for VLBI, GNSS, DORIS, and SLR. one of only a few fundamental geodetic stations worldwide—and the only one in Africa

SANSA participates in space science, Earth observation, and space weather monitoring activities. operates GNSS stations primarily for space weather research



NGI, South Africa's national mapping organisations operates TrigNet, South Africa's national CORS network, which serves as South Africa's official geodetic and cadastral reference system



Progress to Date: GGOS Africa

7. Objectives

7.1. South Africa's geodetic infrastructure, expertise, and leadership in Africa provide an opportunity to strengthen its role in global geodesy while addressing national and regional geodetic challenges. To achieve this, the following key objectives are proposed:

- **Establish a National Geodesy Working Group:** Create a national coordination body to align geodetic efforts across government agencies, research institutions, and industry, ensuring strategic investments and enhanced collaboration.
- **Formalise South Africa's role in global geodesy governance by signing the UN-GGCE multilateral MoU:** Strengthen South Africa's engagement in the global geodetic community, reinforcing its commitment to the sustainability of global geodesy.
- **Develop a National Geodesy Coordination Framework:** Provide an immediate mechanism for coordinating geodetic activities across DSTI, DLRRD, SANSA, universities, and other stakeholders such as the Department of Defense, the SA Navy, and private sector partners. This framework could later evolve into a full National Geodesy Strategy if required.
- **Secure long-term funding for geodetic infrastructure and human capacity development:** Pursue sustainable funding models, including infrastructure grants, public-private partnerships, international collaborations, and infrastructure hosting agreements, to support geodetic infrastructure upgrades, technical staff training, and research initiatives.
- **Lead the establishment of GGOS Africa:** Establish GGOS Africa as a regional coordinating entity under the Global Geodetic Observing System (GGOS) to enhance Africa's integration into global geodesy, coordinate geodetic activities across the continent, and build technical capacity.



United Nations Nations Unies

[19.3.2025]

Dear Minister Nzimande,

Subject: Recommendation for the Establishment of GGOS Africa as an Affiliate of GGOS

I am writing to you on behalf of the United Nations Global Geodetic Centre of Excellence (UN-GGCC) to express the support of the recommendation to establish GGOS Africa as an affiliate of the Global Geodetic Observing System (GGOS), under the support of the Department of Science, Technology and Innovation (DSTI).

UN-GGCC supports the establishment of GGOS Africa as a pan-African chapter, which aims to provide a dedicated platform for African nations to engage in regular dialogue on geodetic issues, share know-how resources and best practices, and collaborate on the development of innovative solutions to the continent's unique challenges. Moreover, GGOS Africa would play a critical role in strengthening the geodesy chain in Africa and ensuring that the continent, with its special geographical location in the Southern Hemisphere, is fully aligned with the global geodesy supply chain. This fully aligns with the United Nations Sustainable Development Goals (SDGs) related to climate action, the efficient use of land, and the reduction of natural disasters to the development of accurate geospatial data for evidence-based decision-making.

South Africa, as the host of the continent's only fundamental geodetic station, is in a unique position to drive GGOS Africa forward. In addition, recent discussions with DSTI have explored the integration of GGOS Africa with the African Astronomical Society (AAS), which oversees a network of subsidiary and affiliated organisations. This dual affiliation would unlock synergies between geodesy and astronomy, providing access to shared resources and funding streams, while enhancing interdisciplinary collaboration. GGOS supports this potential integration and recognises its value in promoting holistic scientific progress across Africa.

We believe that DSTI's leadership in hosting and supporting GGOS Africa will establish a formal structure to promote geodesy in Africa. We seek your support for this initiative, which will provide access to the funding and operational backing necessary for its success. A partnership between DSTI, GGOS and AAS represents an unprecedented opportunity to advance Africa's geodetic capacity and address pressing global challenges.

We would be honoured to discuss this proposal further and work together to ensure the successful establishment of GGOS Africa. Please do not hesitate to contact me for additional information or to coordinate next steps.

Thank you for your consideration and leadership in advancing science, innovation and sustainable development in Africa.

Yours sincerely,

Dr. Richard S. Gross

Global Geodetic Observing System (GGOS)
of the International Association of Geodesy (IAG)

Dr. Richard S. Gross
360 Propulsion Laboratory
Mail Stop 138-000
4800 Oak Grove Drive
Pasadena, CA 91109-1380 USA
E-mail: richard.s.gross@jpl.nasa.gov

Dr. Louis Schärer
GGOS President
Deutsches Geodätisches Forschungsinstitut
Technische Universität München (DGLF-TUM)
Phone: +49 (0) 89 289-23147
E-mail: l.schaerer@tum.de

Assistant: Dr.
85353 Munich, Germany
Phone: +49 (0) 89 289-23147
E-mail: l.schaerer@tum.de

International Association of Geodesy
of the International Union of Geodesy and Geophysics

March 19, 2025

To: Honourable Minister Blade Nzimande
Department of Science, Technology and Innovation
Republic of South Africa

Re: Letter Supporting the Establishment of GGOS Africa

Dear Minister Nzimande,

It is a great pleasure to have this opportunity to write a letter supporting the establishment of GGOS Africa as an Affiliate of the International Association of Geodesy's (IAG's) Global Geodetic Observing System (GGOS).

The IAG is a scientific association in the field of geodesy. It promotes scientific cooperation and research in geodesy on a global scale and contributes to it through its various research bodies. The IAG formed GGOS in 2003 to organize the different technique-specific observing Services of the IAG under one unifying umbrella in order to form a comprehensive geodetic observing instrument and to integrate the separate pillars of geodesy (shape, rotation and gravity) into one consistent observing system. I was the President of GGOS during 2017 to 2019 prior to becoming the Vice President of the IAG in 2019. While I was President of GGOS we established GGOS Affiliates as a way to further promote geodesy in general and to increase participation in GGOS in particular.

A GGOS Affiliate is a national or regional organization that coordinates space-geodetic activities and that provides a forum for multi-technique, space-geodetic discussions in that area. GGOS Affiliates are an important component of GGOS with representation on its Governing Board. There are currently three GGOS Affiliates: GGOS Japan, GGOS D-A-CH (Germany, Austria, and Switzerland), and GGOS IberAtlantic (Spain and Portugal). These Affiliates have had great success in organizing geodetic activities and promoting the importance of geodesy in their area. In fact, in 2023 GGOS Japan received the Tsuhoi Prize from the Geodetic Society of Japan in recognition of its important contributions to geodesy in Japan.

As the president of IAG I enthusiastically support the establishment of GGOS Africa. The Republic of South Africa is a strong supporter of geodesy and through GGOS Africa this support for geodesy can be extended throughout the African continent. I am confident that GGOS Africa will be as successful in promoting geodesy in Africa as the other GGOS Affiliates have been in promoting geodesy in their regions. Please let me know how I and the IAG can help with this.

Sincerely,

Richard S. Gross

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President
Dr. Richard S. Gross
360 Propulsion Laboratory
Mail Stop 138-000
4800 Oak Grove Drive
Pasadena, CA 91109-1380 USA
E-mail: richard.s.gross@jpl.nasa.gov

Vice-President
Prof. Dr. Peter J.G. Teunissen
Delft University of Technology
PO Box 5048
2600 GA Delft
The Netherlands
E-mail: p.j.g.teunissen@tudelft.nl

Secretary General
Dr. Rüdiger TILLOT
Federal Agency for Cartography
and Geodesy (BKG)
Richard-Strassman-Allee 11
D-60599 Frankfurt am Main, Germany
E-mail: iag-office@bkg.bund.de

www.iag-igp.org

Global Geodetic Observing System (GGOS)
of the International Association of Geodesy (IAG)

Dr. Louis Schärer
GGOS President
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Phone: +49 (0) 89 289-23147
E-mail: l.schaerer@tum.de

Assistant: Dr.
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Progress to Date: GGOS Africa



Identification of Need:

Recognition of the need for a Pan-African Institute or Organisation for Geodesy



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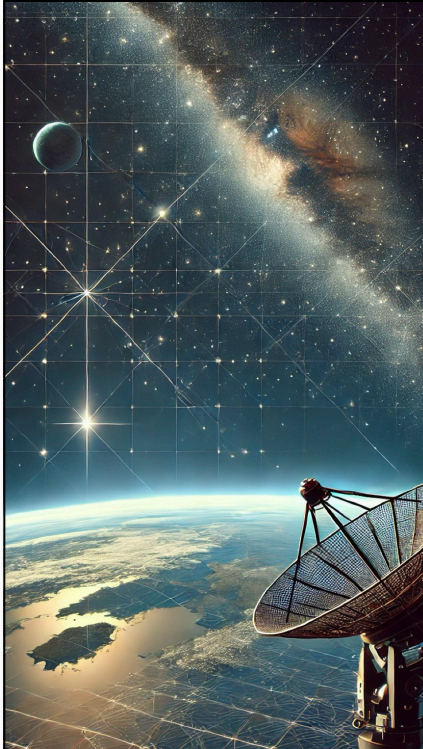


United Nations
Global Geodetic
Centre of Excellence



GGOS
Global Geodetic
Observing System

Geodesy Day at the United Nations Science Summit, New York, USA, September 2024



AfAS
African Astronomical Society

Geodesy: Fundamental Astronomy Meeting Space Science for Global Impact

Discover why geodesy matters for
Science, Society, and Africa
and
join us for an engaging discussion on
—Geodesy's place in Astronomy—

| Monday 24 March 2025 | 16:30-18:00 | Special Session |
AfAS Conference and General Assembly 2025
Location: Emperors Palace Hotel Casino Convention Resort
Johannesburg, South Africa

join us at
<https://events.saa.ac.za/event/10/>

**Geodesy Session at the African Astronomical Society (AfAS)
Conference, Johannesburg, South Africa, March 2025**

Progress to Date: GGOS Africa



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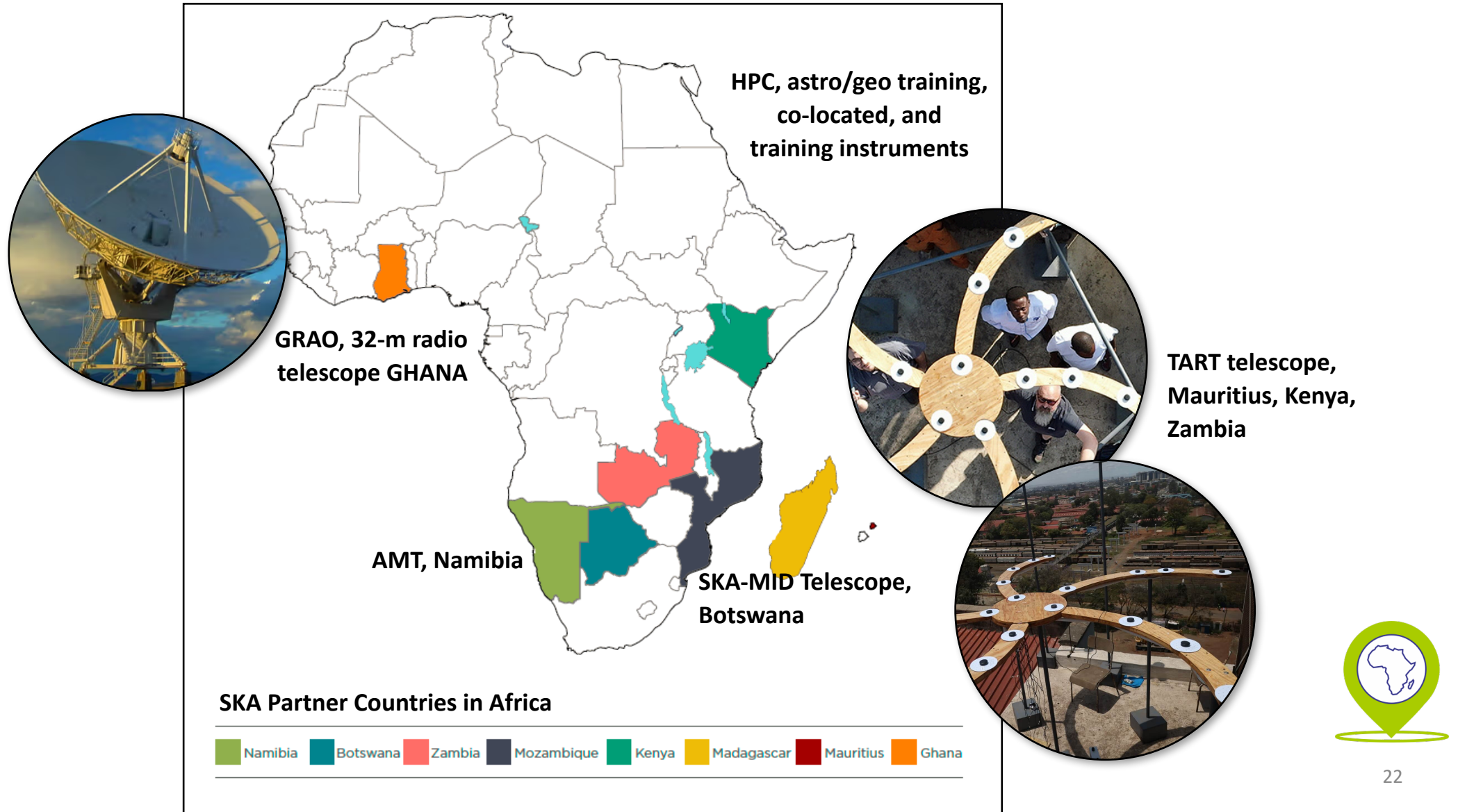
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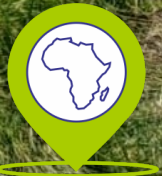
Progress to Date: GGOS Africa



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Self-contained Geodetic GNSS reference stations with full weather systems. Solar powered and cellular communication. Option to add a variety of instruments. ~\$53K (USD) - excluding installation cost.



Progress to Date: GGOS Africa



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The GGOS-Africa project

- UK Research and Innovation (UKRI) & Science and Technologies Facilities Council (STFC) fosters UK-African collaborations such as climate resilience, sustainable energy, and healthcare through its Africa-UK physics partnership collaborative research projects, partnering with Ghana, Kenya, Rwanda, South Africa, Tanzania, and Uganda.
- STFC provided 2-yr seed funding to start building the foundations of GGOS-Africa.
- GGOS Africa Project from Feb 2025 – Feb 2027 and is a collaboration of the following institutes:



The University of Manchester



TECHNICAL UNIVERSITY OF KENYA
Education and Training for the Real World



science & innovation

Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



United Nations
Global Geodetic
Centre of Excellence



SARAO
South African Radio
Astronomy Observatory



GHANA SPACE
SCIENCE & TECHNOLOGY
INSTITUTE



The GGOS-Africa project

Our vision:

- We intend to establish GGOS-Africa and support both new and existing geodetic initiatives throughout Africa, thereby promoting developments at global, regional, and national levels.

** Not a replacement for ongoing initiatives (e.g., AFREF) but instead a forum to network, unify and create common goals in advancing geodetic initiatives across the continent.*

Our goals:

- Assessing Africa's geodetic infrastructure and resources.
- Developing strategic infrastructure plans using simulations.
- Training early-career African geodesists through workshops and collaborations.
- Establishing GGOS-Africa to help coordinate geodetic activities.
- Raising awareness among policymakers about the role of geodesy in sustainable development.

More information at the project website: <https://www.jb.man.ac.uk/GGOS-Africa/> (still partially under construction)

The GGOS-Africa project

Delivered via 5 work packages:



WP1 - Project office

WP lead: J. Radcliffe (Manchester)

Develops the governance, structures, and processes to enable and monitor the project and ensure all deliverables and milestones are achieved.



WP2 - Assessment of geodetic infrastructure in Africa

WP lead: Prof P. Baki (TUK)

Conducts a comprehensive assessment of the current status of geodetic equipment, computational infrastructure, and human capacity across the participating countries.



WP3 - Simulations and strategic planning for infrastructure development

WP lead: Dr A. de Witt (DSI)

Utilise simulations and geospatial analysis to identify optimal locations for new geodetic infrastructure and develop a strategic plan for infrastructure enhancement



WP4 - Building the foundation for GGOS-Africa

WP lead: Prof R. Botha

Lay the groundwork for establishing GGOS Africa, a regional GGOS affiliate coordinating geodetic activities across the continent.



WP5 - Sustaining and expanding the initiative

WP lead: J. Radcliffe (Manchester)

Ensure the long-term sustainability of the project's outcomes and explore opportunities for expanding the initiative to cover more regions and aspects of geodesy.



The GGOS-Africa project

WP2: Assessment of Geodetic Infrastructure in Africa (Prof Paul Baki, TUK, Kenya)

This Questionnaire seeks to gather information on the current GNSS CORS Infrastructure and Capabilities within Africa. This information will help considerably to building a sustainable geodetic reference frame for Africa

RESPONDENT INFORMATION

- 1.1. Name:
- 1.2. Email:
- 1.3. Telephone Contact:
- 1.4. Country:
- 1.5. Organisation or Agency (Name):
- 1.6. Website :
- 1.7. Your Role:
- 1.8. Organisation or Agency (Type/Sector):

- ☐ Government / Gouvernement
- ☐ Academia / Universitaire
- ☐ Commercial / Commerciale
- ☐ Other:

GNSS CORS

2.1 - Are there national and openly available Continuously Operating Reference GNSS Stations (CORS) installed in your Member State?

- ☐ Yes
- ☐ No
- ☐ I'm not sure

2.2 - In your Member State, which agency/agencies, private companies, etc (if any) provides positioning services, such as real time corrections, data streaming or online processing and GNSS reference station data?

- ☐ My agency or organisation
- ☐ I'm not sure
- ☐ Other (state):

2.3 - Are there permanent/semi permanent GNSS stations or passive benchmarks that are occasionally measured?

Building the Foundation for Geodetic Excellence in Africa project

Gantt Chart for Work Package 2

		2025												2026				
		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
	Task/Activity																	
1	Identify one person to sit in the project oversight committee																	
2	Identify key institutions to collaborate with work package 2 team in the assessment of the geodetic infrastructure in Africa																	
3	Organise a consultative meeting with a team hired by the Kenya government to develop a strategy for the Kenyan geodetic system																	
4	Develop a questionnaire for data collection																	
5	Convert the questionnaire into a digital format such as KOBOLLECT App or other similar applications																	
6	Undertake a desktop review to understand the current status of the geodetic infrastructure in Africa																	
7	Identify contact/liaison persons within the target countries																	
8	Identify countries in which the WP2 team may need to acquire research licences																	
9	Acquire research licenses in the identified Countries before data collection process																	

The Next Steps: GGOS Africa

“Together, we can build a geodetic infrastructure that not only strengthens Africa’s position globally but also addresses the continent’s unique challenges. Let’s seize this opportunity and make GGOS Africa a reality—because Africa’s future in geodesy is not just needed, it’s essential.”



*Dankie
Enkosi
Ha khensa
Re a leboga
Ro livhuwa
Siyabonga
Siyathokoza
Thank you*

M $\overline{\text{Making}}$ < sure $\left(\frac{\text{it's}}{\text{possible}} \right)$



science, technology
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Department:
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REPUBLIC OF SOUTH AFRICA

**UN-GGCE Geodesy Capacity Development
Workshop for Africa**
19–23 May 2025, Nairobi

