

AFREF- REGIONAL REFERENCE FRAME

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Department of Land Reform and Rural Development
Republic of South Africa



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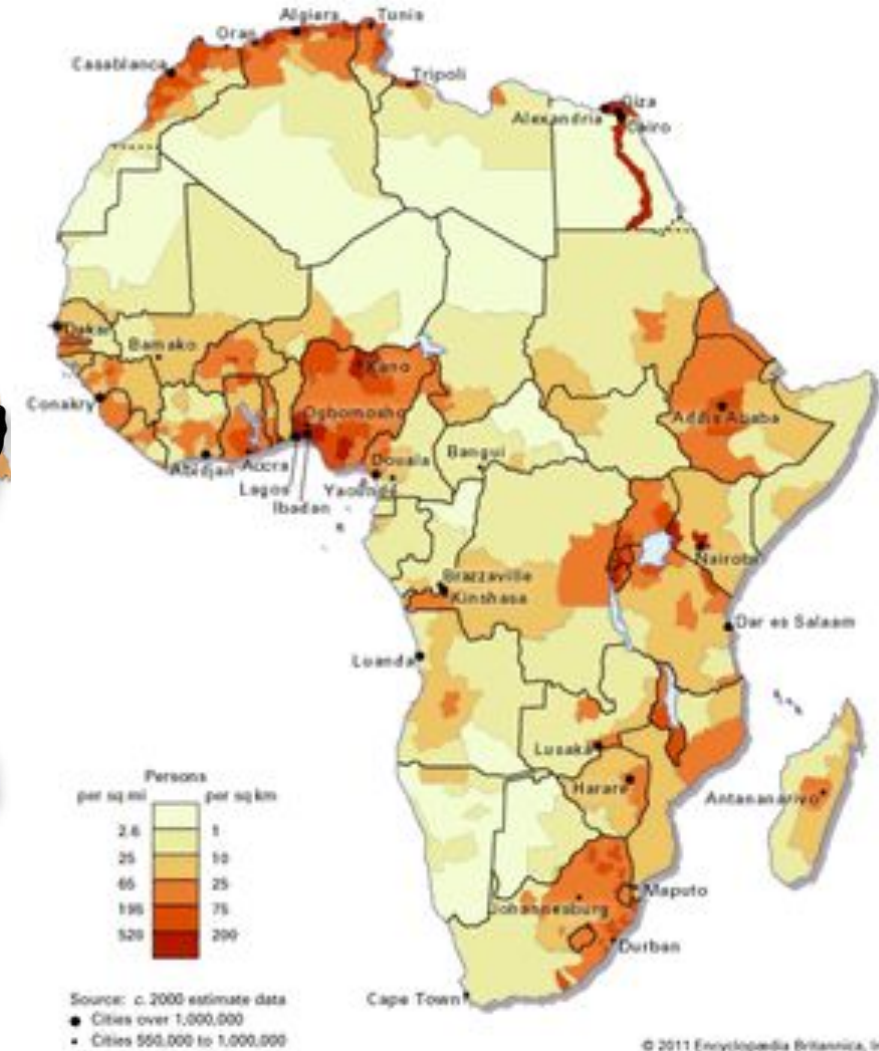
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Africa is BIG!!

China	9596915 sq km
USA	9372570 sq km
Europe	4933927 sq km
India	3280465 sq km
Argentina	2758826 sq km
New Zealand	268674 sq km
Total	30 211 377 sq km

Africa 30 321 130 sq km



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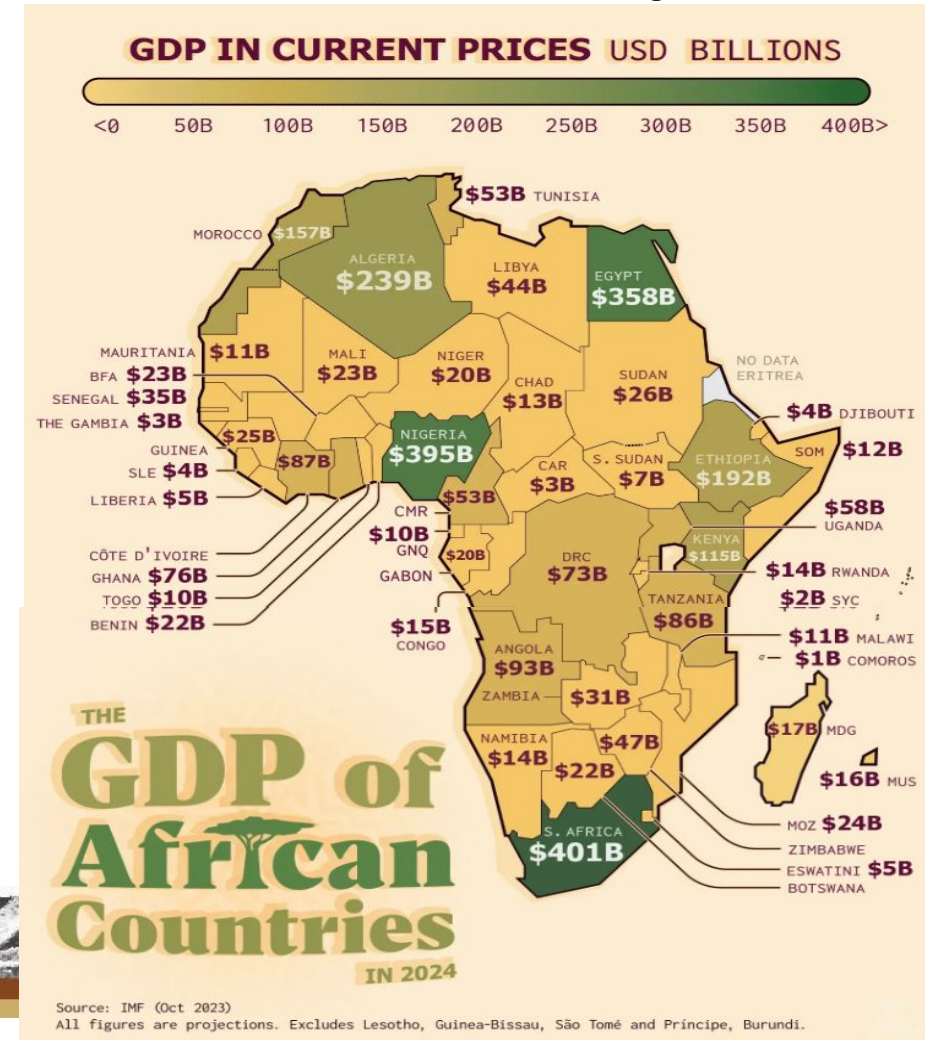
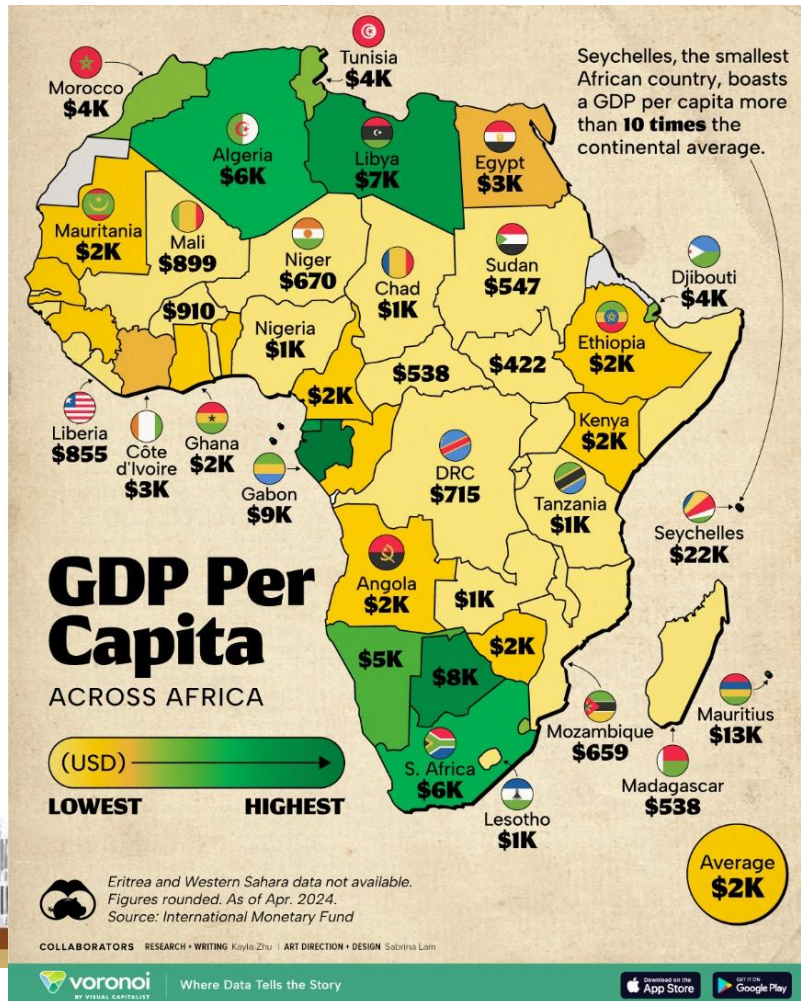
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Africa, poorest continent with Great potential



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Introduction: UN-GGIM: AFRICA

Executive WG3 on AFREF/Geodesy

- At the 10th meeting of the Regional Committee of UNGGIM for Africa, held in Addis Ababa (hybrid), 30 October–1 November 2024, it was resolved to reinstate an executive working group of the Regional Expert working group on AFREF/Geodesy.
- Formally constituted in July 2025.
- **Main Objective:** to address the development, promotion, and implementation of the African Geodetic Reference Frame (AFREF), and ensuring the availability, accuracy, and accessibility of a robust geodetic reference frame for Africa.



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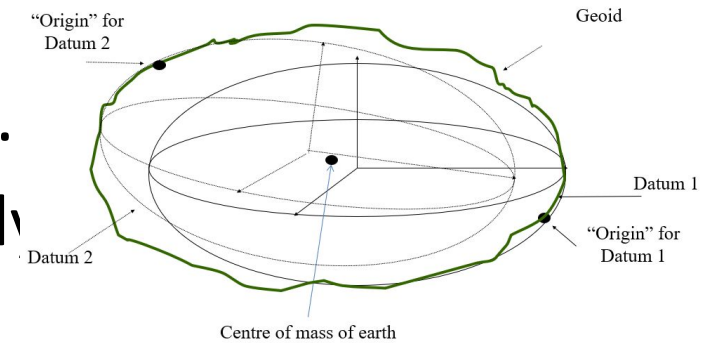
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Problem\Consequences

- Africa is characterised by a multitude of different non-geocentric datums, ellipsoids and different projections.
- Problem is compounded by lack of authoritative and publicly available information for many countries.
- Records of legacy systems either destroyed or not well preserved.
- Unclear strategy within countries as to appropriate datums, projections and transformations strategies to use.



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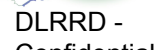


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- 
- South Africa northwards
all the way to Cairo.



UN-GGIM: Africa Working Group 3

African Geodetic Reference Frame/Geodesy

- **Membership, Composition and Structure**
 - headed by a Chair assisted by a Vice-Chair, both drawn from the representatives of the member states:
 - Representatives from national geospatial or mapping agencies of African countries.
 - Experts and professionals with expertise in geodesy, surveying, and geospatial information sciences and technologies.
 - Representatives from relevant international bodies, regional centers/bodies/societies, and industry stakeholders.
- Secretariat support from ECA



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United Nations
Global Geodetic
Centre of Excellence

WG3 Membership



UN-GGIM
UNITED NATIONS
COMMITTEE OF EXPERTS ON
GLOBAL GEOSPATIAL
INFORMATION MANAGEMENT

Secretariat (appointed)		Voting Members (appointed)		Observers Member States (appointed)		Observers (Organizations)	
		1	Cameroon	1	Burkina Faso	1	Trimble (appointed)
1	RCMRD	2	Côte d'Ivoire Chair	2	Ghana	2	AFRIGIST (appointed)
2	UNECA	3	Madagascar	3	Kingdom of Morocco	3	International Federation of Surveyors (FIG)
		4	South Africa (Deputy Chair)	4	Nigeria	4	International Association of Geodesy
		5	Tunisia	5	Uganda	5	UN-Global Geodetic Centre of Excellence
				6	Togo		



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WG3 (AFREF/Geodesy) – Core Activity Framework

- **Governance & Standards**

- Review national geodetic systems and identify gaps
- Develop AFREF guidelines, standards, and best practices
- Ensure alignment with the Global Geodetic Reference Frame (GGRF)

- **Technical Coordination & Infrastructure**

- Coordinate continental AFREF implementation
- Densify and monitor CORS networks
- Establish and operate AFREF Data & Analysis Centres
- Provide technical support to Member States



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WG3 (AFREF/Geodesy) – Core Activity Framework

- **Capacity Building & Knowledge Transfer**
 - Deliver training, workshops, and seminars
 - Facilitate continental capacity-building programmes
 - Support outreach on geodetic reference frame value
- **Advocacy, Partnerships & Sustainability**
 - Advocate AFREF endorsement (AU, RECs, stakeholders)
 - Promote data sharing, interoperability, and quality standards
 - Mobilise funding, equipment, and resources
 - Collaborate with IAG, GGCE, UN-GGIM and partners
 - Monitor progress and report to UN-GGIM: Africa



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AFREF Implementation & Support Cycle (WG3 – Geodesy)

Review & Assessment

- National geodetic systems reviewed
- Gaps and needs identified

Standards & Alignment

- AFREF guidelines and standards developed
- Alignment with Global Geodetic Reference Frame (GGRF)

Continental Implementation

- AFREF implementation coordinated,
- CORS networks densified and monitored
- Data & Analysis Centers operated

Capacity Building

- Training, workshops and seminars delivered
- Continental capacity strengthened

Advocacy & Partnerships

- Training, workshops and seminars delivered
- Continental capacity strengthened

Monitoring & Sustainability

- Resources mobilised
- Progress monitored & Reporting to UN-GGIM: Africa



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WG3: Call for Participation in the Second Continental Computation of the AFREF

- **Call for provision of data from all African Countries**
- **Provisional dates postponed**
- **Specifications:**
 - 7 daily 30 Sec RINEX 3 (preferable) or RINEX 2.x , all constellations
 - If no CORS available, requesting campaign
 - At least 2 stations per country – many as possible
 - Computation to be done by various countries
 - Wherever possible approximate transformation parameters from local datum to AFREF(2) to be computed per country.



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REGIONAL COORDINATION



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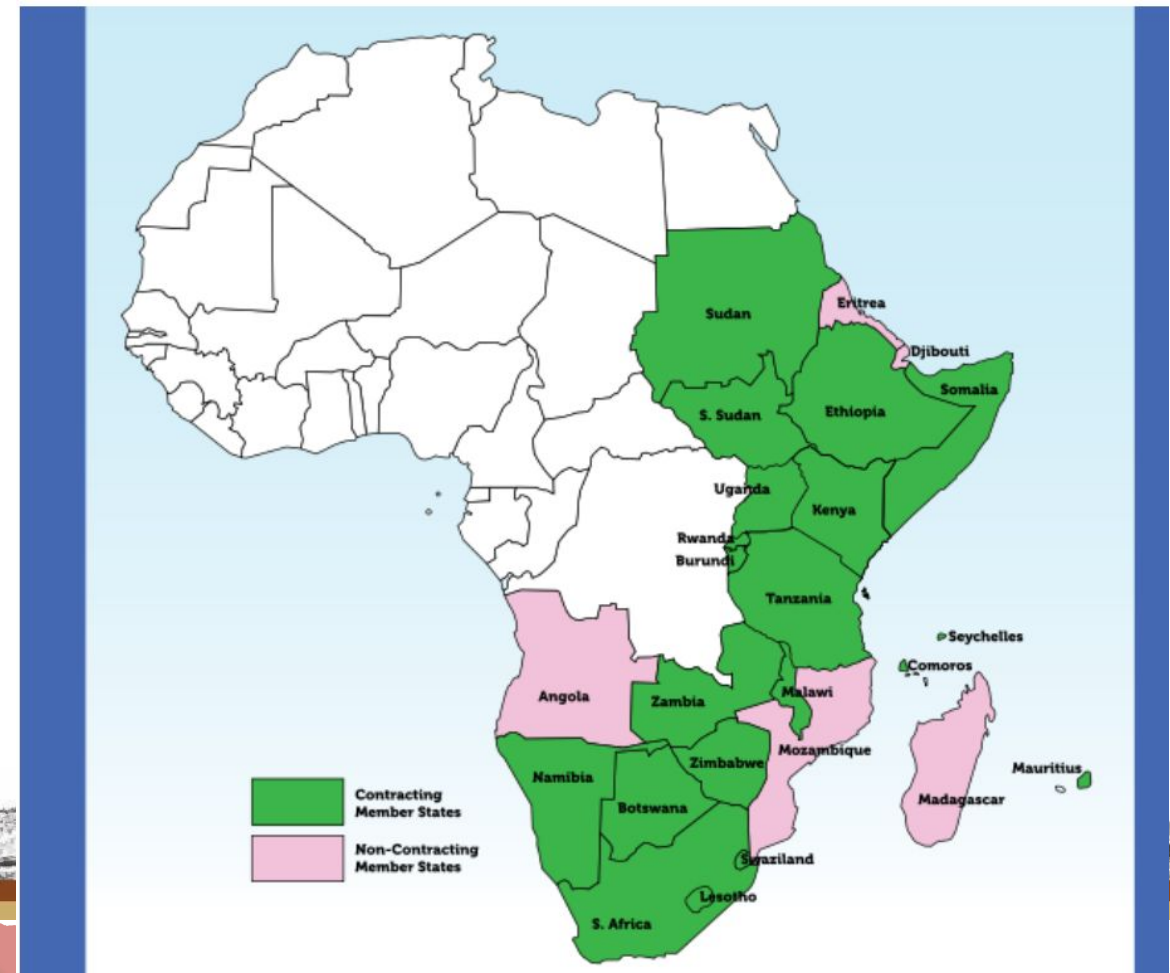
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Regional Centre for Mapping of Resources for Development (RCMRD)



- The Regional Centre for Mapping of Resources for Development (RCMRD) was established in Nairobi – Kenya in 1975 under the auspices of the United Nations Economic Commission for Africa (UNECA) and the then Organization of African Unity (OAU), today African Union (AU).
- RCMRD is an inter-governmental organization and currently has 20 Contracting Member States in the Eastern and Southern Africa Regions



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Regional Centre for Mapping of Resources for Development (RCMRD)

- **Overview:**
 - RCMRD plays a vital role in AFREF capacity building, training about 25 professionals annually on AFREF and GNSS data processing.
 - The training programs have been critical in creating awareness on the project and building the capacities of its member states to implement the AFREF project.
 - The training programs led by RCMRD are designed to significantly enhance national capabilities, ensuring effective AFREF implementation across Member States through skill development in key geodetic areas.
- **Target group:** Land surveyors, Geodesist, Engineers, Earth Research Scientists, and Cartographers from RCMRD member States with experience in GNSS technologies



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AFREF & GNSS Capacity Development at RCMRD

- **Key Training Areas:**

- Reference Frames: Principles, realization, and datum transformation from legacy to ITRF
- GNSS positioning, ephemerides, and data processing
- CORS standards, installation, operation, and maintenance
- GNSS levelling, vertical datums, and height modernization

- **Impact:**

- Over 450 professionals trained
- Strengthened national capacity for AFREF implementation
- Improved management and utilization of GNSS/CORS infrastructure
- Enhanced regional collaboration and knowledge sharing in geodesy
- Increased accuracy and consistency of geospatial data

- **Challenges:**

- Resource constraint as RCMRD can fund only one participant from each member State
- Training is basic, limiting participants' ability to perform advanced AFREF operations, including computations.



- African Regional Institute for Geospatial Information Science & Technology (AFRIGIST) was formerly known as RECTAS.
- Established in 1972 under the auspices of the United Nations Economic Commission for Africa (UNECA), with full diplomatic immunity in Nigeria.
- A Centre of Excellence for specialised and quality graduate training, education and research in aerospace and geophysical surveys/geospatial information science and technology, as well as the strengthening of essential national mapping capacities for the sustainable development of Africa.

AFRIGIST: Geodesy Capacity Development

- ❑ AFRIGIST provide theoretical and practical training and research in the fields of Geospatial Information Science and Technology, including:

👉 **Geodetic Science**

👉 **Hydrography and Marine Science**

👉 **Photogrammetry & Remote Sensing;**

👉 **Cartography & Geovisualisation &**

👉 **Geographic Information Science;**

Applications in:

- ◇ **geodetic control & reference frame**
- ◇ **geodetic mapping,**
- ◇ **land administration,**
- ◇ **geophysical surveys,**
- ◇ **Health and epidemiology,**
- ◇ **agriculture and water**
- ◇ **environmental monitoring**
- ◇ **climate change,**
- ◇ **natural resources management,**
- ◇ **infrastructure mapping,**
- ◇ **security and safety**
- ◇ **geohazard & disaster management,**
- ◇ **transport, navigation, etc.**



Station is being replaced with New Antenna



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Geodesy Capacity Development Workshop for Africa

- Very Successful workshop held in Nairobi 19-23 May 2025
- Theme: Transitioning to a Modern Geospatial Reference System
- Attendance attended by XXX members of XX countries
- Huge thank you to UNGGCE and partners for organization
- Countries encouraged to complete factbook and roadmap

The Roadmap



Guidance on how to build a country's Geospatial Reference System



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UNGGCE Geodesy Capacity Development Workshop- Africa



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The Place of Centre for Geodesy and Geodynamics Toro, Nigeria in Global Space Geodetic Observation



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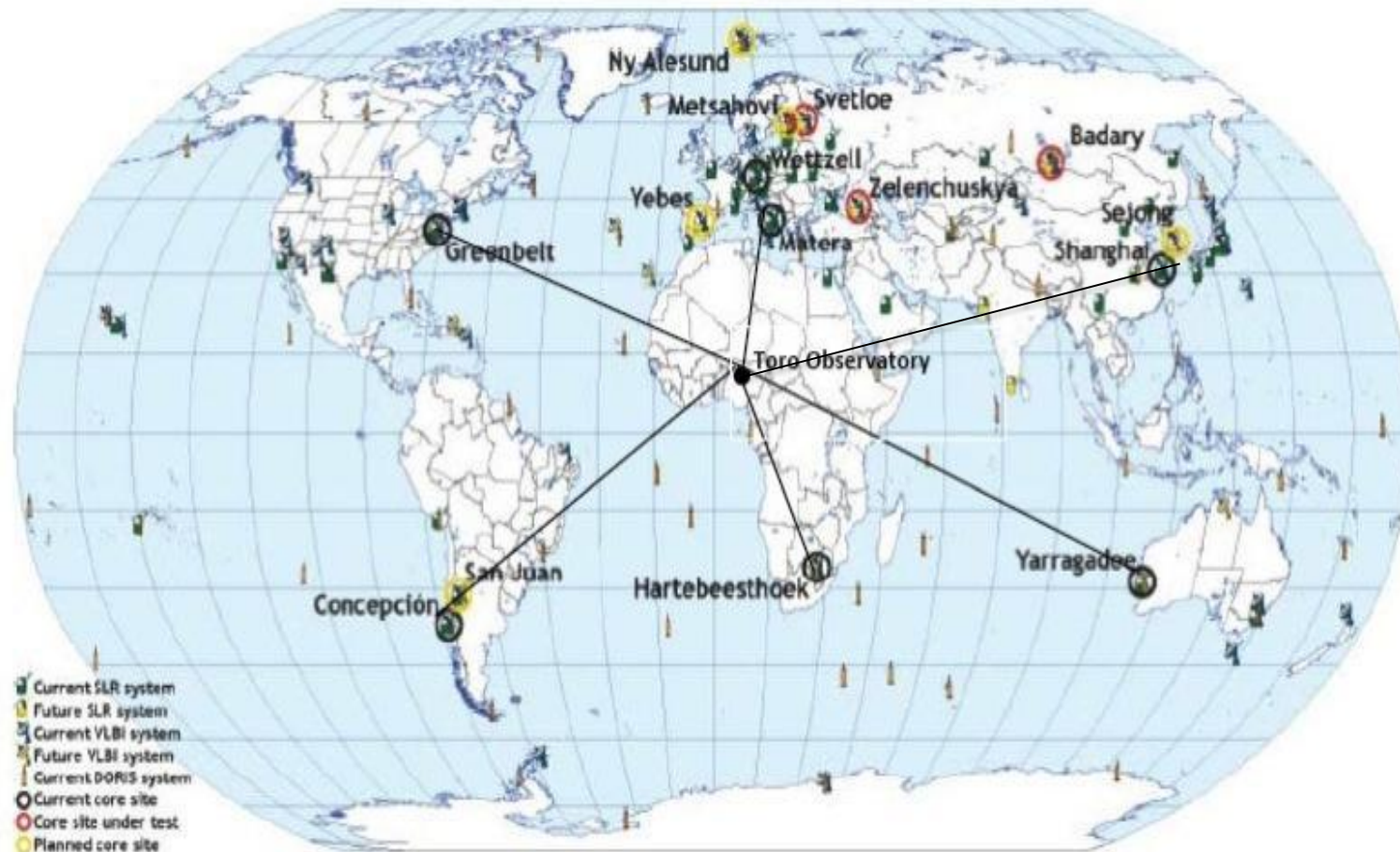


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CGG Toro as GGOS “Candidate Site”



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SPACE GEOGESY INFRASTRUCTURE AT CGG TORO

- Inter
CGG



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SPACE GEOGESY INFRASTRUCTURE AT CGG TORO

- Very Long Baseline Interferometry Global Geodesy Observation System (VGOS) at CGG Toro.



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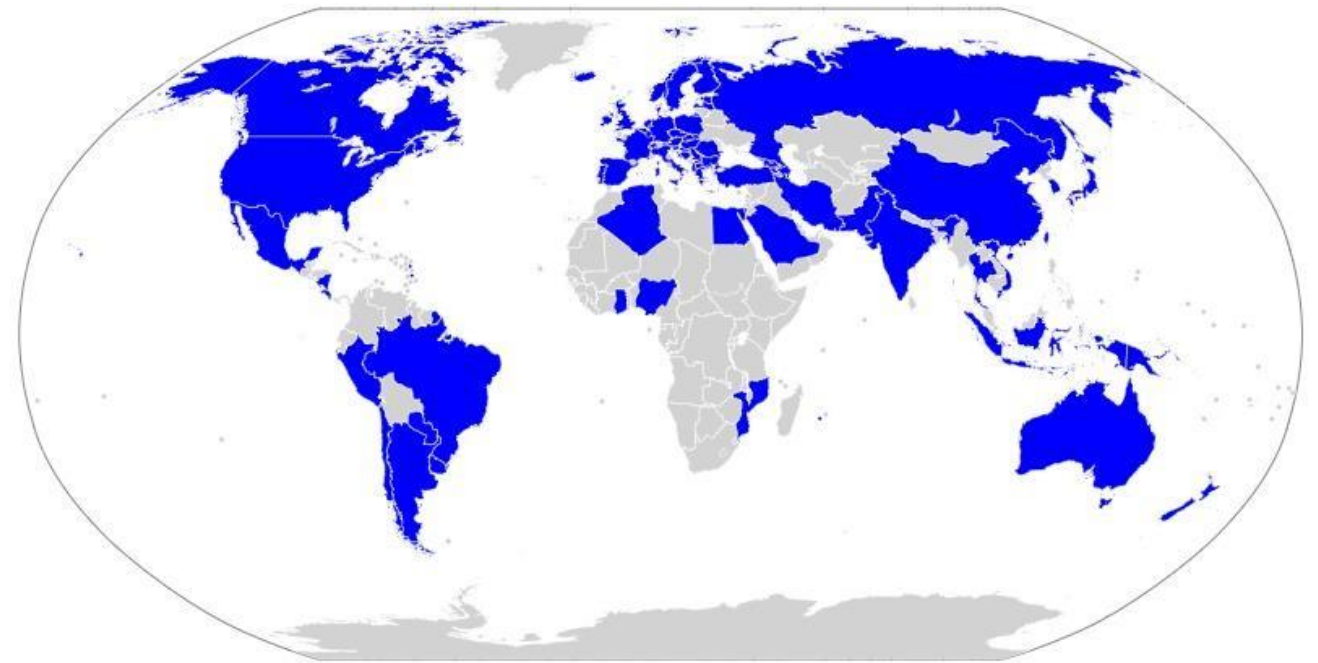
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African Membership of IAG

- Although many countries participate in IAG services
- Encourage more African States to be formal members of IAG through IUGG

Member Countries of IUGG
with National IAG Correspondents



Legend: ● IUGG Member Countries with IAG National Correspondents
(geodesy.science | last update: 2026-02-11)



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Purpose: South African Geodesy Working Group

- To coordinate the development and oversee the implementation of a long-term **South African Geodesy Strategy** that is:
 - Aligned with the UN-GGIM Global Geodetic Reference Frame (GGRF) Roadmap;
 - Aligned with the UN-GGCE 1st Joint Development Plan;
 - Integrated with national science, technology, and innovation policies;
 - Responsive to South Africa's spatial data infrastructure (SDI) requirements; and
 - Supportive of regional and continental geodesy coordination and global geodesy governance.



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AFREF Data Centre

GNSS data from “AFREF” CORS is currently being achieved at AFREF Operational Data Centre, (AODC), <ftp://ftp.trignet.co.za/AfrefData/>

Currently being hosted by National Geo Information (NGI) agency in South Africa.

Other documents relating to AFREF can be found at AFREF website at UNECA and at RCMRD.

Sufficient participation remains a challenge



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GGOS Africa

- GGOS is the scientific and technical backbone behind:
 - The UN Global Geodetic Reference Frame (GGRF)
 - UN-GGIM geodesy resolutions
 - Global coordination of geodetic infrastructure
- South Africa offering to take lead in establishment of GGOS Africa.
- GGOS integrates and coordinates observations from multiple space- and ground-based geodetic techniques.



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Ends



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