

DEVELOPMENTS OF GEODESY IN AFRICA

From observation to intelligence

Strengthening observations, analysis and human capacity for an African
geodetic capability

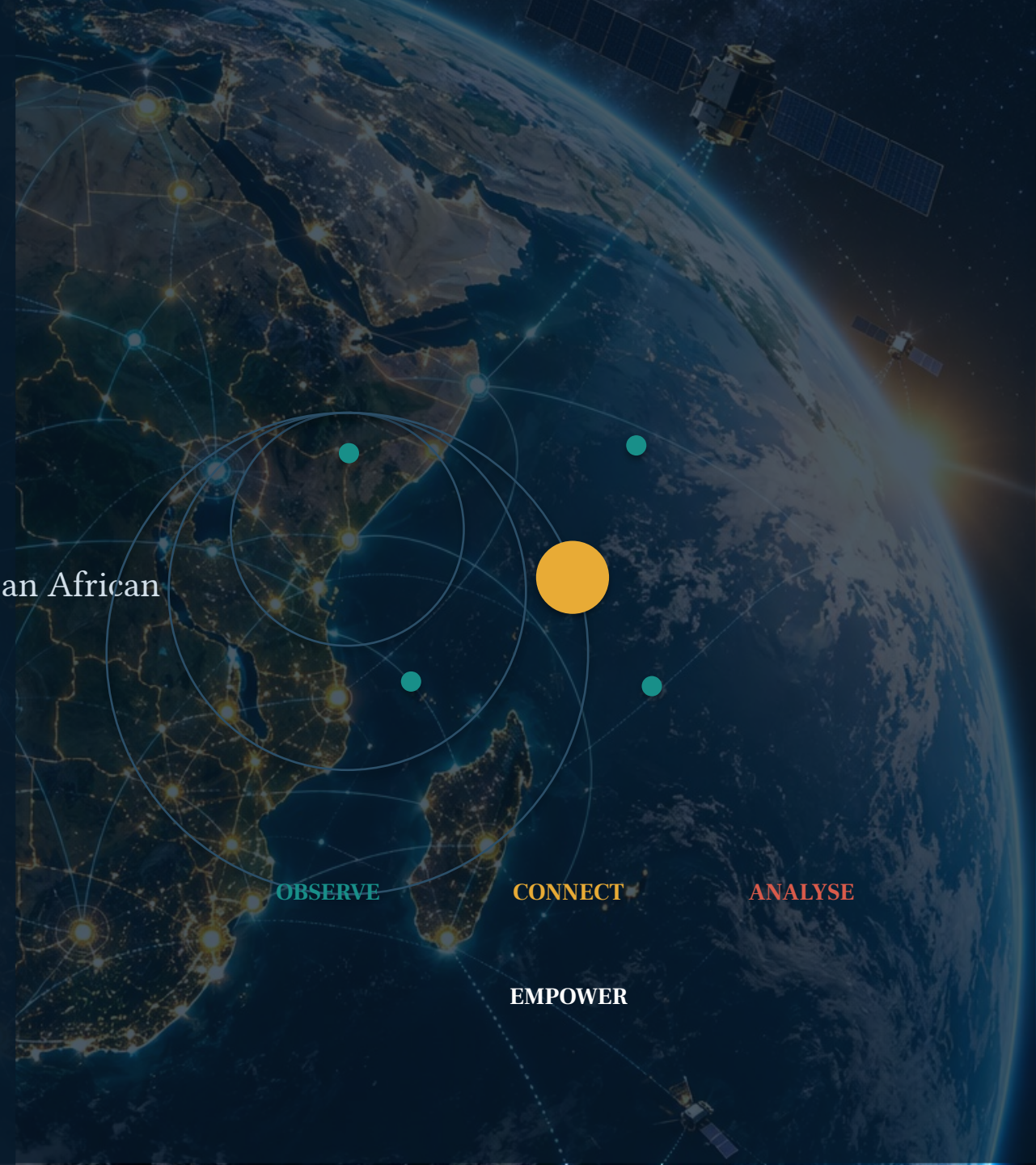
Andre Nonguierma | UN-GGIM: Africa

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OBSERVE

ANALYZE

INSPIRE



OBSERVE

CONNECT

ANALYZE

EMPOWER

Geodesy is Africa's invisible infrastructure

Every modern geospatial service begins with a trusted answer to: “Where, exactly?”

01

Borders

Common coordinates reduce ambiguity

02

Infrastructure

Corridors connect across jurisdictions

03

Climate

Change is measured through time

04

Digital economy

Positioning enables services at scale

OBSERVE

CONNECT

ANALYSE

EMPOWER

**A unified reference frame is not a technical “nice-to-have”.
It is the “must-have” coordinate layer beneath planning, safety, science
and integration.**

A 150-year pursuit of one African frame

Three eras. One persistent continental ambition.



The 30° Arc: a continental feat measured point by point

A scientific and logistical achievement spanning generations.

7,100 km

Approximate arc length from southern Africa toward Egypt

600+

Triangulation points

13

Modern-day countries crossed

75 yrs

From 1879 to completion in 1954

“Exactly measured lines on which geographical work would be based.”



ADOS proved continent-scale cooperation was possible

The technology changed. The coordination challenge remained.



300+

Stations with data available

≈45

Participating countries

1982–86

Observation and computation period

Lesson

Campaign success does not automatically become an operational reference frame.

From periodic campaigns to a sustained continental service

A geocentric frame, aligned to ITRF, accessible across Africa

The programme links reference systems, infrastructure, standards and capabilities

OBSERVE

Permanent GNSS Infrastructure

At least one CORS anchor in every country
Continuous stations, $\leq 1,000$ km spacing, with open-access data availability

CONNECT

Open data flows

Stations $\rightarrow$ data centres $\rightarrow$ users:
Transformation parameters linking existing national frames to ITRF while preserving historical data.

REALIZE

Continental frame

Coordinates, velocities and vertical datum
A standardized vertical datum supporting a precise African geoid model.

TRANSFER

Capabilities and Sustainability

In-country expertise
Operate, process, analyze, maintain
Technology transfer, institutional development and stronger national GNSS processing capacity.

AFREF’s ambition: users anywhere in Africa within 1,000 km of a permanent station, with density increasing toward 500 km

Institutional Landscape

A programme supported by a broad geodetic ecosystem

1

ECA

Recognition, Working Group and
programme integration

2

UNOOSA

Acknowledgement of AFREF applications
and support to participation

3

IAG

Ongoing technical support and
organizational coordination

4

IGS

Commitment and support to AFREF-
related activities

5

FIG

Support to key AFREF workshops

6

UNAVCO

Support and participation in AFREF-
related events

Institutional acceptance and technical support are reflected in the source deck

Proposed governance: simplify, align, accelerate

The source proposal concentrates coordination while separating technical and scientific advisory roles

AMCOST • oversight, monitoring & evaluation

AU / ECA JOINT SECRETARIAT

1

Coordinate implementation

Capacity building • review meetings • fundraising

2

Technical Advisory Working Group

Reconstituted from the UN-GGIM AFREF working group; UNOOSA representation

3

Scientific Advisory Working Group

Scientific oversight with IAG, IGS, FIG, ICA, ISPRS and other partners

4

Streamlined governance

Dissolve the current International Steering Committee to avoid duplication

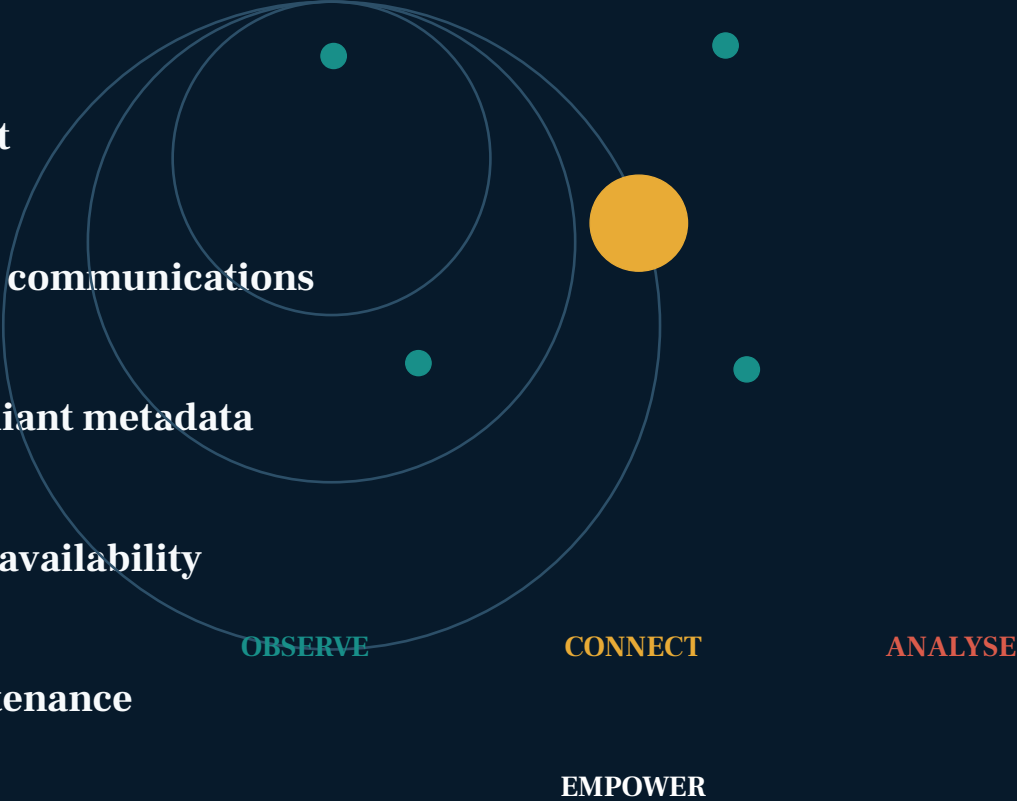
A governance mechanism is the bridge between a technical network and a continental public good

The Network | A station is not simply hardware. It is an Earth observatory

Continuous measurements turn position into an evolving picture of Earth



- Stable monument
- Reliable power & communications
- Standards-compliant metadata
- Continuous data availability
- Long-term maintenance



~89%

of African countries have CORS

91%

of those CORS are government-operated

1

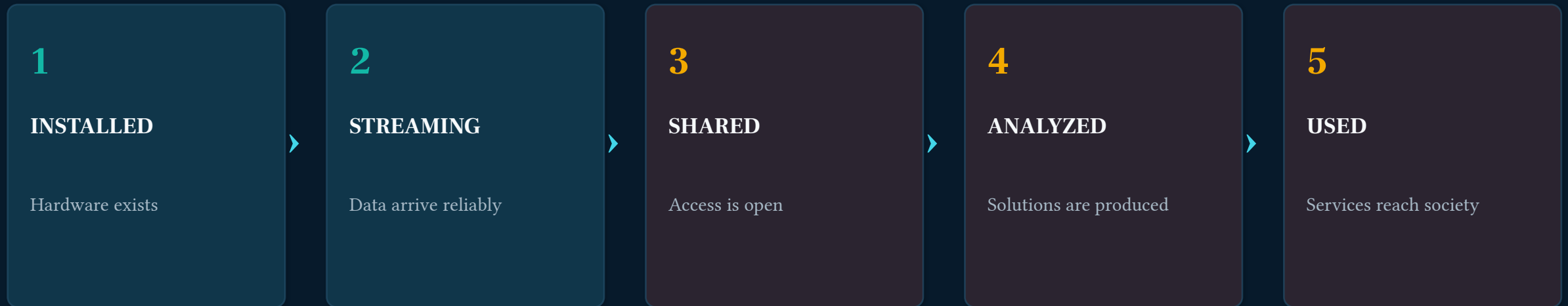
fully operational VLBI station in Africa

7

DORIS network stations in Africa

The real gap is not only where stations are absent

It is also where data, maintenance or integration are missing.

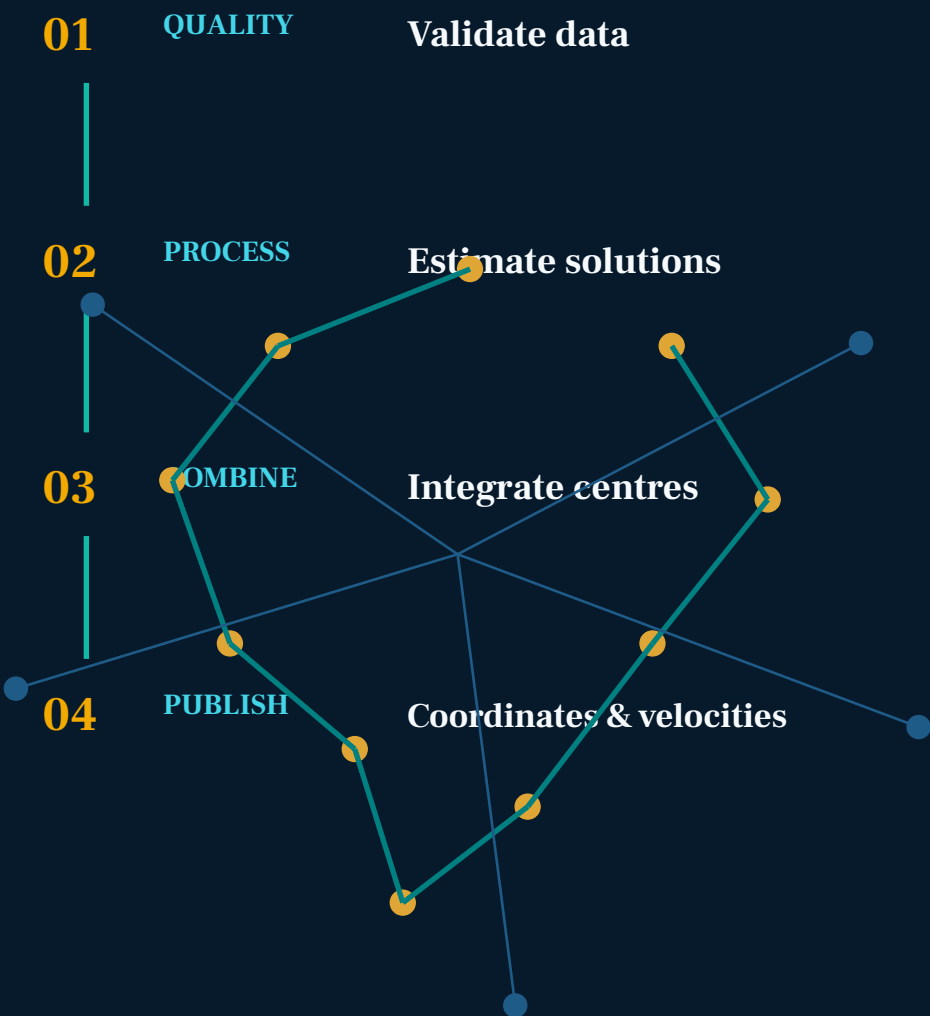


2017 baseline: 112 stations listed in the AFREF ODC, but fewer than 50 supplying daily data.

The operational metric is continuity, not inventory.

Data & Analysis Centres: Observations become public value only through analysis

Data centres keep the record. Analysis centres create the reference frame.



Build a resilient African geodetic service chain

Governance and operations must be designed together.



Resilience comes from clear ownership, redundancy, standards and sustained funding

People are the most important geodetic infrastructure

Equipment depreciates. Capability compounds. Technology empowers.

OPERATE	Station installation & maintenance
ANALYZE	GNSS processing & reference frames
LEAD	Programme management & partnerships
TEACH	Universities & regional centres

The capacity pipeline must connect training
→ responsibility → retention → leadership.



Where we want to be

A trusted African geodetic infrastructure that is open, connected, computationally coherent and institutionally sustainable.

Connected

GNSS infrastructure

Open

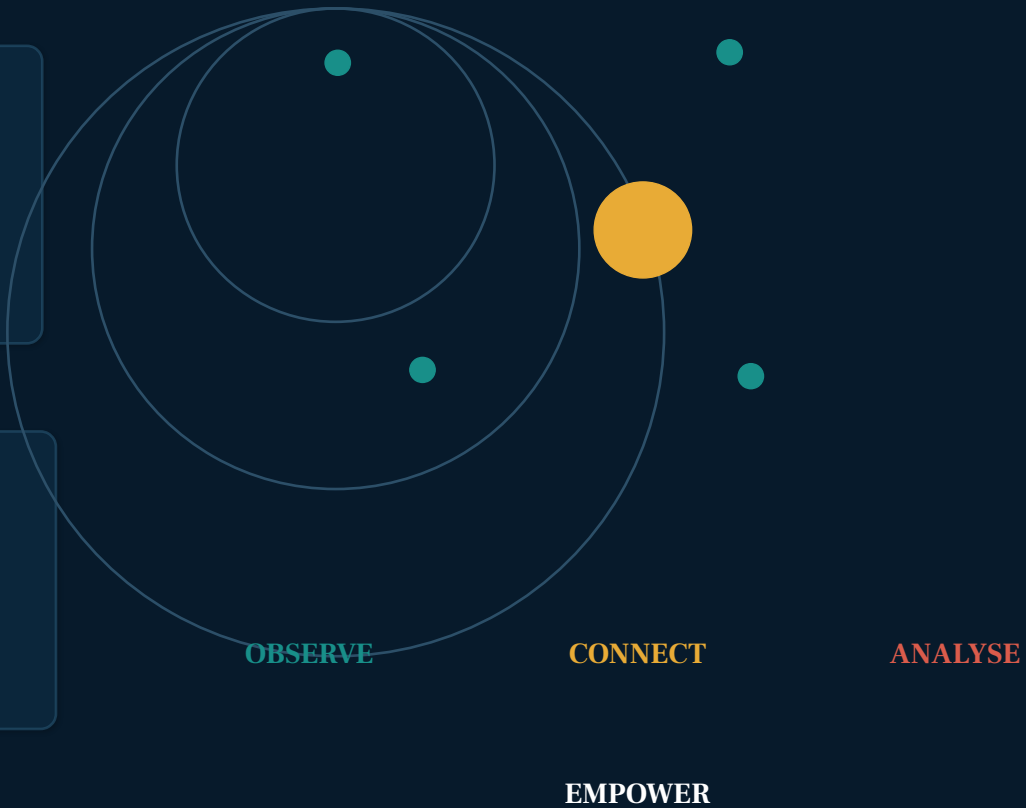
Data availability

COHERENT

Reference & transformation

Sustainable

African capability



Move from isolated successes to a shared African service

The next chapter: a coordinated continental observing system

Infrastructure + open data = a usable continental reference

A

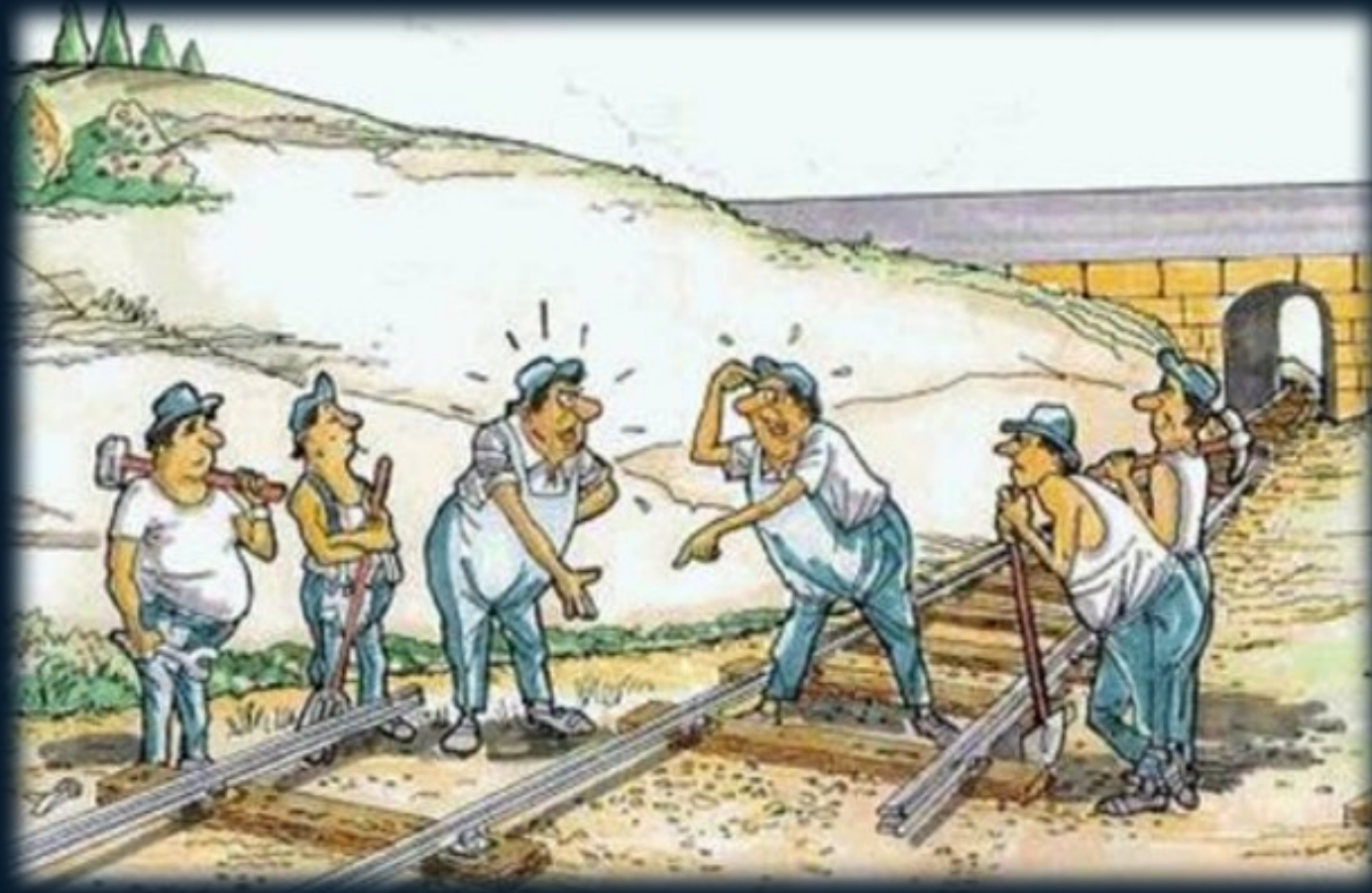
1 CLOSE THE GAPS

Identify gaps and determine optimal locations for new GNSS reference stations across Africa.

B

2 OPEN THE DATA

Advocate for open and unrestricted release of GNSS data by African countries, prioritizing reference-station data availability.



OBSERVE • ANALYZE • INSPIRE

OBSERVE

Sustain stations and open data

ANALYZE

Build African centres and solutions

INSPIRE

Invest in the next generation

Africa's geodetic future is not about catching up
It is about becoming indispensable

Thank you