



Geodesy Education and Research at Traditional Universities



Current Provision and Future Needs

Siphiwe Mphuthi and Patroba Odera | UCT

Mulemwa Akombelwa | UKZN

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Why geodesy matters

Reliable positioning, reference frames and heights support national priorities



● Teaching in the basic curriculum

- 01 Satellite surveying**
Multi-GNSS, PPP and RTK, network adjustment, frames and quality control
- 02 Control networks**
Horizontal and vertical control
- 03 Space geodesy**
VLBI, SLR, LLR, GNSS and DORIS concepts and applications
- 04 Physical geodesy**
Gravity field, geoid modelling and height systems
- 05 Applied practice**
Reduction, computation and uncertainty assessment

- **Who teaches geodesy**
- Four-year university programmes: **UCT and UKZN**
- Three-year universities of technology: **DUT, MUT, TUT and CPUT**
- Geodesy sits within geomatics and surveying programmes, with depth varying by institution
- Postgraduate training in specialised geodesy remains limited

- **The postgraduate pipeline needs strengthening**

Limited MSc and PhD training constrains future research and teaching capacity.

● Skills and curriculum needs

1

Physical geodesy

Gravity data handling, geoid modelling and uncertainty budgets

2

Geometrical geodesy

GNSS and InSAR for horizontal and vertical deformation

3

National infrastructure

Practical work with TrigNet, HartRAO, gravity and levelling ties

4

South African datasets

Real observations, transformations and reference-frame practice

- **Regional and global alignment**

- **Reference frames**

- AFREF and ITRF consistency
- Continental integration and shared data practices
- South African contributions to regional reference-frame work

- **Height systems and collaboration**

- IHRF-aligned height modernization
- National vertical datum considerations
- UN-GGCE and GGOS Africa training opportunities

• Geodesy training pathway



B.Sc. 4 year degree Geomatics and surveying foundations

Specialised research training

Research leadership and future teaching capacity

Geodesy research profile

Moderat

e

Positioning applications

LOW

Earth rotation and
geodynamics

LOW

Reference systems and gravity
field or geoid modelling

• Research challenges



- Lack of specialised research facilities for physical geodesy research. [Specialised gravity modelling centre needed)
- Fragmented research conducted by university researchers. [Collaborative research needed between SRAO, SANSA, NGI, CoG, Universities etc)
- Lack of funding for high impact research. [Research funding needed]
- Lack of national geodesy framework to coordinate geodesy teaching and research [current initiative!)

● Teaching strengths and existing assets



- Students develop GNSS RTK and NTRIP field skills
- They practise network quality control and coordinate transformations
- They learn about datums, tide systems and observation epochs
- Exposure to InSAR and GNSS deformation applications is growing

● Useful infrastructure already exists

TrigNet supports the surveying community. HartRAO provides a multi-technique environment, while SANSA archives and computing lower student analysis costs.

● Pain points and resourcing



● Pain points

- Open GNSS-levelling workflows and geoid validation remain limited
- Access to gravity instruments and field campaigns is scarce
- The postgraduate pipeline in physical geodesy is thin

● Resourcing pathways

- Bursaries and mini-grants through NRF/DSI, SANSA and SARAO
- Shared access to relative gravimeters and partners for absolute observations
- IGS/VLBI internships and GGOS Africa or UN-GGCE training



**Build and fund a coordinated geodesy
capacity-building programme in South Africa.**

South African Geodesy Working Group

Thank you



Dr Siphiwe Mphuthi | UCT
siphiwe.mphuthi@uct.ac.za

A/Prof Patroba Odera | UCT
patroba.odera@uct.ac.za

Dr Mulemwa Akombelwa | UKZN
Akombelwa@ukzn.ac.za

