

# **Geodesy Teaching, Training and Research at South African Universities**

**(Pillar 7: Human Capacity Development)**

South African Geodesy Working Group  
Workshop (1-2 October 2025)

**Presenters:** S. Mphuthi, P. Odera (UCT), and  
M. Akombelwa (UKZN)



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# Why Geodesy Matters (in South Africa)

- Positioning for land administration, engineering & BIM, natural hazards and disaster management, and infrastructure monitoring.
- Climate change and sea level monitoring in space and time.
- Tectonic motion and crustal deformation monitoring
- Modern reference frames (**ITRF/AFREF**) and height modernization (**IHRF**)
- Industry productivity: **GNSS** - RTK/PPP, geoid-based heights, deformation monitoring



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# Who Teaches (Current Footprint)

- Universities (4-year programme): **UCT, UKZN**
- Universities of Technology (3-year programme): **DUT, MUT, TUT, CPUT**
- Embedded in Geomatics/Surveying programmes (UG → Honours/PG) with varying depth
- Minimal training at postgraduate level (**MSc & PhD**) hence very low capacity building in Geodesy



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# Teaching (Basic Curriculum)

- **Satellite Surveying:** multi-GNSS, PPP/RTK, network adjustment, frames & tide systems, quality control
- **Control Networks:** horizontal and vertical.
- **Space Geodesy exposure:** VLBI, SLR, GNSS, DORIS concepts & applications
- **Physical Geodesy:** gravity field & models, geoid/height systems, RCR pipeline, uncertainty budgets



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# Skills & Curriculum Gaps (Needs)

- **Physical geodesy practice:** gravity data handling, geoid modelling (RCR), uncertainty budgets
- **Hands-on with national infrastructure:** TrigNet workflows; HartRAO labs; gravity/levelling ties
- Reference-frame hygiene taught with real SA datasets and transformations



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# Skills & Curriculum Snapshot (Strengths)

- **Field skills:** GNSS RTK/NTRIP, network QC, coordinate transformations
- **Reference-frame awareness:** datum, tide system, epoch management
- **Emerging exposure:** InSAR, deformation, GNSS synergies



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# Level of Geodesy Research in SA Universities

- Positioning Applications (**moderate**)
- Earth rotation and Geodynamics (**low**)
- Reference systems and frames (**low**)
- Gravity field modelling including geoid modelling (**low**)



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# 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, CGS, 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!)



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# Regional & Global Alignment

- AFREF / ITRF consistency: continental frame integration and data-sharing norms
- IHRF-aligned height modernization and vertical datum considerations
- Participation in UN-GGCE/GGOS Africa initiatives and training opportunities (e.g., recent UN-GGCE capacity building workshop in Kenya)



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# Resourcing & Partners

- **Bursaries & mini-grants:** NRF/DSTI, SANSA training calls, SARAO student programmes
- **Equipment pathway:** borrow/rent relative gravimeter; partner for absolute visits; upgrade GNSS kits
- **International:** IGS/VLBI internships, GGOS Africa training, UN-GGCE workshops



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# What's Working Well

- TrigNet continuity & modernization; services to the surveying community
- HartRAO multi-technique co-location and VLBI participation
- SANSA's data archives + on-platform compute that lower student analytics costs



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# Call to Action

- Develop and fund geodesy capacity building in South Africa.
- Nominate institutional focal points (academic + technical)
- Commit to data-sharing and joint student supervision across institutions
- Ring-fence seed funding for campaigns, lab kits, and shared training resources



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# Thank You

- Dr Siphiwe Mphuthi – UCT ([Siphiwe.Mphuthi@uct.ac.za](mailto:Siphiwe.Mphuthi@uct.ac.za))
- A/Prof Patroba Odera – UCT ([Patroba.Odera@uct.ac.za](mailto:Patroba.Odera@uct.ac.za))
- Dr Mulemwa Akombelwa – UKZN ([Akombelwa@ukzn.ac.za](mailto:Akombelwa@ukzn.ac.za))



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