

What is Geodesy and Why is It Important?

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Restless Earth

- The Earth is a restless planet.
- Subject to a wide range of external and internal processes that change its shape (including continental, oceanic and ice-covered areas), the distribution of mass between and within its components, and its rotation and orientation in space.



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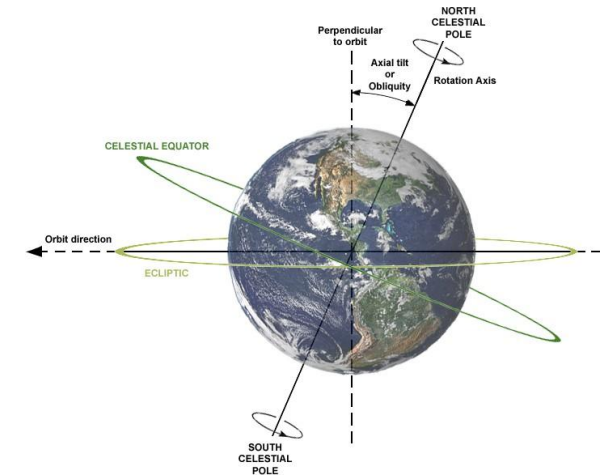
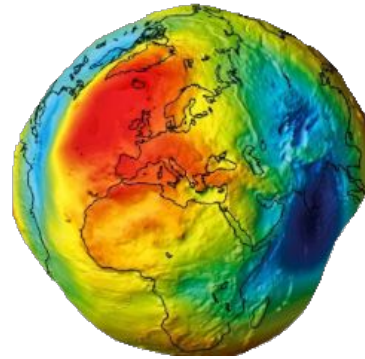
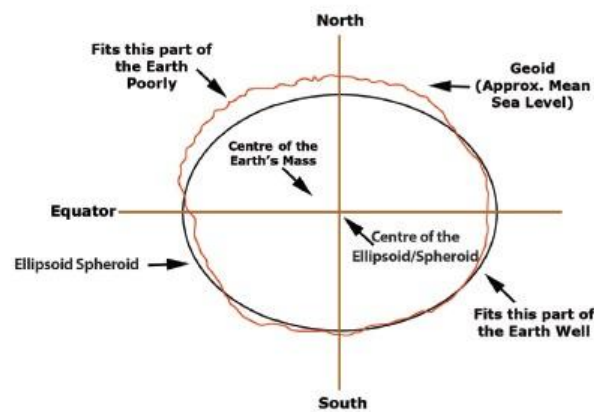


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What is Geodesy

- Geodesy is the science of precisely measuring Earth's **shape**, **gravity field** and **rotation** of the Earth as a function of space and time.



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What does Geodesy involve ?

*Geodesy involves measuring and understanding the Earth's **geometric** and **physical** properties, including:*

- *Determining exact locations*
- *Developing coordinate systems (reference frames)*
- *Monitoring the Earth's gravity field*



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What does Geodesy involve ?

- *Measuring variations of the Earth rotation*
- *Tracking the movement of tectonic plates and surface deformation*
- *Measuring sea level changes, ice melting and global water cycle*
- *Detecting environmental changes*



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Everything happens somewhere



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Geodesy – Framing our World

- Imagine trying to navigate on a changing planet without a stable frame of reference — it would be like trying to measure the displacement of one moving object from another moving object.



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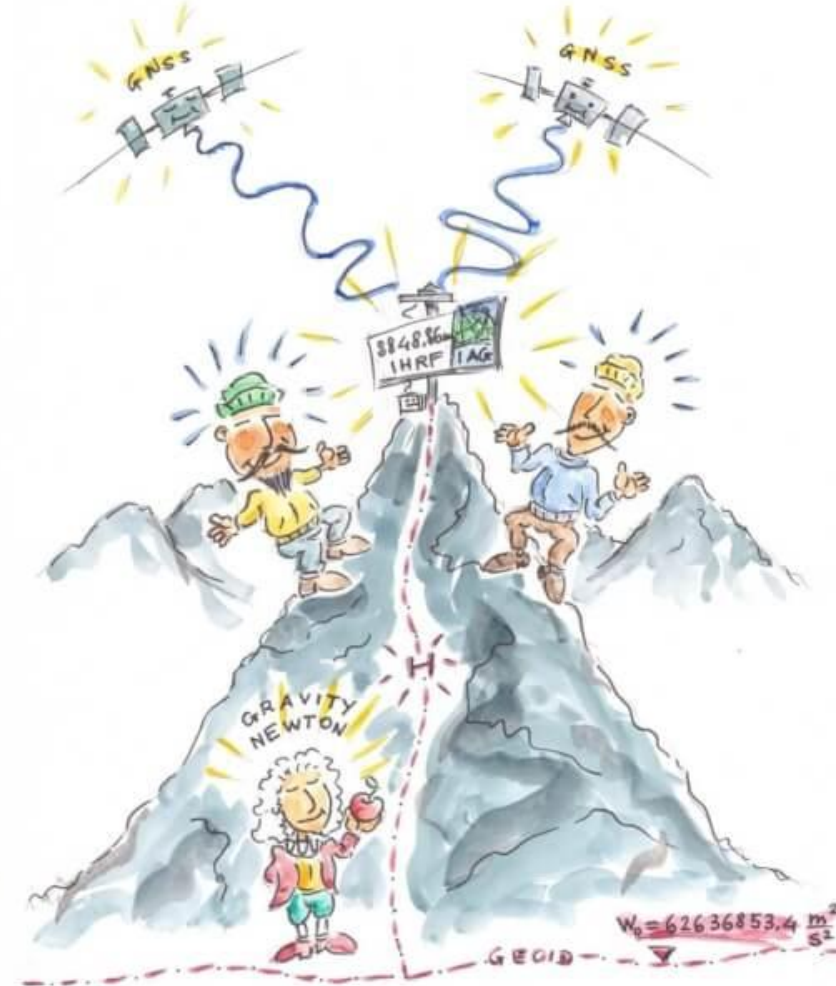
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The new Height of Qomolangma (Mt. Everest)



Before

The height was measured with respect to mean sea level observed at different locations.



Now

The new height refers to a global unified reference level (the geoid), based on the International Height Reference Frame (IHRF)



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Connecting with historical context

Datum	Ellipsoid	a	b	Unit	Used
Tete, Observatoria and Madzansua	Clarke 1866	6378206.4000	6356584.4670	International metres	Mozambique
Campo de Aviaco	Clarke (1880)	6378249.1450	6356514.8700	International metres	Angola
Arc 1950	Mod. Clarke 1880	6378249.1450	6356514.9670	International metres	Botswana, Zimbabwe, Lesotho, Swaziland
Shwarzeck	Bessel	6377397.1550	6356078.9630	German Legal meters	Namibia
Hartebeesthoek94	WGS 84	6378137.0000	6356752.3140	International metres	RSA



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Geodesy - Navigation and Mobility

- Geodesy is essential for satellite positioning applications such as GNSS (Global Navigation Satellite Systems), observation of the Earth from satellites, land management and climate studies.

Lost Without Geodesy



No GNSS – No Position



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Geodesy - Saving Lives

Geodesy in Disaster Management and Risk Reduction

- When every second counts, geodesy can make the difference between safety and catastrophe.
- By enhancing early warning systems for earthquakes, tsunamis, and volcanic eruptions, geodetic technologies such as GNSS are helping to save lives.



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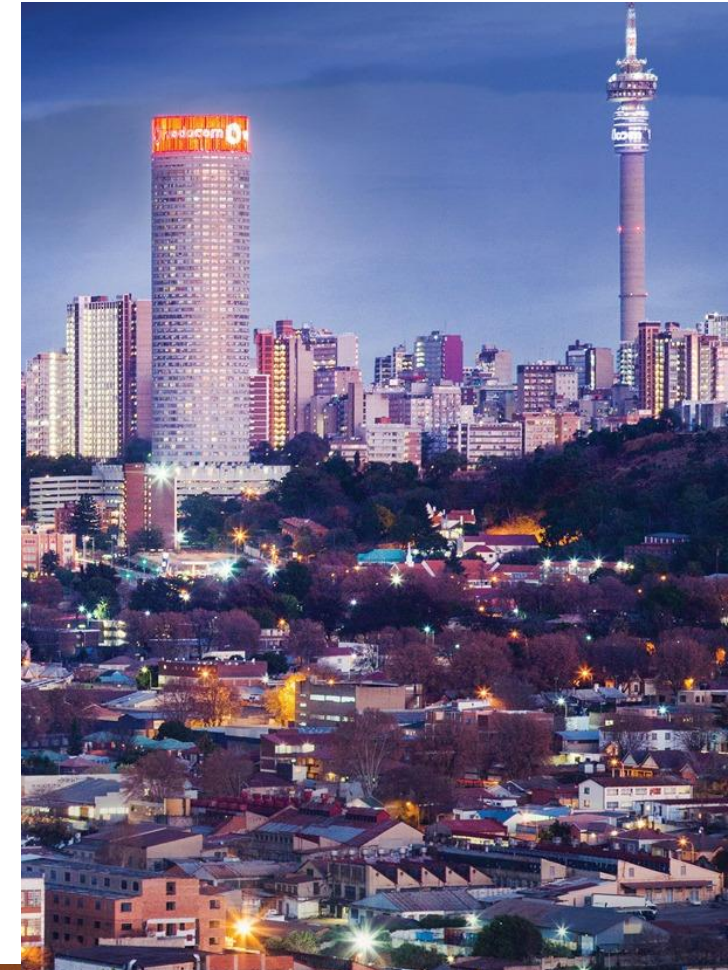
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Building the Future

Geodesy in Urban Planning and Infrastructure

- Modern cities need solid foundations — and not just in concrete.
- Geodesy provides the precise position and elevation data that urban planners and engineers rely on to design infrastructure, manage land and resources efficiently, monitor deformation, and ensure structural safety.



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Earth Gravity Field

- Gravity is much more than a force that keeps us on the ground — it is critical to understanding the structure and changes of the Earth system.
- Geodesy measures gravity variations to construct detailed models of the Earth's gravity field, revealing the distribution and transport of mass beneath the surface.



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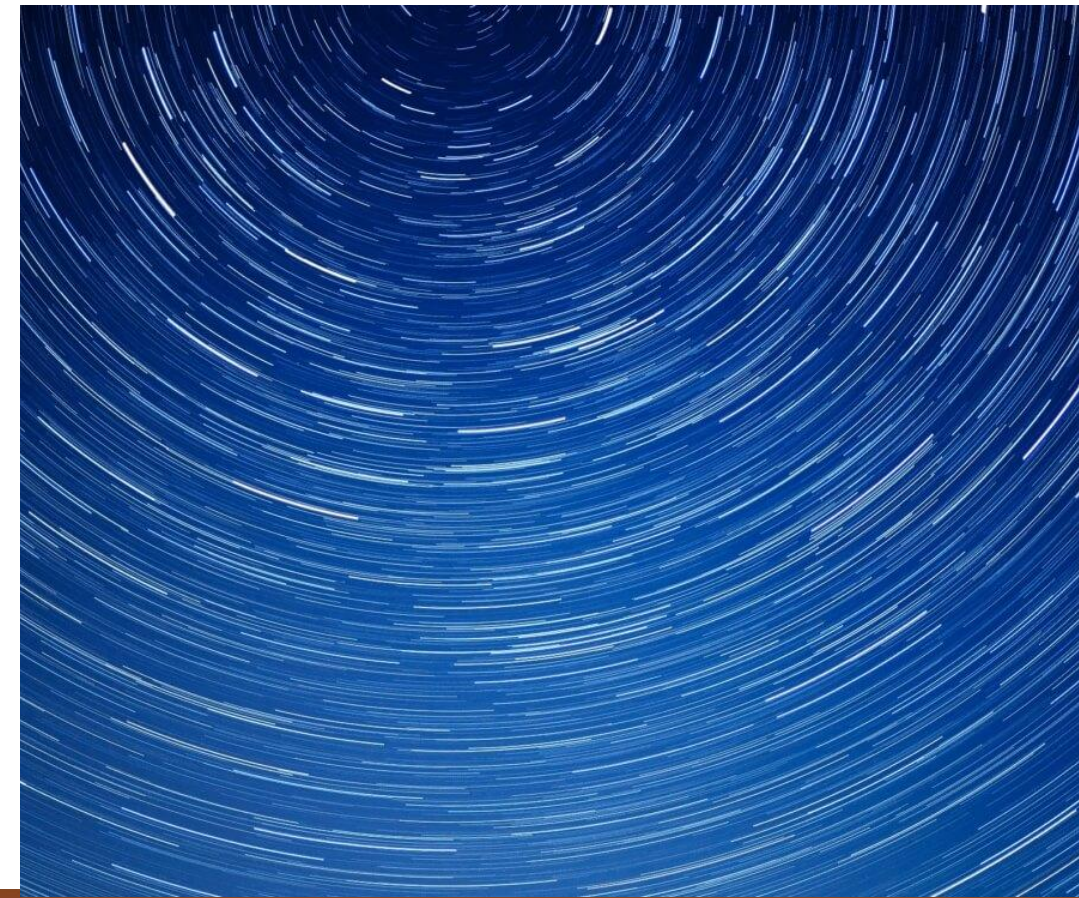


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Geodesy's Role in Space Exploration

- Geodesy not only measures the Earth, but also extends its reach into space, playing an essential role in the exploration of the Moon and planets. The International Celestial Reference Frame (ICRF) is a key component in linking Earth-based observations to the wider cosmos.



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Importance of Geodesy

- In 2015, the United Nations General Assembly adopted Resolution A/RES/69/266 on the Global Geodetic Reference Frame (GGRF) for Sustainable Development.
- South Africa, as a UN member state, has a responsibility to align its national efforts with this global agenda



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THANK YOU



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