



Satellite Geodesy and Global Navigation Satellite System (GNSS)

Surfaces, Projections, Reference Systems and Reference Frames





Mission Statement : *“To establish precise and accessible geodetic infrastructures”*

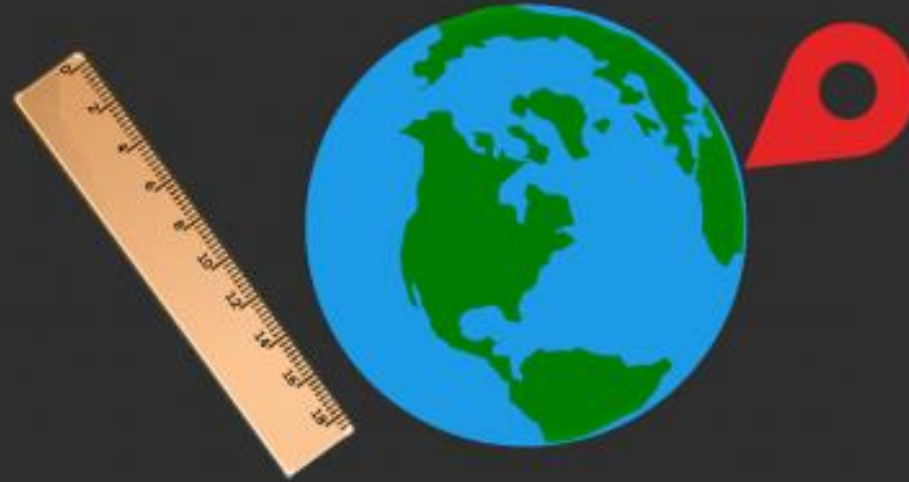


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What is Geodesy?

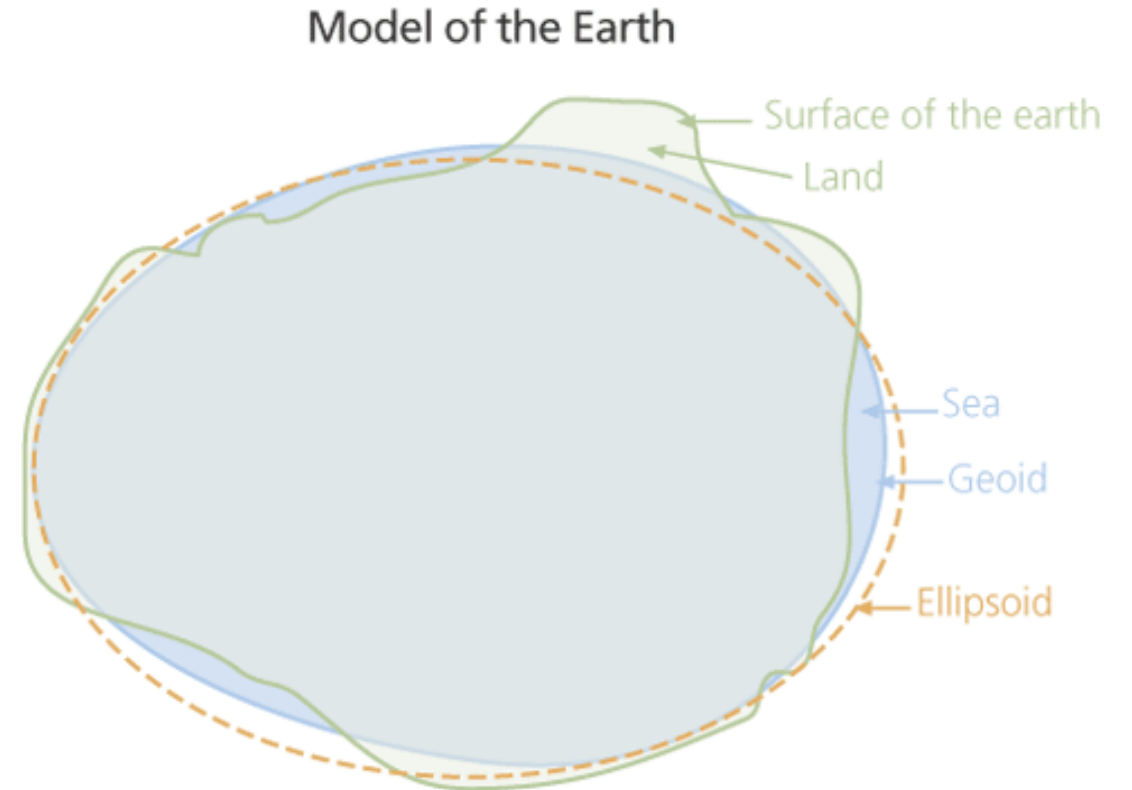
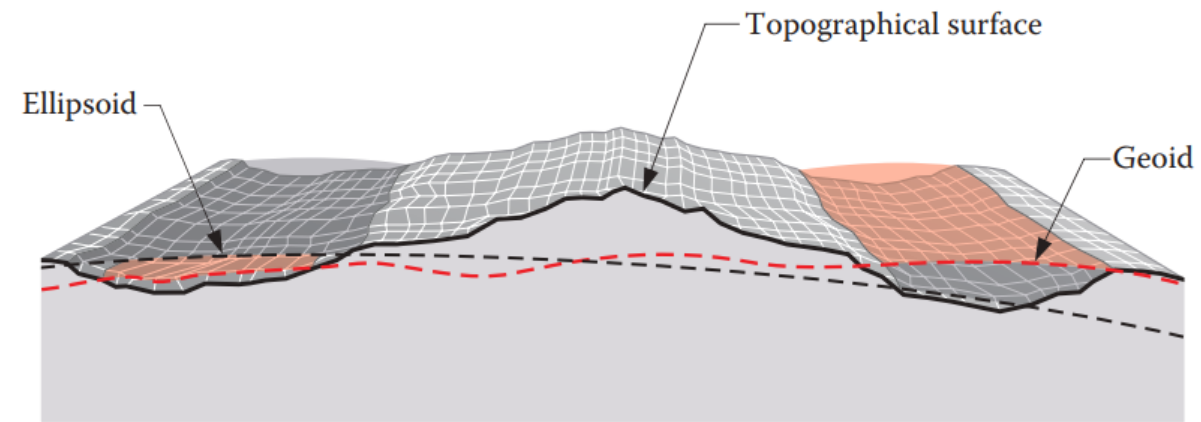


Source : <https://gisgeography.com/geodesy/>

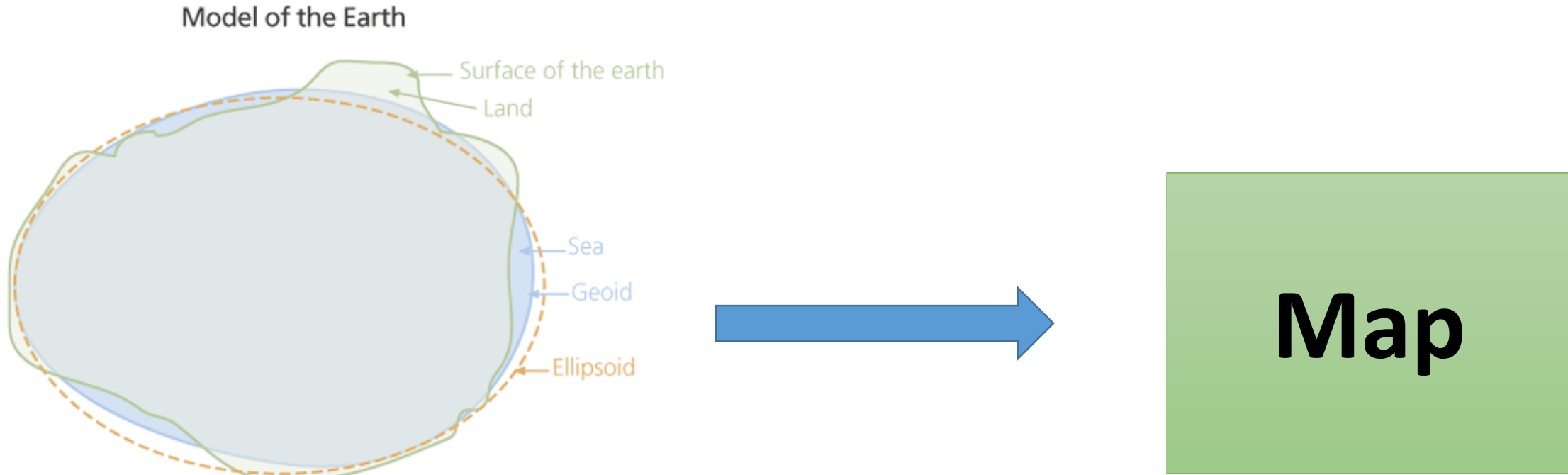
The Mathematics of “Where”

“....because the earth is not flat and is non-homogeneous.”

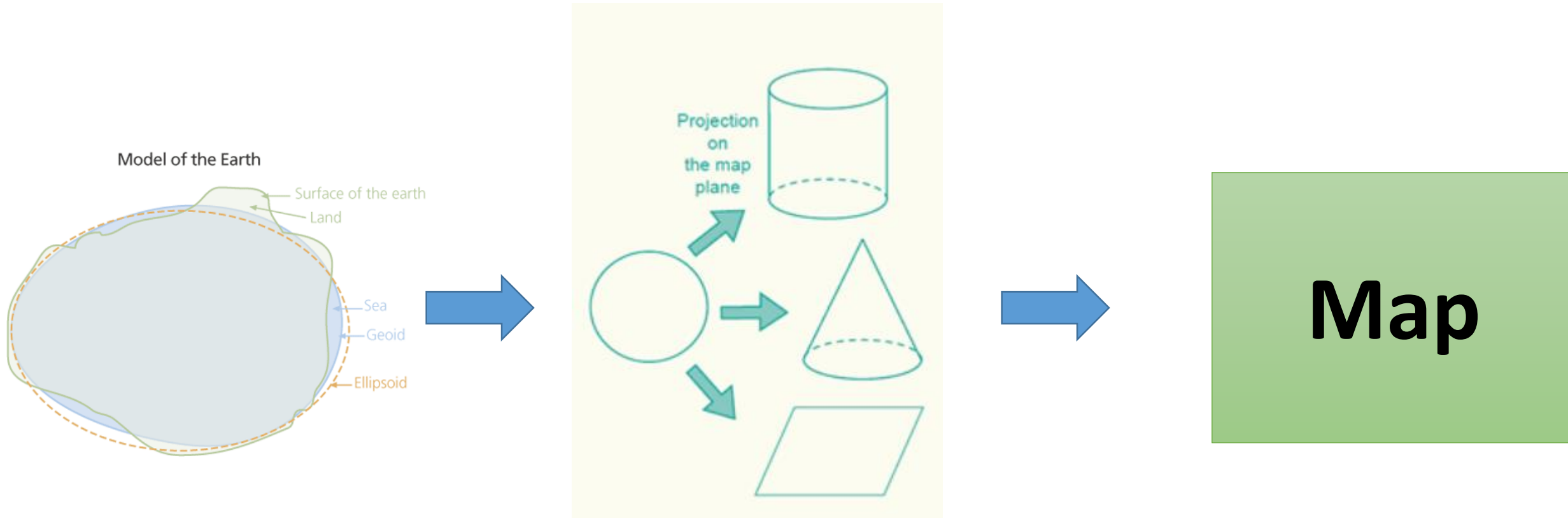
Surfaces



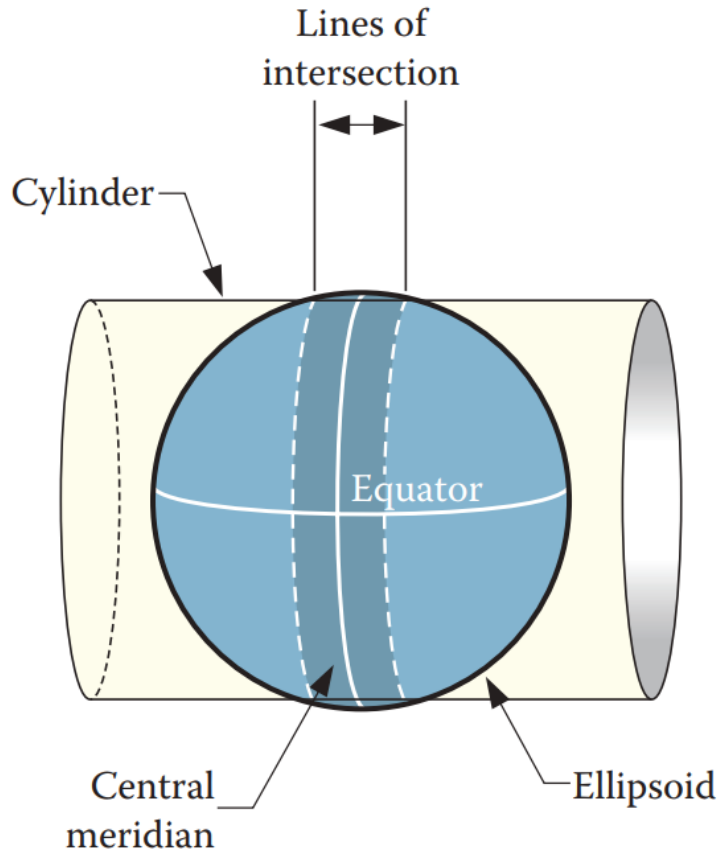
Projection



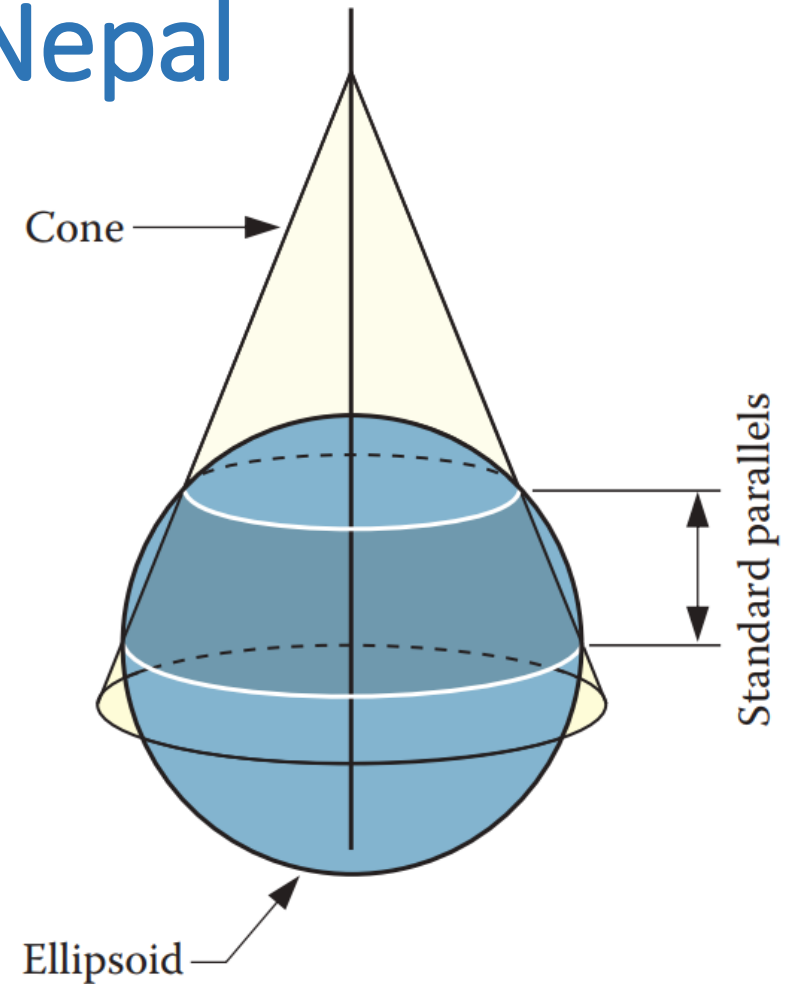
Projection



Projection used in Nepal



**Transverse
Mercator
(TM)**



**Lambert
Conformal Conic
(LCC)**

Reference Systems and Reference Frames used in Satellite Geodesy

Reference

Simply put, reference is answer of “From where?”

Ill-defined reference implies ill position.

Terrestrial Reference System



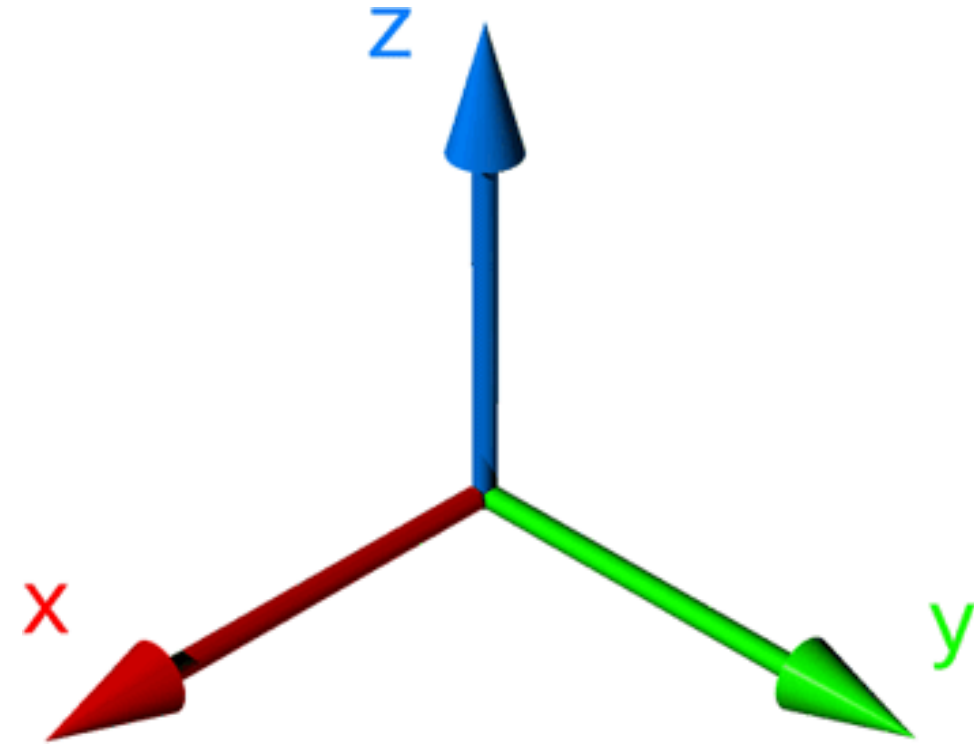
Classical Terrestrial
Reference System

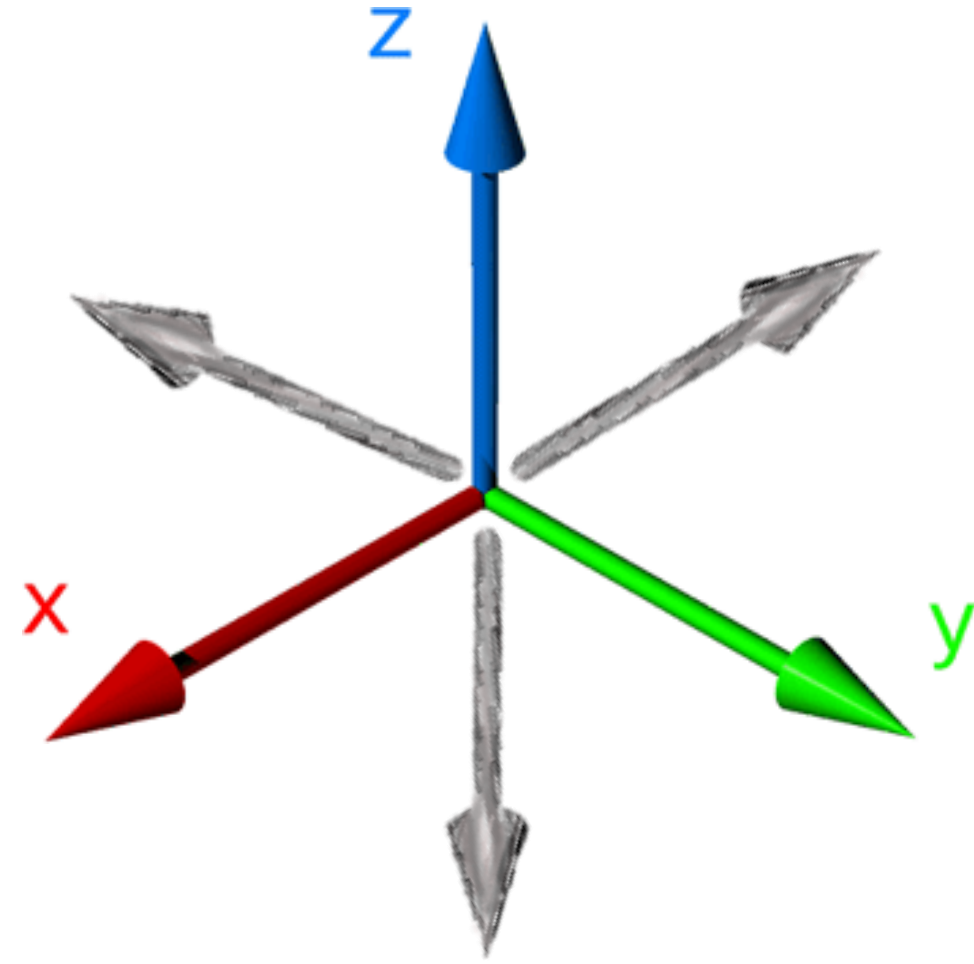


Modern Terrestrial
Reference System

Modern Terrestrial Reference System









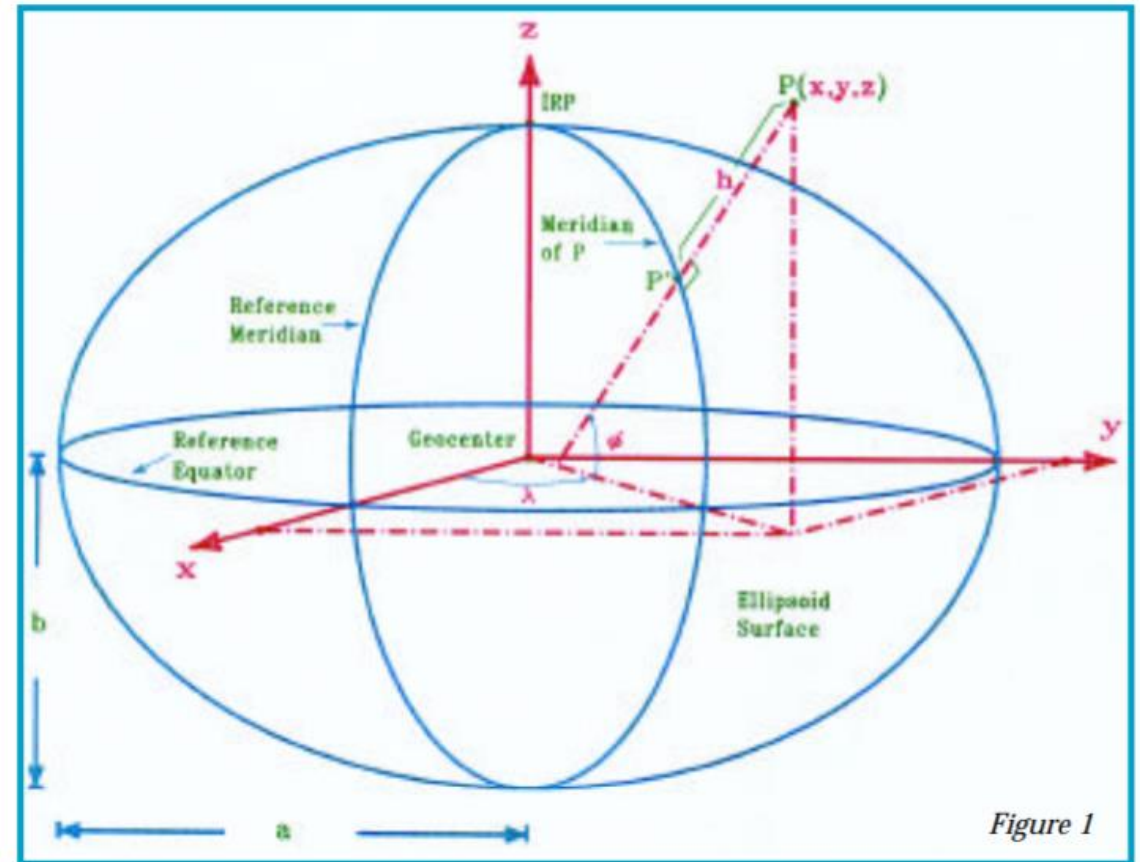
Steps to defining a terrestrial reference system

1. Location and orientation of the three coordinate axes
2. Unit of length
3. Auxiliary geometric surface that approximates the size and shape of earth



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Common Reference Systems for GNSS



International Terrestrial
Reference System (ITRS)

	Semi-major axis	Inverse of flattening
GRS80	6378137	298.257222101



World Geodetic System 84

	Semi-major axis	Inverse of flattening
WGS84	6378137	298.257223563

Realization of Reference System

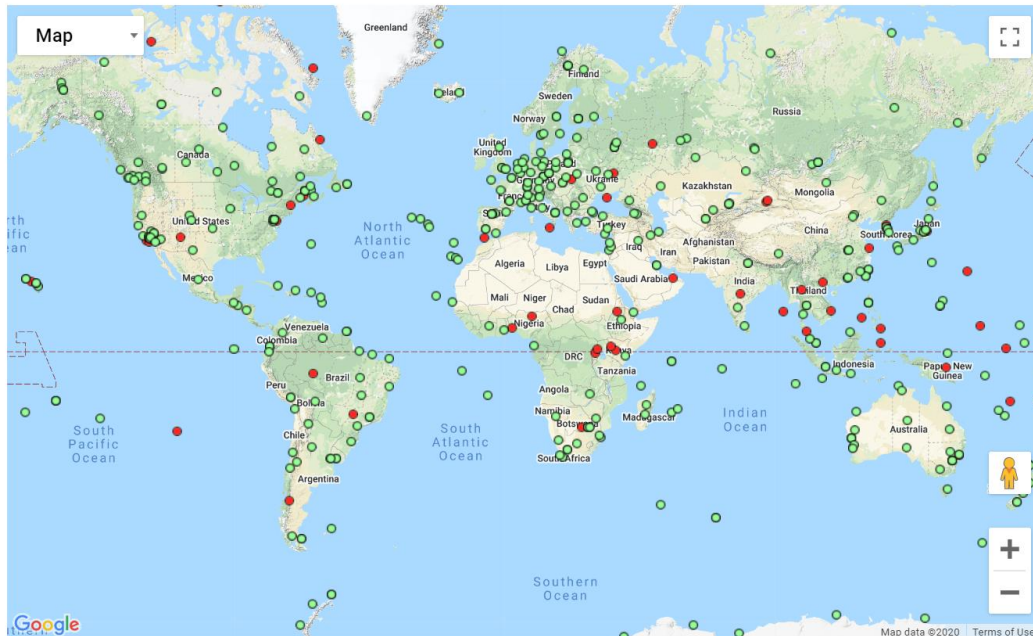


Reference Frame

International Terrestrial Reference System (ITRS)



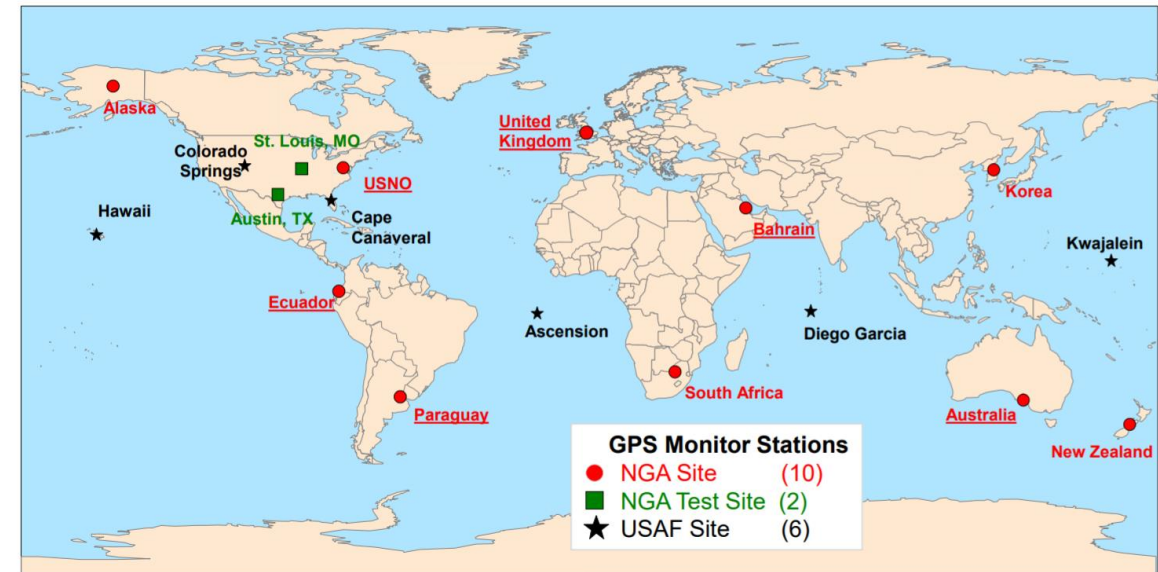
International Terrestrial Reference Frame (ITRF)



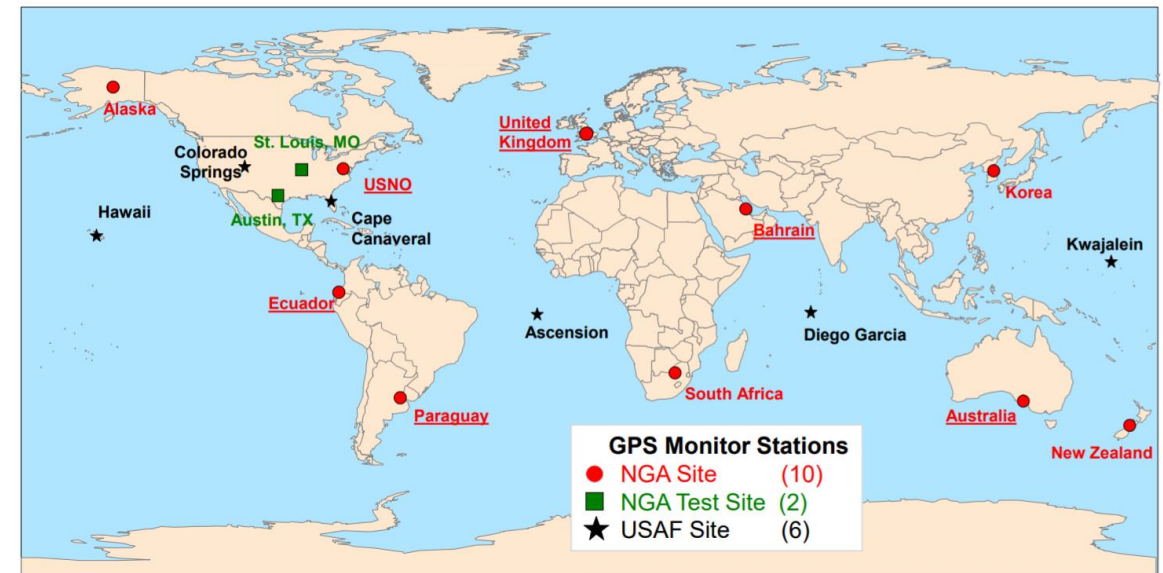
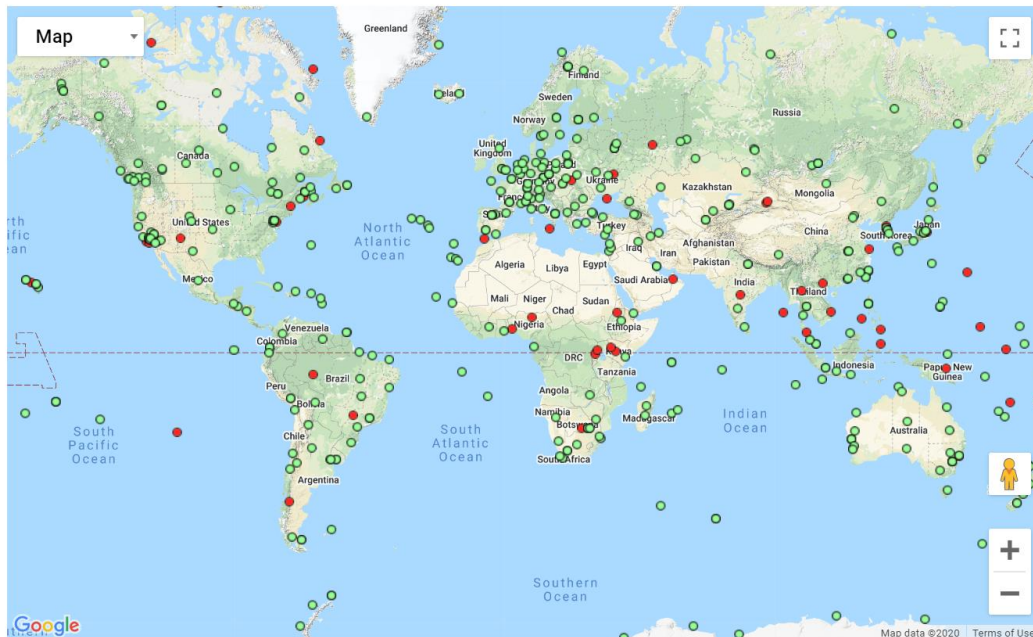
World Geodetic System 84



GPS Tracking Stations



Does the realization change?



International Terrestrial Reference Frame (ITRF)

WGS84

ITRF89

ITRF90

ITRF91

ITRF92

ITRF93

ITRF94

ITRF96

ITRF97

ITRF2000

ITRF2005

ITRF2008

ITRF2014

WGS84

WGS84(G730)

WGS84(G873)

WGS84(G1150)

WGS84(G1674)

WGS84(G1762)

<http://itrf.ensg.ign.fr/>

[https://confluence.qps.nl/qinsy/latest/en/world-geodetic-system-1984-wgs84-182618391.html#id-.WorldGeodeticSystem1984\(WGS84\)v9.1-WGS84realizations](https://confluence.qps.nl/qinsy/latest/en/world-geodetic-system-1984-wgs84-182618391.html#id-.WorldGeodeticSystem1984(WGS84)v9.1-WGS84realizations)

Queries