

Time Keepers

A prolog to GIS Survey
Standards & Specifications

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Overview

1. Time Keepers - Atomic clocks
2. Global Navigation Satellite Systems (GNSS)
3. Space based PNT services
4. Calculate positions on the earth
 - Shape of the Earth - Ellipsoid, Geoid
 - Reference for measurement - Datum (eg: WGS 1984)
 - Transformation of a curved earth to a flat map - Projections (eg: UTM 1975)

Time Keepers

Atomic Clocks

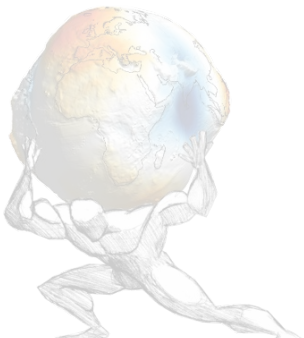
Distance is Measured in Time

In 1 nanosecond light travels ~30cm

Since 1983 , the standard meter has been redefined as the length of the path traveled in the vacuum by the light for a duration of $\frac{1}{299\,792\,458}$ seconds.

Once synchronised, a cesium atomic clock—which harnesses the transition of electron energy levels in cesium atoms to measure time accurately—won't miss a second in 10,000 years

Poor the accuracy of these atomic clocks,
less the accuracy of the distance calculated



GNSS - Global Navigation Satellite System

Operational

GPS – USA

GLONASS – Russia

Galileo – European Union

In Development

BeiDou 2 – China (by 2020)

RNSS - Regional Navigation Satellite System

Japan – QZSS

China – BeiDou 1

India – NavIC (IRNSS)

GNSS Augmentation

US – WAAS, DGPS

RU - SDCM

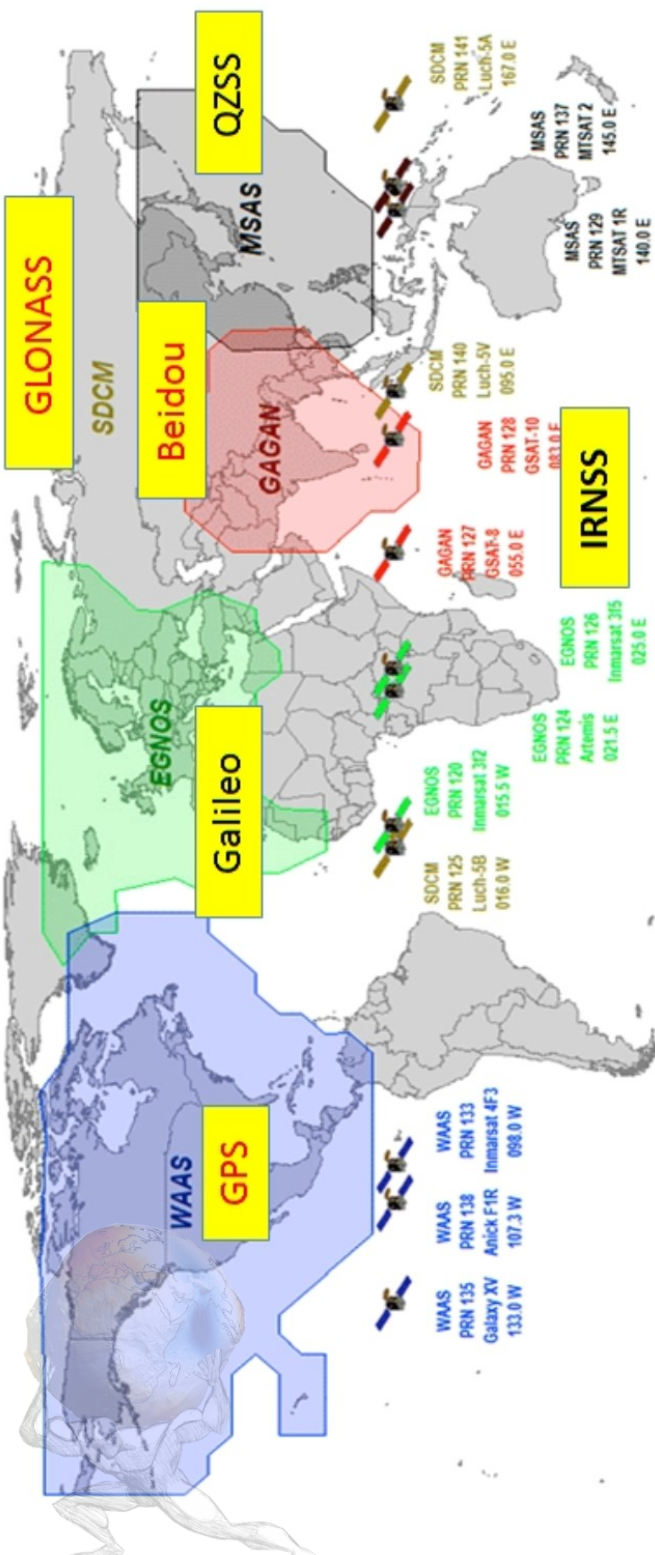
EU – EGNOS

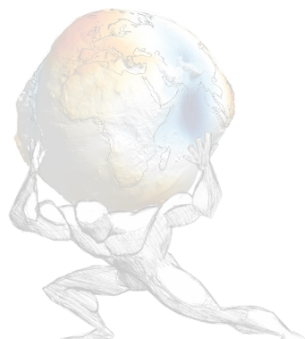
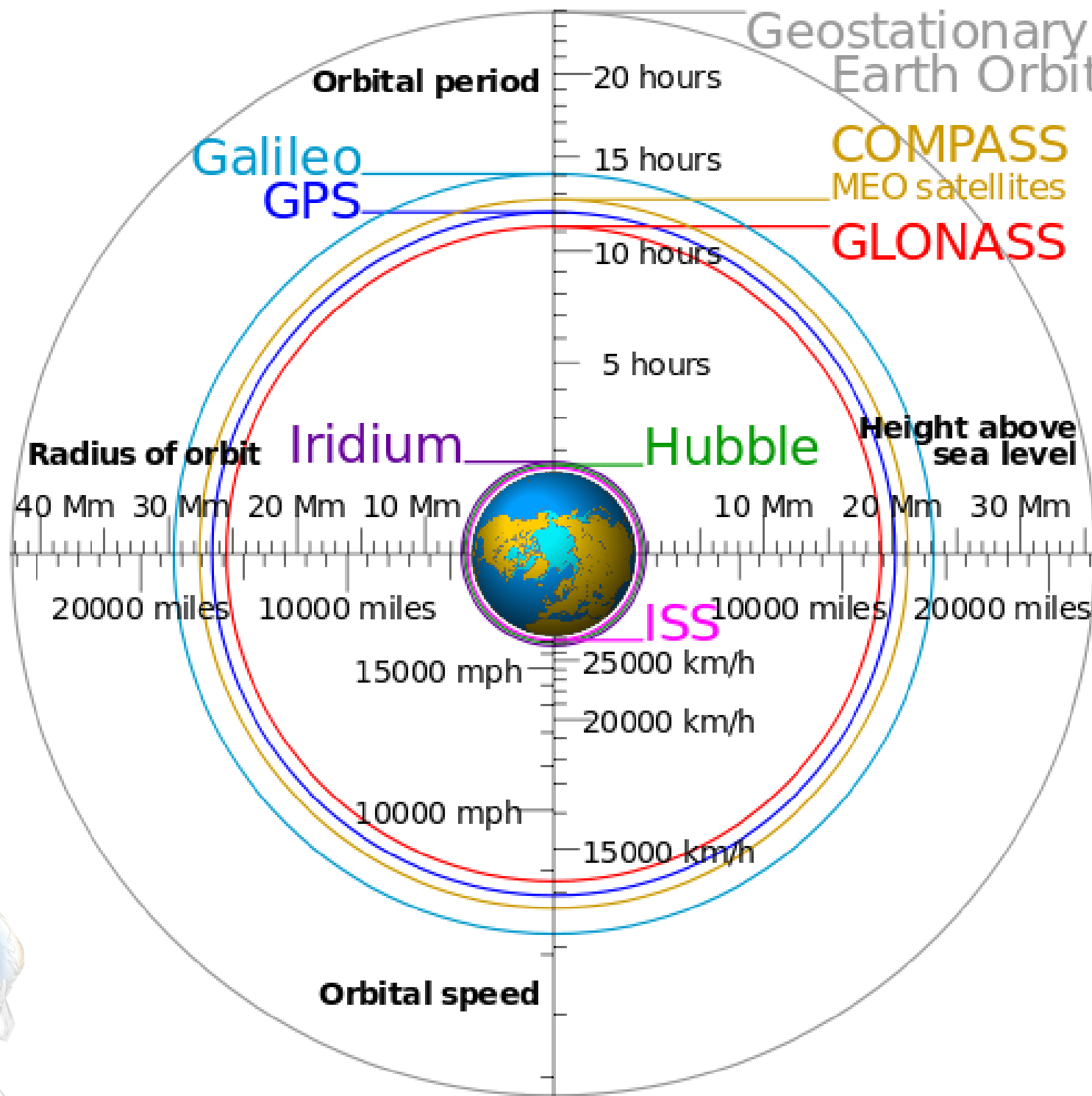
FR - DORIS

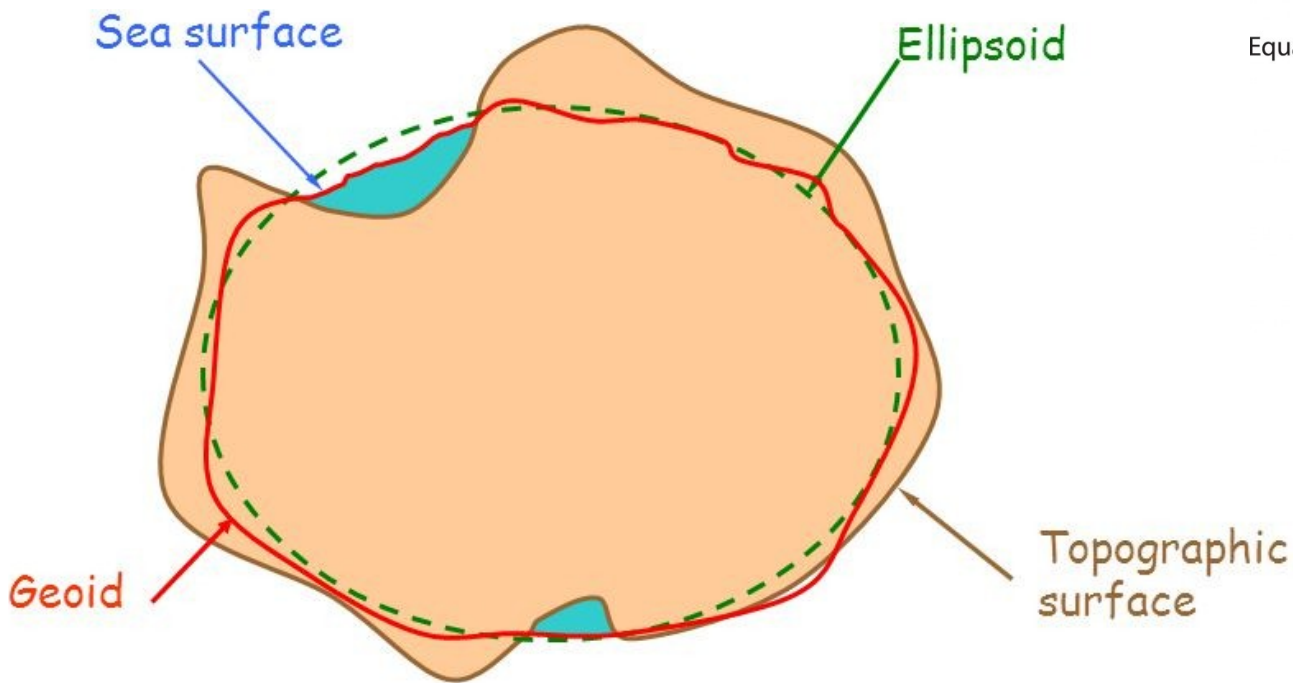
JP – MSAS

IN – GAGAN

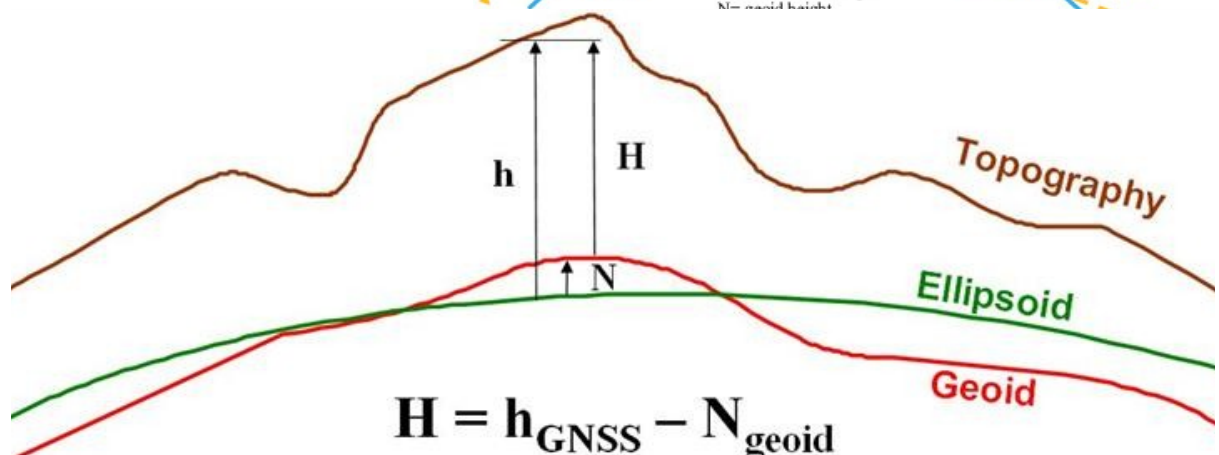
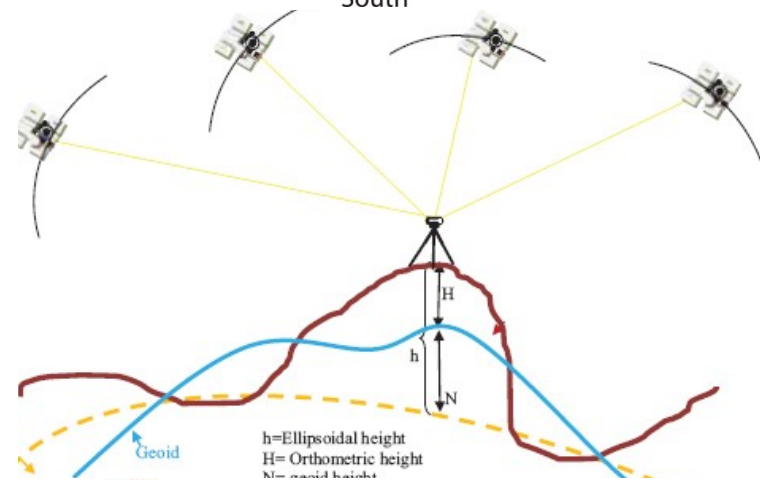
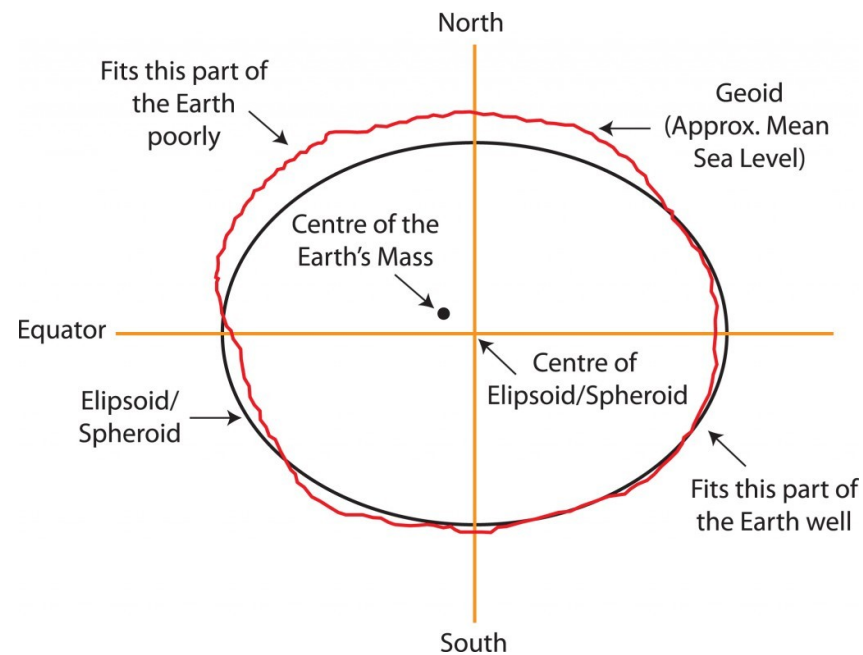
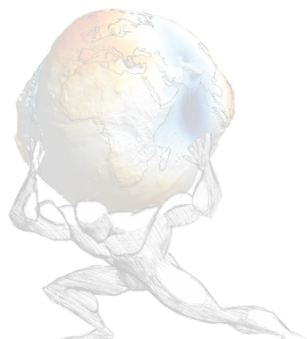
PNT services for public and military (encrypted, 2x-10x higher accuracy)







Geoid is a surface of constant gravity.



Appendix

IERS - International Earth Rotation and Reference Systems

BIPM - Bureau International des Poids et Mesures

UTC - Coordinated Universal Time

Thank You

