WGS-84: What is it, Maintaining data and the impacts related

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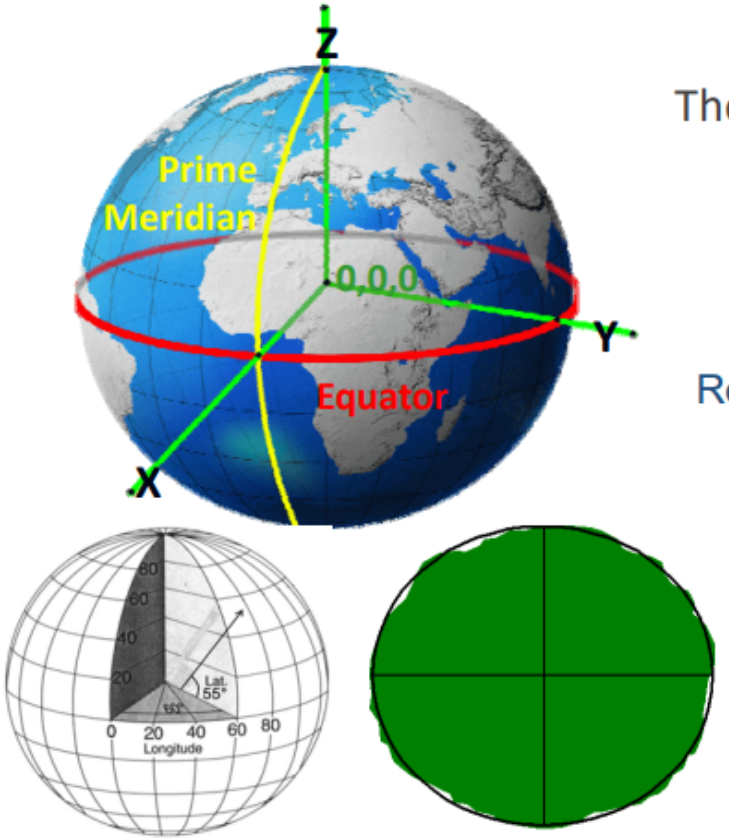
What is WGS-84?

World Geodetic System 1984



The defining Common Operating Picture to reference all Geospatial Information

WGS 84 is a system of systems

Reference Frame / Coordinate System (Lat / Long)

Earth Gravitational Models (EGM)

Datum Transformations

World Magnetic Model

Elevations

Maps and Charts

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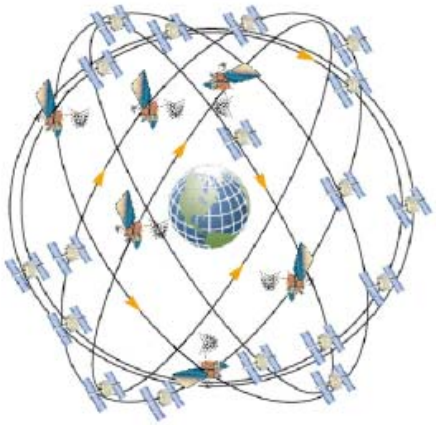
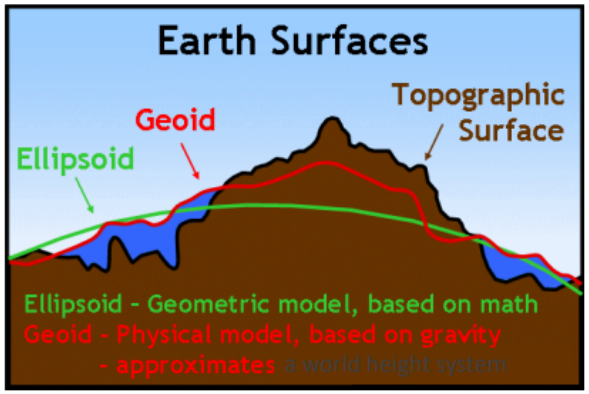
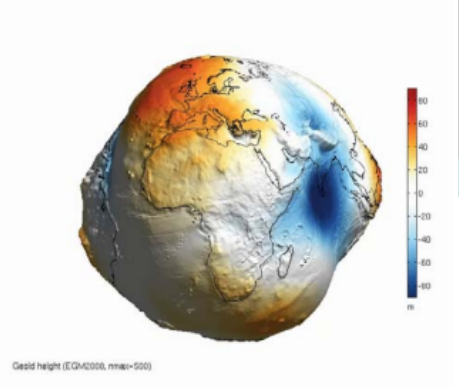
What is WGS-84?







WGS 84 Reference Frame

- Ensure Scientific Integrity
- Ensure Interoperability with other global systems

WGS 84 Earth Gravitational Model (EGM)

- Earth Gravity Model 1996 (EGM96)
  - 30 min resolution (0.5 – 1 M)
- Earth Gravity Model 2008 (EGM08)
  - 5 min resolution (0.15 cm RMS)

Much care must be taken when working with datums other than WGS 84.
Biases when mixing datums can approach 300 meters if you're not careful.

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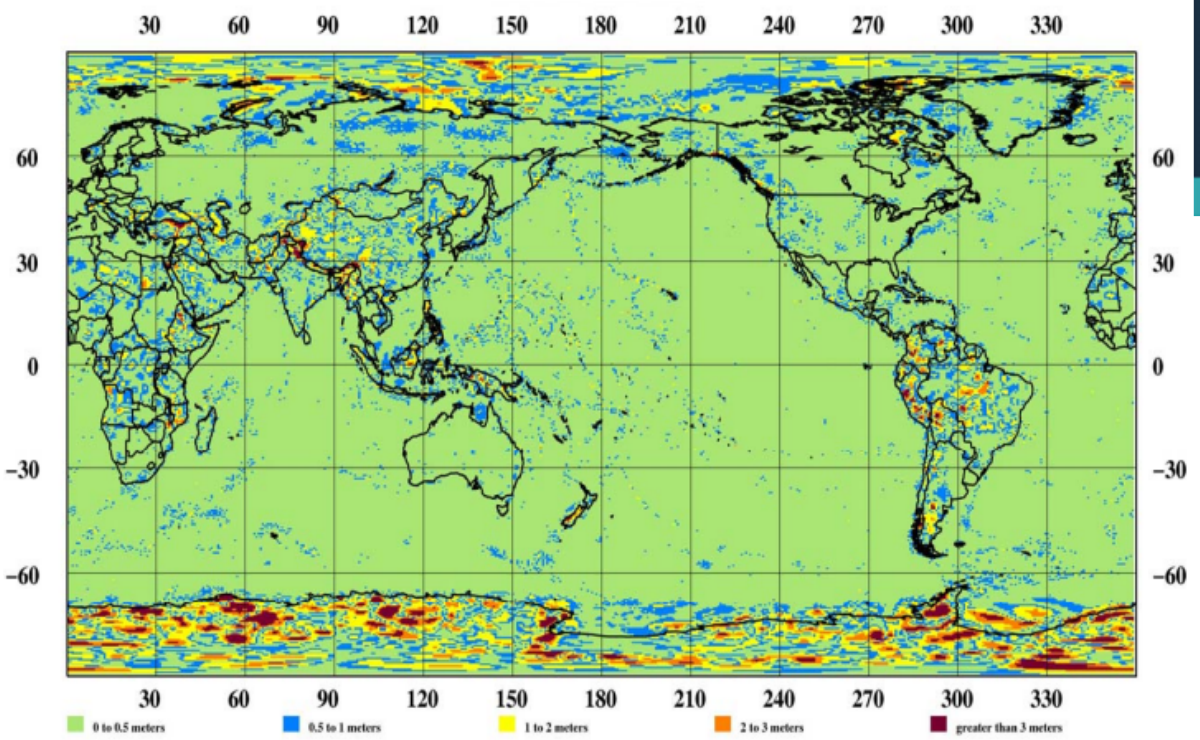
What is WGS-84?

Difference between EGM96 & EGM08

- Maximum difference is 12M
- 90% of the world has a less than 0.5m difference
- Models are always being updated
- Most Aircraft avionics operate on EGM96



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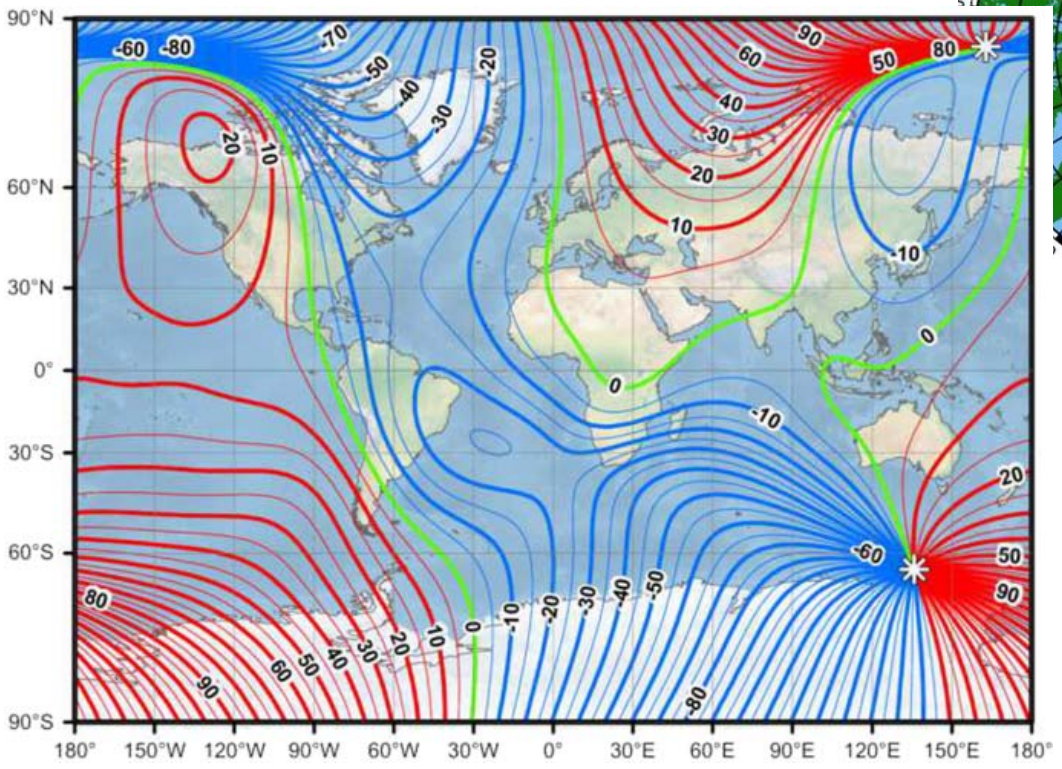
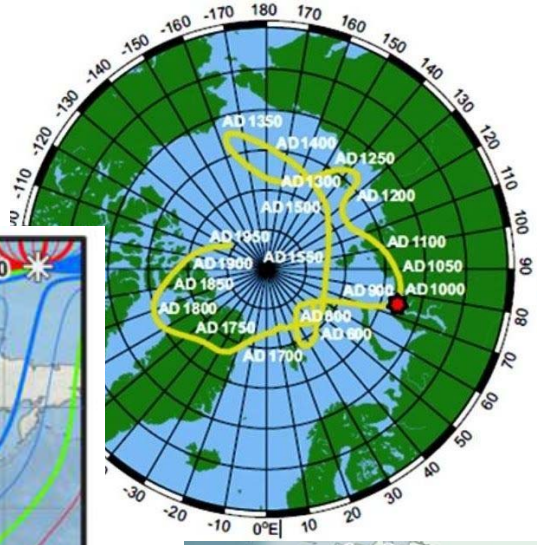
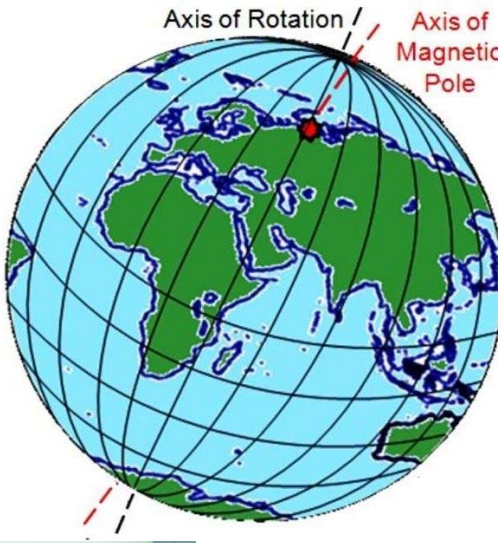
World Magnetic Model







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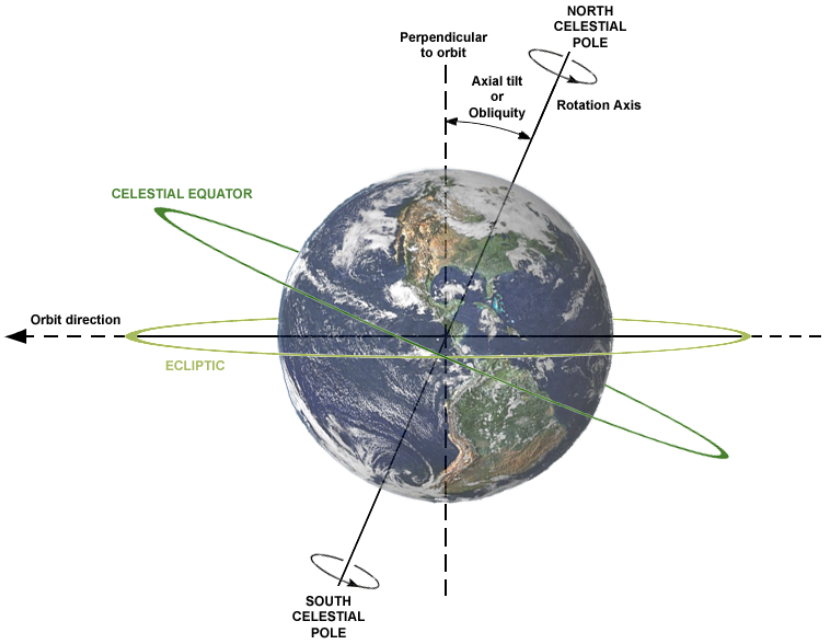
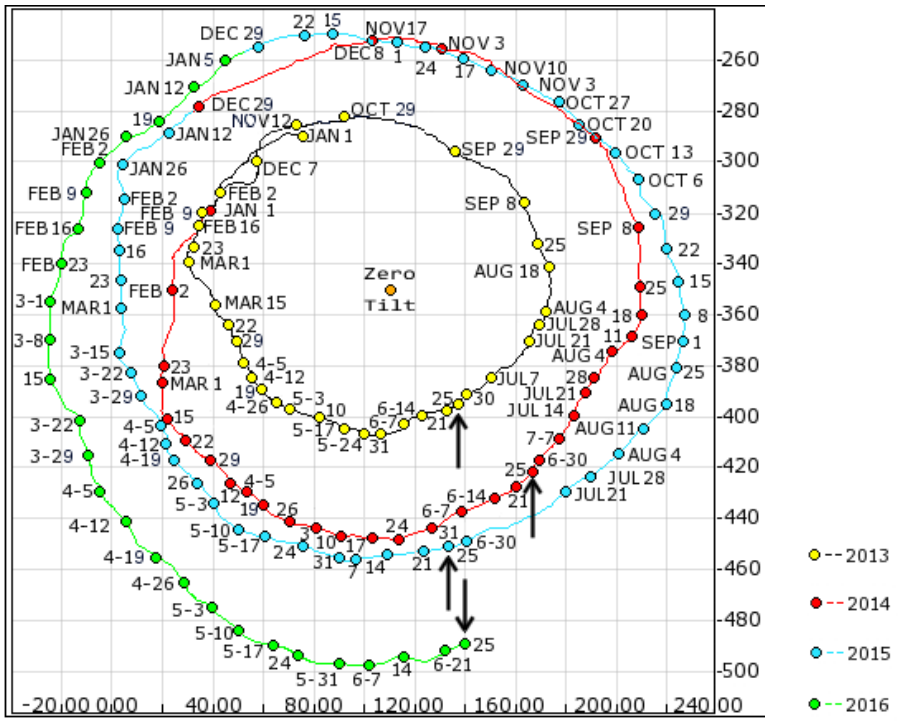
Why does one need to re-collect?





Why does one need to re-collect?

Natural events cause movements of surface layers (i.e. earthquakes, volcanic actions, etc.)

- Not just horizontally, but vertically

Over time small movements add up over time to large values of change

- Initial event causes most noticed but not only movement

A dry stream is suddenly split, shifting one side 13 feet away from the other.

Photo by Brian Olson / California Geological Survey

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Data Recollection/Validation – Standard practice

Due to the various factors, the recommended recollections are:

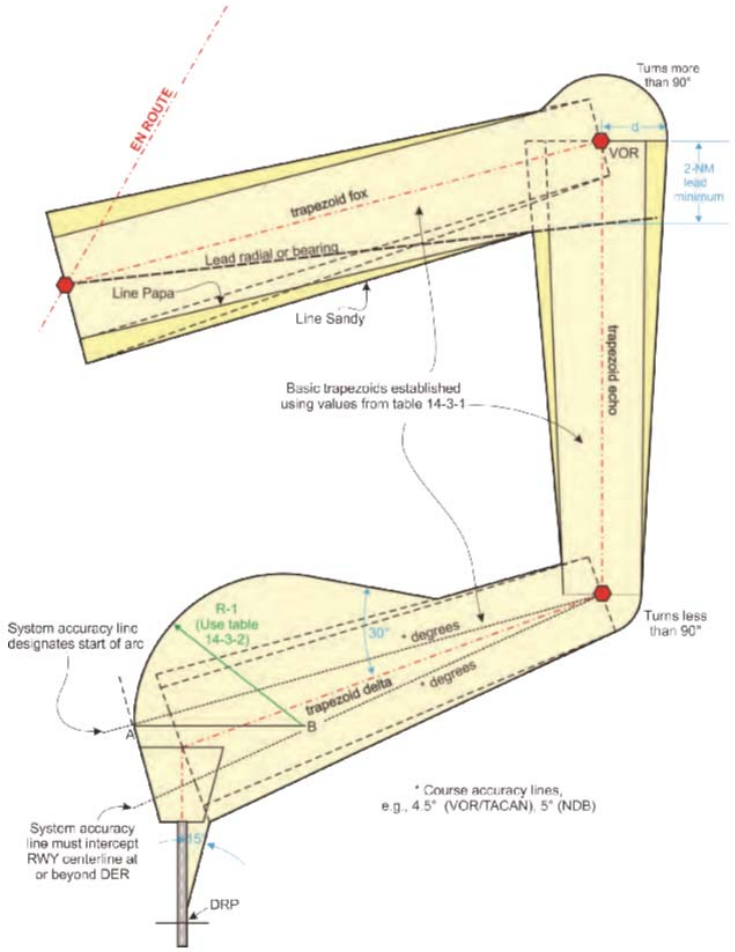
- Revalidate the data every 5 years
- After Major Natural event
  - Each country will have different levels of what qualifies as major
- After Construction of critical airport elements

What does the base collection impact? - Terminal Procedure

When WGS-84 data is not provided or maintained, terminal procedure accuracy is not precise.

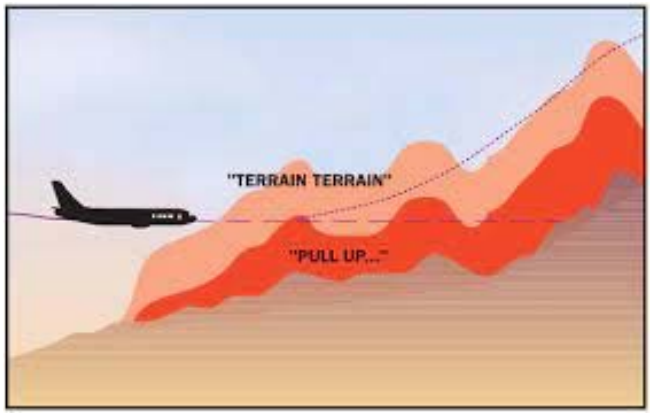
- The users may apply an obstacle horizontal accuracy (buffer) up to 3400ft when this datum is not utilized by the host nation.

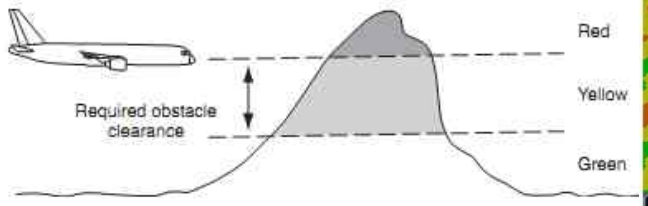
- This adjustment could impact instrument procedure segment minimum altitudes and IFR landing minimums.



What does the base collection impact? - TAWS

Not maintaining the vertical obstructions outlined in the AIP or per host country would create a deficit in the aircraft's Terrain Awareness Warning System (TAWS). Obstacle avoidance/guidance is provided as a function of this software.



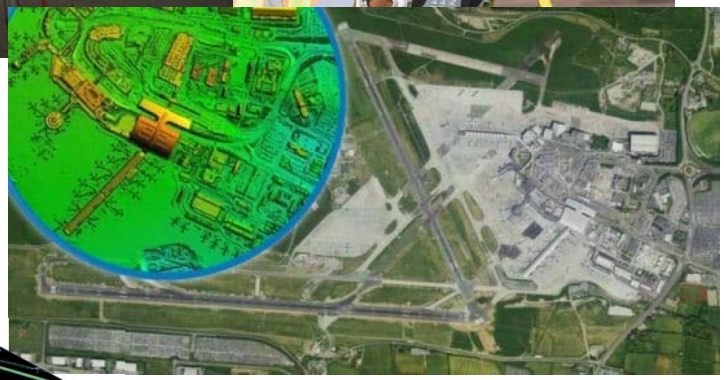


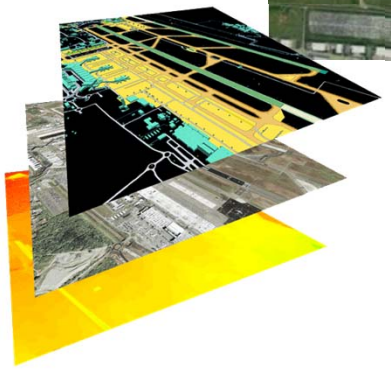
Methods available to maintain and re-validate the data

Ground Surveys
- PRO:
  - Traditional Method of Collection
  - Very high level of accuracy
- CON:
  - Not Timely / Slower process to collect

LIDAR Survey
- PRO:
  - Medium amount processing time
  - Good for locations with no change to the infrastructure (no construction)
- CON:
  - Newer method
  - Requires training / tools / software
  - Lot of data to process

Imagery collections
- PRO:
  - Timely Method of collection
- CON:
  - Newer method
  - Requires training / tools / software
  - Requires some reference data to orient collections





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Beware of the Following....

According to ICAO Doc 9613 (section 3.4) Performance Based Navigation, we should be aware of the following:

- All coordinate data must be referenced to the **World Geodetic System — 1984 (WGS-84)**
- All surveys must be based upon **the International Terrestrial Reference Frame**
- All **data must be traceable** to their source
- Equipment used for surveys must be **adequately calibrated**
- Software tools used for surveys, procedure design or airspace design must be **suitably qualified**
- Standard criteria and algorithms must be used in all designs
- Surveyors and designers must be **properly trained**
- **Comprehensive verification and validation routines** must be used by all data originators
- Procedures must be subjected to **ground validation** and, where necessary, **flight validation and flight inspection** prior to publication.
    - For guidance on the validation process see ICAO Doc 9906 Vol 5, Validation of Instrument Flight Procedures
- Aeronautical navigation data must be **published in a standard format**, with an appropriate level of detail and to the required resolution; and
- All data originators and data processors must implement a **quality management process** which includes
    - A requirement to **maintain quality records**
    - A **procedure for managing feedback and error reporting** from users and other processors in the data chain.

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