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# Ellipsoidal height of MSL at the coast & Vertical Reference Frames

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**Observing accurate and long term coastal MSL records are  
fundamental for:**

**: Studying MSL rise**

**: Creating National and Global Vertical Reference Frames (VRF).**



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**GNSS observations at coastal tide gauges is an objective of GLOSS for its Core Network of gauges. (“Continuous” GPS)**

**Detailed documentation on “best practise” is readily available (IOC website: [www.ioc.unesco.org](http://www.ioc.unesco.org))**

**GNSS MSL observations also allow vertical measurement of land /crustal movement to be monitored.**

**Also allows an accurate time standard for the tide gauge and of course its horizontal positioning.**



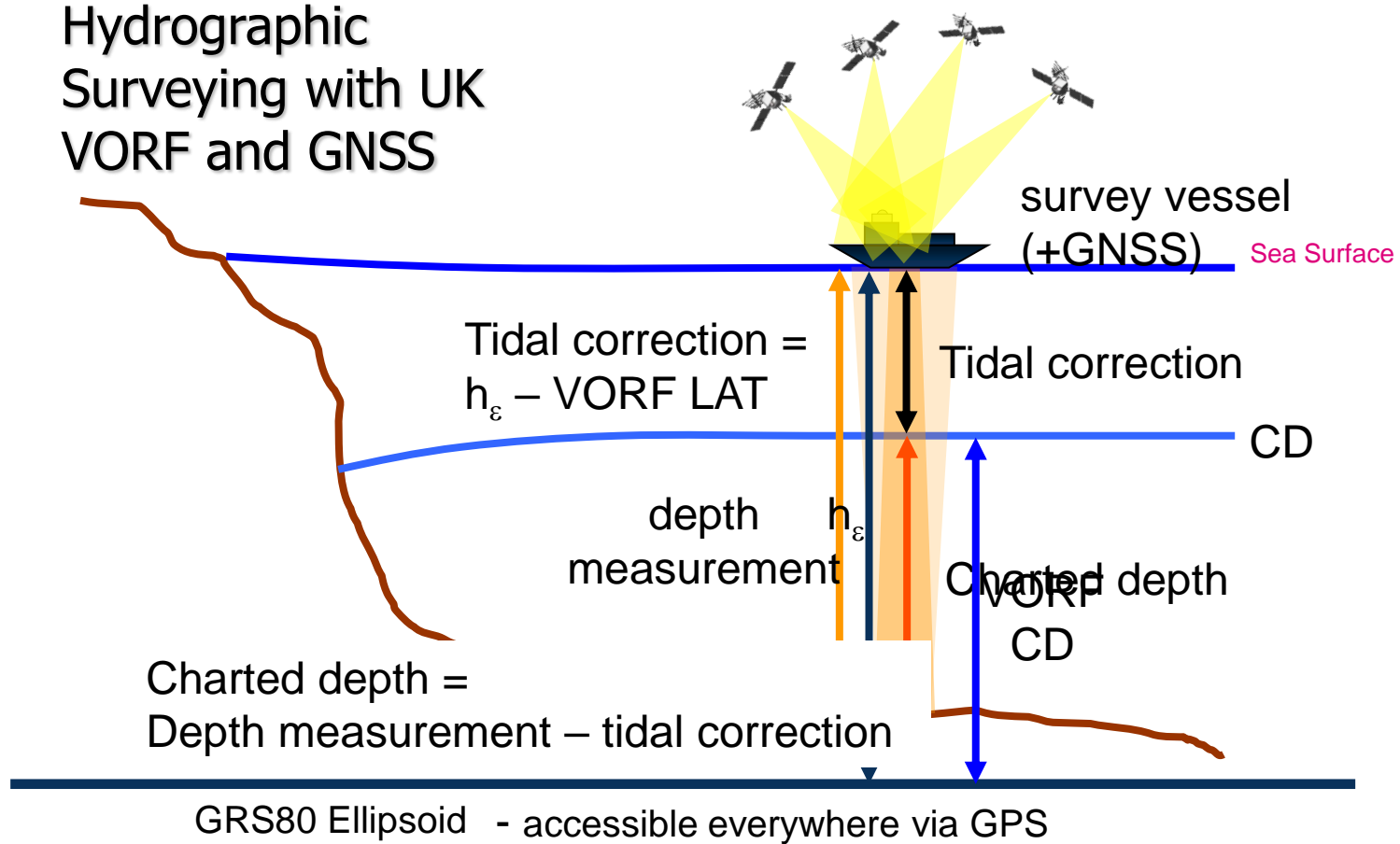
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## **Vertical Reference Frames:**

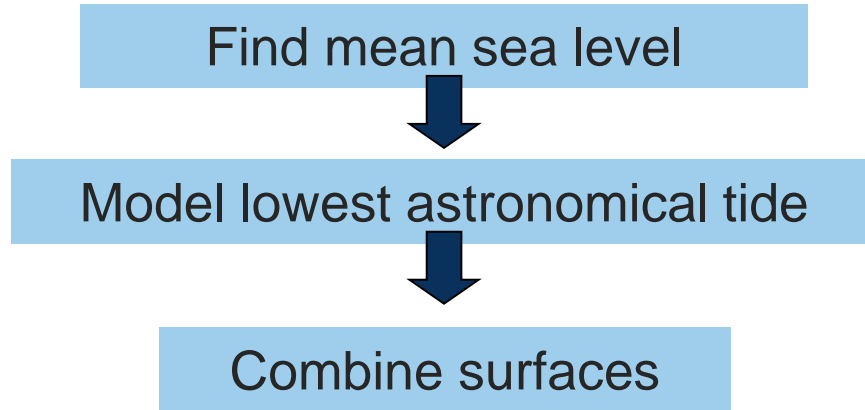
**A set of mathematical models of the major surfaces used in marine applications**

**May also include a suite of software utilities to compute the transformation of mapping and positioning data between the surfaces**

# Hydrographic Surveying with UK VORF and GNSS



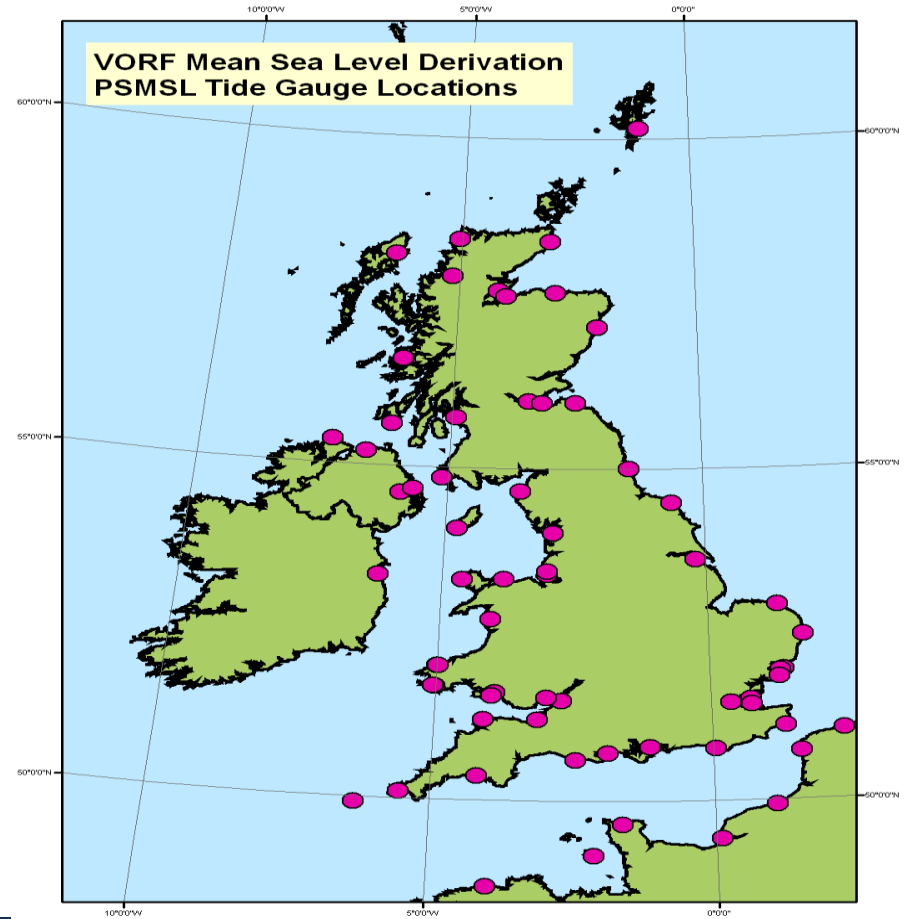
# UK VORF Overall Approach



## Data sources:

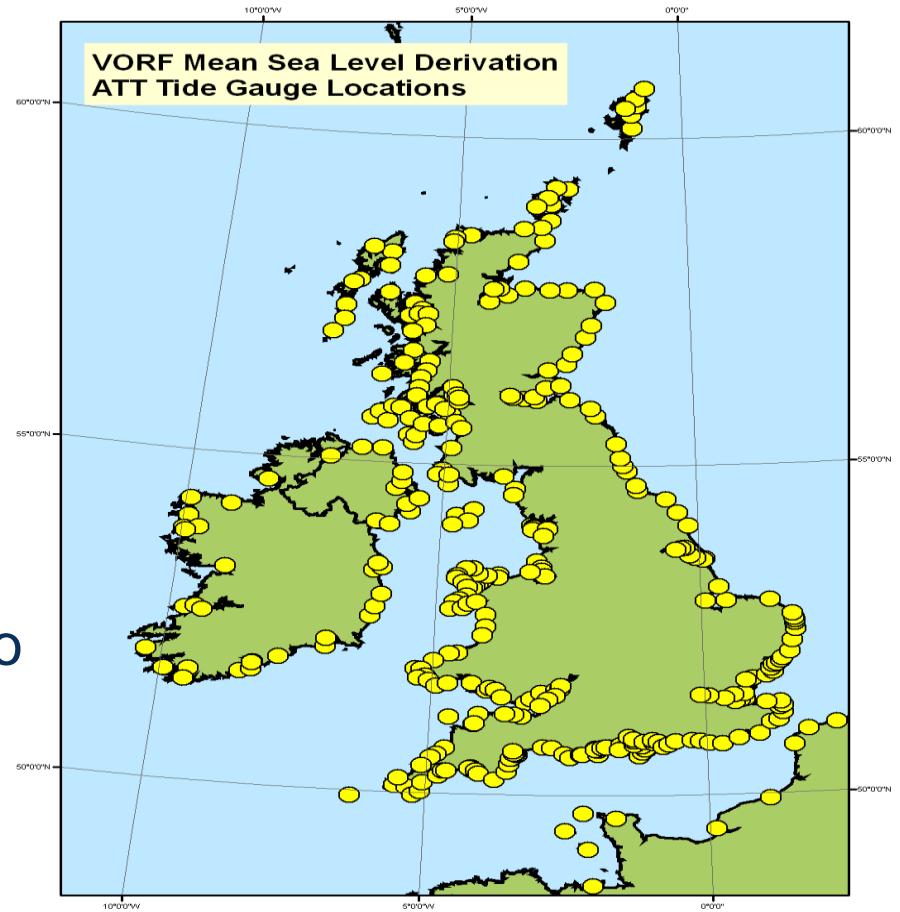
### Tide Gauge data via the Permanent Service for Mean Sea Level (PSMSL)

- National Tidal and Sea Level Facility (NTSLF) stations
- High quality continuous observations
- Low spatial density



**Data sources:**  
**UK Tide Gauges**  
**“Admiralty Tide Tables (ATT)”**

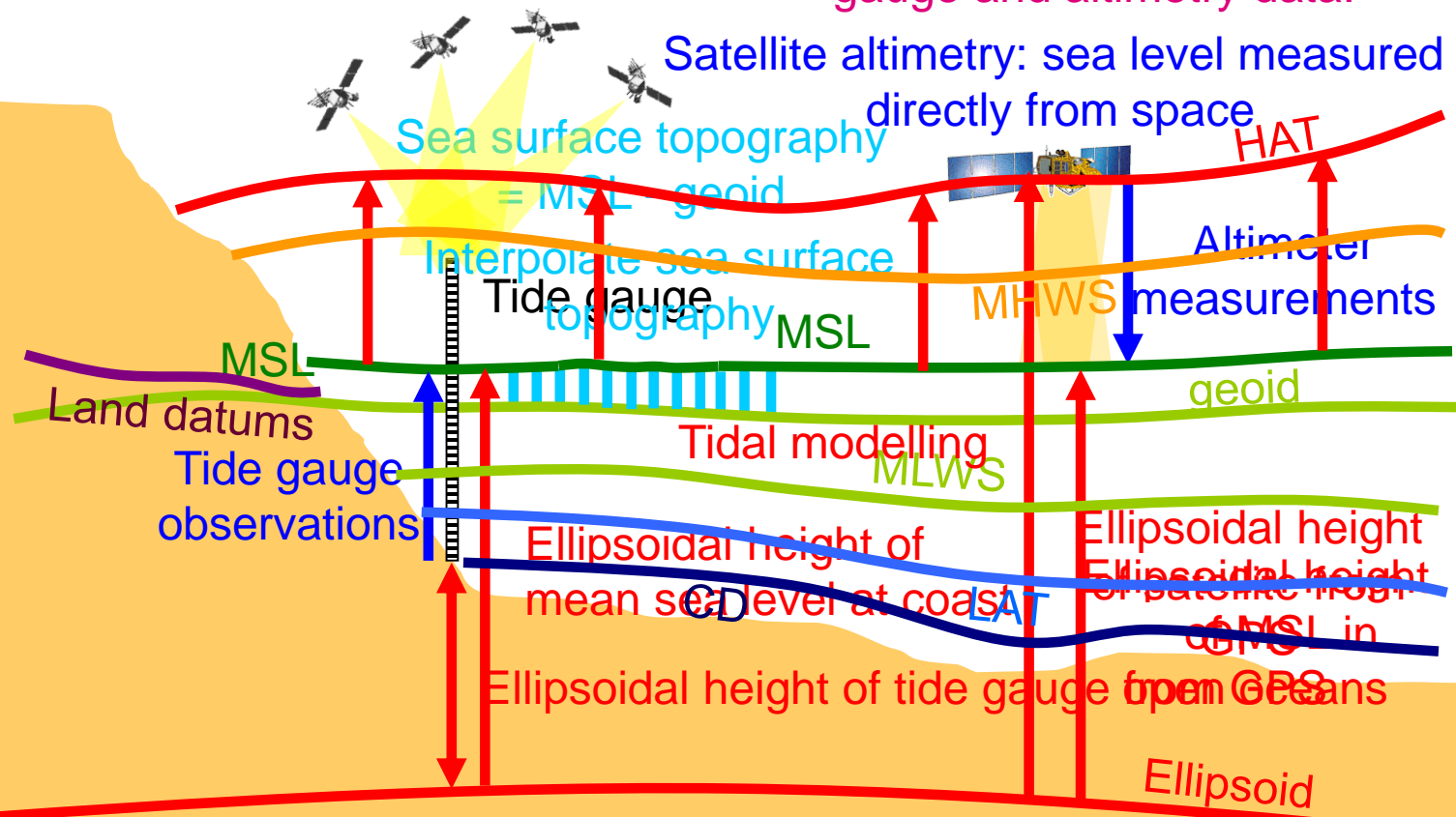
- Around 700 Standard and Secondary Port locations
- Good spatial density
- Occasionally low precision due to short term data series





# Developing VORF (in one slide)

Interpolation (data merging) derived from the characteristics of the tide gauge and altimetry data.





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## Reference:

**Iliffe, J. C., Ziebart, M. K. and Turner, J. F. (2007) 'A New Methodology for Incorporating Tide Gauge Data in Sea Surface Topography Models', *Marine Geodesy*, 30:4, 271 - 296.**