Referencing the Discussion of Sea Level

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The Geodetic Reference System best approximates an absolute (vice relative) reference. GPS data has greatly improved understanding of the differences between the geoid and ellipsoid.

The geoid approximates mean sea level. The shape of the ellipsoid was calculated based on the hypothetical equipotential gravitational surface. A significant difference exists between this mathematical model and the real object. However, even the most mathematically sophisticated geoid can only approximate the real shape of the earth.
Geodetic Reference Systems

World Geodetic System (WGS)84

International Terrestrial Reference Frame (ITRF2005)
Vertical Datum (relative reference) for Sea Level

Measurement of sea level – hydrographic and bathymetric surveys
Typically used to produce nautical charts for Navigation
Vertical Charting Datums (references) vary across large geographic locations

Fig. 42. Relation between tidal surfaces, charting datums and physical features.
Measuring Sea Level

Tide Gauge

Relative motion of the water and the land
Data referenced to various vertical datums

Satellite Altimetry
Topex- Poseidon, Jason 1-3
Geosat Follow-on
Data referenced to the ellipsoid
Regional trends in sea level, with arrows representing the direction and magnitude of change. Click on an additional information about that station.
Land Subsidence

Subsidence process

Exacerbated by human intervention

Vulnerable Land Resources
ALASKA TIDAL DATUM UPDATE
Juneau and Sitka Sea Level Trends

1960 - 1978 National Tidal Epoch

Slope = -0.042

Slope = -0.007

Year

Annual MTL in Feet
15.0 14.5 14.0 13.5 13.0 12.5 12.0 11.5 11.0 10.5 10.0 9.5 9.0 8.5

Juneau, AK - 9452210  Sitka, AK - 9451800  Tidal Epoch  Linear Regression
Relative to the land, the new MLLW Elevation is about 0.234 m (0.77 ft) below the old MLLW Elevation.

Sea Level is falling relative to land at a rate of approximately 9.8 mm/yr (0.033 ft/yr).
Correcting Sea Level Measurements for Land Movement

Continually Operating Reference Station (CORS)
- Co-located with a tide gauge
- Precise (GPS) measured corrections

Modeled Corrections
- Glacial Ice Rebound Model
- Glacial Isostatic Adjustment (GIA)
Where We Are

Sea level has been rising 0.08-0.12 inches per year (2.0-3.0 mm per year) along most of the U.S. Atlantic and Gulf coasts.

The rate of sea level rise varies from about 0.36 inches per year (10 mm per year) along the Louisiana Coast (due to land sinking), to a drop of a few inches per decade in parts of Alaska (because land is rising).
"It seems a very simple task to make correct tidal observations; but, in all my experience, I have found no observations which require such constant care and attention...."
Questions