

Sea Level Calculator Glossary

annual maximum (*also* annual maximum series)

- Time series of the largest rainfall amounts in a continuous 12-month period at a specific location and duration.

average high tide (*see also* Mean Higher High Water)

datum

- A base elevation used as a reference from which to measure heights or depths.

annual exceedance probability (*see also* exceedance probability)

- The likelihood that a flood of a certain magnitude or larger will occur within a year. For example, a one percent annual exceedance probability flood means that there is a 1 in 100 chance of a flood of that size or larger occurring in any given year.

exceedance probability (*see also* annual exceedance probability)

- The likelihood that a specific water level will be exceeded during a specific period. It could apply to any timeframe, but in sea level and flooding contexts, it often refers to an annual period. Low percentages correspond to rare, extreme events like hurricanes, while high percentages reflect common events such as high tide flooding or minor coastal flooding.

extrapolation (*see also* trajectory, observation-based extrapolation)

- An estimated continuation of sea level changes based on extending observed tide-gauge trends from 1970–2020 out to 2050.

extreme water levels

- Elevated water levels that are experienced during a wide range of flooding events, from common events that happen ten times a year to rare events such as hurricanes. In addition to long-term sea level rise, many contributing factors can affect coastal water levels on much shorter time scales, such as winds, storm surges, tides, ocean currents, and waves.
 - **generalized extreme value**
An analysis of water level data determined by the expected frequency of extreme water levels rising above or falling below any given level. The results are a set of annual exceedance probability levels relative to the tidal or geodetic datums for each tide station with at least 30 years of water level data.

- **regional frequency analysis**

A statistical method used to estimate the frequency distribution of extreme events. It involves pooling data from multiple sites within a region to develop regional frequency curves or equations that can be used to estimate the frequency of extreme events at ungauged sites.

flooding

- The overflow, or excess accumulation, of water that covers typically dry land.

flood alerts (*also* coastal flood alerts)

- The National Weather Service issues three tiers of coastal flood alerts to inform the public when hazardous weather conditions pose varying threats of flooding.
 - **Advisory:** A coastal flood advisory is issued when minor or nuisance coastal flooding is occurring or imminent.
 - **Watch:** A coastal flood watch is issued when there is a significant increase in the risk of a hazardous weather event, but the timing, location, or occurrence is still uncertain. Conditions are favorable for flooding, but is not a guarantee flooding will occur.
 - **Warning:** A coastal flood warning is issued when moderate to major coastal flooding is occurring or imminent. This flooding will pose a serious risk to life and property.

flood day (*also* inundation day, historical flood day)

- Occurs when verified hourly water levels exceed a specified flood threshold for at least one hour.

frequency

- The rate at which something occurs or is repeated over a particular period of time or in a given sample.

glaciers

- An accumulation of snowfall in excess of snowmelt on land over many years, compressing into ice and accounting for about one percent of total ice trapped on land. Glaciers are found in many locations, including the polar regions, mountain regions, and the fringes of ice sheets. They are found on every continent except Australia. Glaciers are sensitive indicators of climate change. Changes in glaciers are expressed regionally through gravitational, rotational, and deformational changes that have a characteristic pattern or fingerprint.

global mean sea level (*see* Mean Sea Level)

high tide flooding

- Occurs when sea level rise combines with local factors to elevate water levels above the normal high tide mark. Changes in prevailing winds, shifts in ocean currents, and strong tidal forces (which occur during full or new moons) can all cause high tide flooding, inundating streets and other infrastructure even on sunny days.

ice sheets

- A mass of glacial land ice extending more than 20,000 square miles. The two ice sheets on Earth today cover most of Greenland and Antarctica. Together, the Antarctic and Greenland ice sheets contain more than 99 percent of the freshwater ice on Earth. The melting of ice sheets contributes to global sea level rise, and these changes are expressed regionally through gravitational, rotational, and deformational changes that have a characteristic pattern, or fingerprint.

Intergovernmental Panel on Climate Change (IPCC)

- The United Nations body for assessing the science related to climate change.

land water storage

- Changes associated with the transfer of water between land and ocean and includes variability in the global water cycle, groundwater withdrawal, and water impoundment. These changes are expressed regionally through gravitational, rotational, and deformational changes that have a characteristic pattern or fingerprint.

local sea level (*also* relative sea level)

- The height of the water as measured by tide stations along the coast relative to a specific point on land. The measurements at any given tide station include both global sea level rise and vertical land motion, such as subsidence, glacial rebound, or large-scale tectonic motion. Because the heights of both the land and the water are changing, the land-water interface can vary spatially and temporally and must be defined over time. Depending on the rates of vertical land motion relative to changes in sea level, observed local sea level trends may differ greatly from the average rate of global sea level rise, and vary widely from one location to the next.

Mean Higher High Water (MHHW)

- A tidal datum. The average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch, a 19-year time period used by NOAA to collect water level observations and calculate tidal datums.

Mean High Water (MHW)

- A tidal datum. The average of all high water heights observed over the National Tidal Datum Epoch, a 19-year time period used by NOAA to collect water level observations and calculate tidal datums.

Mean Lower Low Water (MLLW)

- A tidal datum. The average of the lower low water height of each tidal day observed over the National Tidal Datum Epoch, a 19-year time period used by NOAA to collect water level observations and calculate tidal datums.

Mean Low Water (MLW)

- A tidal datum. The average of all the low water heights observed over the National Tidal Datum Epoch, a 19-year time period used by NOAA to collect water level observations and calculate tidal datums.

Mean Sea Level (MSL)

- The average height of the entire surface of the ocean.
Mean sea level can also refer to a tidal datum. It is the average of hourly water level heights measured over the National Tidal Datum Epoch, a 19-year time period used by NOAA to collect water level observations and calculate tidal datums.

meteorological year

- A meteorological year runs from May to April.

North American Vertical Datum of 1988 (NAVD 88)

- Vertical control datum established in 1991 by the minimum-constraint adjustment of the Canadian-Mexican-United States leveling observations. The National Geodetic Survey is developing a new geodetic datum called the North American-Pacific Geopotential Datum of 2022 (NAPGD2022). The NAPGD2022 will replace the North American Datum of 1983 (NAD 83) and the North American Vertical Datum of 1988 (NAVD 88). The release of the NAPGD2022 is expected to occur between 2024 and 2025.

observations

- Systematic collection and recording of data related to the Earth's climate system.

observation-based extrapolation (*see also* trajectory, regional trajectory, extrapolation)

- Estimates of relative sea level rise projected out to 2050. To create them, the rate and acceleration of sea level rise from 1970 to 2020 is calculated from sea level rise observations from sets of tide gauges and then extrapolated into the future.

prediction (*also* climate prediction)

- Refers to the short-term forecasting of weather or climate conditions based on the current state of the climate system and its known patterns of variability. These predictions typically cover timescales from a few months to a few years and aim to forecast specific climate phenomena, such as seasonal weather patterns, temperature anomalies, and precipitation trends. Climate predictions rely on observations, statistical models, and physical understanding of climate dynamics to make accurate forecasts, often for regions and specific seasons.

projections (*see also* scenarios)

- The long-term simulation of future climate conditions based on various scenarios of greenhouse gas emissions and other socioeconomic factors. These projections extend over decades to centuries and are not predictions of specific future weather events but rather scenarios of how the climate might change under different assumptions about human activities and natural processes. Climate projections use complex climate models to estimate changes in temperature, precipitation, sea level, and other climate variables. They help policymakers and researchers understand potential future climates and guide decisions on climate adaptation and mitigation strategies.

regional trajectory (*see also* trajectory, extrapolation, observation-based extrapolation)

- Estimates of relative sea level rise projected out to 2050. To create them, the rate and acceleration of sea level rise from 1970 to 2020 is calculated from sea level rise observations from sets of tide gauges and then extrapolated into the future.

scenarios (*also* sea level rise scenarios)

- Generally based upon climate model outputs, these climate models allow scientists to simulate different responses, such as how the ocean might continue to warm, where ice melts and major ice sheets dynamically respond, and where and how the additional water disperses around the world's ocean and affects circulation patterns. These responses differ under models that use different bounding conditions associated with various amounts of greenhouse emissions and ocean and atmospheric warming projections. Thus sea level rise scenarios help us plan in the face of uncertainty by providing a range of possible futures that help represent a) potential future human-driven greenhouse gas emissions, and b) how earth's physical processes will respond to increased temperatures.

sea level scenarios (*also see scenarios*)

- A plausible description of how sea level may change based on a coherent and internally consistent set of assumptions about key driving forces (e.g., emissions) and relationships. Note that scenarios are neither predictions nor forecasts but are used to provide a view of the implications of developments and actions. They are built from probabilistic projections.

six-minute peak water level

- The average of multiple one-second observed water level values is compiled to determine the six-minute height. The exact number of one-second samples and the time period algorithm varies depending on the capabilities of the different sensor types used on tide gauges. This sampling frequency allows for accurate recording of the times of high and low tide, as well as other individual events.

sea level (*see also global mean sea level, local sea level*)

- The average height of the ocean's surface. NOAA measures sea level using a combination of tide stations and satellites.

seasonal

- A period of time ranging from three months to two years.

sterodynamic

- Sea level change caused by the combined effects of thermal expansion and salinity changes (steric effects) and changes in ocean circulation (dynamic effects). This term captures the influence of both temperature and salinity on seawater volume and the redistribution of water due to currents and winds.

storm surge

- The temporary increase, at a particular locality, in the height of the sea due to extreme meteorological conditions (low atmospheric pressure and/or strong winds). Storm surge is defined as being the excess above the level expected from the tidal variation alone at that time and place.

sub-seasonal

- A period of time ranging from two weeks to three months.

thresholds (*also* coastal flood threshold, flooding impacts)

- The coastal water level elevation that must be exceeded for an adverse reaction or condition to occur or be manifested.
- **National Ocean Service (NOS) derived thresholds** are a consistent set of location-specific flood levels that are set above the average local tide range. They are based on the relationship between the National Weather Service minor flood thresholds and the local tide range. They are computed based on a statistical regression model detailed in [NOAA Technical Report NOS CO-OPS 086 - Patterns and Projections of High Tide Flooding](#).
 - **Minor:** The level at which typically presents a low threat of property damage and no direct threat to life. Minor flooding happens more frequently, resulting in cumulative impacts over time.
 - **Moderate:** The level at which typically presents an elevated threat of property damage and some risk to life if one places themselves in unnecessary danger.
 - **Major:** The level at which typically presents a significant threat to life and property.
- **National Weather Service (NWS) thresholds** - For forecasting purposes to ensure public safety, NWS has established three coastal flood severity thresholds. The thresholds are based upon water level heights established by local NWS weather forecasting offices based on many years of impact monitoring. All thresholds were established by working with local emergency managers to determine the elevation when a given area begins to be affected by flooding. The thresholds take into account local land cover, topography, the built environment, and human mitigation strategies.
 - **Minor:** A general term indicating shallow flooding in the most vulnerable locations near the waterfront and shoreline. Minimal or no threat of property damage but possibly some public inconvenience. Characterized by one to two feet of inundation in shoreline and vulnerable areas.
 - **Moderate:** A general term indicating widespread flooding of vulnerable areas. Elevated threat of property damage, inundation of secondary roads, some evacuation may be required. Characterized by two to three feet of inundation in shoreline and vulnerable areas.
 - **Major:** A general term indicating severe flooding. Extensive inundation and flooding of numerous roads and buildings resulting in a significant threat to property and life. Usually includes the evacuation of people and livestock and the closure of both primary and secondary roads. Characterized by three to five feet of inundation.

tidal datum

- A standard elevation that defines the height of water at a specific phase of the tide. Tidal datums are used to measure local water levels and depths, and to determine horizontal boundaries.

tide gauge (*see also* water level station)

- An instrument fitted with sensors that continuously record the height of the surrounding water level to help with tide and sea level change monitoring. Measures the height of the sea relative to land at a specific location.

trajectory (*see also* extrapolations, regional trajectory, observation-based extrapolation)

- Estimates of relative sea level rise projected out to 2050. To create them, the rate and acceleration of sea level rise from 1970 to 2020 is calculated from sea level rise observations from sets of tide gauges and then extrapolated into the future.

trend

- A long-term, persistent change in the average state of the climate system or its components, such as temperature, precipitation, or sea level. These trends are identified by analyzing climate data over extended periods, typically decades or longer, to distinguish systematic changes from short-term variability and natural fluctuations.

vertical land motion

- The upward or downward movement of the Earth's surface. This movement can result from tectonic activity, glacial rebound, or human activities like groundwater withdrawal. Uplift, or the upward movement of the Earth's surface, influences relative sea level change by reducing the effects of sea level rise. Subsidence, or the downward movement of the Earth's surface, influences relative sea level change by amplifying the effects of sea level rise.

water level station (*see also* tide gauge)

- An instrument fitted with sensors that continuously record the height of the surrounding water level to help with tide and sea level change monitoring. Measures the height of the sea relative to land at a specific location.