



Defining Storm Surge, Storm Tide, and Inundation

Understanding the risk associated with storm surge-driven coastal flooding requires using common references and language. When common references or language is not used, flooding risk can be misunderstood, having significant implications on the ability to communicate life-saving information and decisions during an event. To help ensure clear communication and understanding of storm surge-induced flooding, the terms used to describe storm surge, storm tide, and inundation are described below.

Storm surge is defined as the abnormal rise of water generated by a storm, over and above the normal astronomical tide, and is expressed in terms of height above predicted or expected tide levels. Since storm surge represents the deviation from normal tide levels, it is not referenced to a vertical or tidal datum. By contrast, storm tide is defined as the water level due to the combination of storm surge and the astronomical tide, and is expressed in terms of height above a vertical or tidal datum. A vertical datum is simply a base elevation used as a reference from which to measure heights (or depths). Similarly, a tidal datum is a base elevation defined by a certain phase of the tide. The definitions of various tidal datums can be found here: http://tidesandcurrents.noaa.gov/datum_options.html.

Inundation is the total water level that occurs on normally dry ground as a result of the storm tide, and is expressed in terms of height of water, in feet, above ground level. Inundation provides the most clearly and commonly understood method for communicating storm surge-driven coastal flooding. As such, the National Hurricane Center's (NHC) official forecasts provide storm surge-induced flooding information in terms of inundation or feet of water above ground level. However, many customers and partners have asked for the relationship between inundation and various tidal or vertical datums. This is particularly important in understanding the relationship between the water level observations at a tide station and the official NHC forecast. The tidal datum Mean Higher High Water (MHHW) is the best possible approximation of the threshold at which inundation can begin to occur. At the coast, areas higher than MHHW are typically dry most of the time.

The National Ocean Service's (NOS) Center for Operational Oceanographic Products and Services (CO-OPS) has made several enhancements to its existing products to be consistent with NHC official forecasts and [NWS Instruction 10-601](#). While maintaining the flexibility for users with specific needs to use alternate tidal and vertical datums, all storm tide related products will now feature MHHW options, and language consistent with NHC forecasts regarding inundation at the coast. NOAA's *Storm QuickLook* product, which highlights real-time storm tide information at locations where a tropical cyclone is impacting the U.S. coast, has been upgraded to provide more datum options

within the product, allowing users to further customize the storm tide and tidal predictions being viewed. This will be supplemented in 2014 with the transition to MHHW as the default display option for the *Storm Quicklook* product.

In addition to changes to the *Storm QuickLook* product, changes are being made to the Preliminary Extreme Water Level & Meteorological Data reports, which are produced and disseminated by CO-OPS following tropical cyclones that impact the U.S. In 2013 CO-OPS will provide maximum storm tide value relative to Mean Higher High Water (MHHW) in addition to the usual tidal/vertical datums: Mean Sea Level (MSL), Mean Lower Low Water (MLLW) and the North American Vertical Datum (NAVD88).

In addition to the CO-OPS website (www.tidesandcurrents.noaa.gov) and the *Storm Quicklook* product, storm observations relative to MHHW at any coastal water level station can be accessed through multiple web services, including the Integrated Ocean Observing System Sensor Observation Service (IOOS SOS): <http://opendap.co-ops.nos.noaa.gov/ioos-dif-sos/> This service has sample Java clients that demonstrate how one can automatically connect and retrieve data using these services for an individual application.

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