Title:

Inundation Due to Potential Sea Level Rise (filename-SeaLevelRise_Potential_MHHW_Inundation.tif)

Tags:

Sea Level Rise, MHHW, Inundation, LIDAR, NYHOPS, Hudson River, Scenic Hudson

Summary:

This is a raster dataset of the extent and depth of potential inundation due to sea level rise in the Hudson River Estuary. Inundation is defined relative to mean higher high water (MHHW) vertical tidal datum calculated using the NYHOPS operational forecast model, as reported by the Stevens Institute of Technology (Davidson Laboratory Technical Report TR-2926). Sea level rise is calculated in one-inch increments, from 0 up to 120" of sea level rise. Inundation depths (reported in 1" increments) are calculated for forty-one 3" bins of sea level rise, ranging from 0 to 120 inches of potential sea level rise.

Description:

Scenic Hudson's Inundation Due to Potential Sea Level Rise raster dataset is generally described as a "modified bathtub" model of current and potential future inundation driven by sea level rise in the Hudson River Estuary. The model uses a base condition of mean higher-high water (MHHW) to define inundation areas. MHHW is the height of the higher tide each day averaged over a 19 year period, specifically the current National Tidal Datum Epoch (NTDE) from 1983 through 2001. The extent of inundation for each vertical 1" increase in sea level above MHHW is modeled up to 120". Inundation depths are calculated from the increments of sea level rise by summarizing sea level rise into forty-one 3" increment bins, then calculating inundation depth for each bin in 1" increments.

The inundation raster dataset was created using the following steps, which closely parallel methods for mapping sea level rise inundation published by NOAA (NOAA Office for Coastal Management, January 2017, https://coast.noaa.gov/data/digitalcoast/pdf/slr-inundation-methods.pdf): 1. Create a continuous surface for current MHHW elevation by extrapolating NYHOPS tidal datum elevations to the extent of LIDAR elevation data; 2. Overlay the current MHHW elevation surface with high resolution LIDAR bare-earth elevation data to create a continuous surface of elevation difference between the current MHHW and current dry land, used to map the extent of inundation due to increments of sea level rise; 3. Calculate the inundation depths for binned 3" increments of sea level rise by subtracting the height of current dry land from the total height of sea level rise, i.e. 120" of SLR - 30" height of dry land above MHHW = 90" inundation depth.

Scenic Hudson created a continuous surface of current MHHW elevation generated from tidal datum elevations calculated by the Davidson Laboratory at the Stevens Institute of Technology using the NYHOPS operational forecast model for the tidal Hudson River north of Yonkers, NY and south of the Federal Dam at Troy, NY. The continuous surface was generated by extrapolating the modeled tidal datum elevations to the extent of the LIDAR

digital elevation model using Inverse Distance Weighting (IDW) technique. The MHHW elevation surface was calibrated from the mid-point of the NTDE of 1992 to a baseline year of 2002 by applying a factor of 2.84mm/yr, calculated by NOAA for The Battery, NY using simple linear regression of annual MSL data (https://tidesandcurrents.noaa.gov/sltrends).

We then calculated the difference between the MHHW surface and 2012 LIDAR digital elevation model (DEM) data provided by NYS Department of Environmental Conservation (downloaded through the NYS GIS Clearinghouse, https://gis.ny.gov/gisdata/inventories/details.cfm?DSID=841). The result is a continuous model of the height, in integer inches, of current dry land above the current (baseline year of 2002) MHHW tidal datum surface. This result allows mapping of the extent of inundation due to sea level rise for any increment up to 120". The dummy value of 254 was used for any calculated values <= 0. This represents the extent of current (2002) MHHW inundation. Inundation depths due to sea level rise were not calculated for currently inundated areas because high-quality bathymetric data was not available at sufficient resolution. Spurious values in the LIDAR DEM resulted in some positive values showing as speckle in the current inundation and main channel of the river. To reduce the visual impact of these data collection errors, some areas within the current extent of river inundation were manually masked and calculated to the dummy value of 254.

To calculate inundation depths, a value attribute table (VAT) was created for the difference raster above and 41 attribute fields were added for each 3" increment of sea level rise, from 0" to 120". Inundation depths were calculated using this formula:

Height of SLR - Height of dry land above MHHW = Inundation depth

For example:
120" of SLR - 30" height of dry land above MHHW = 90" inundation depth

Because the model is based on bare-earth elevation, there is the possibility for low-lying areas that are not contiguous with the river to be identified as inundation. If areas do not become connected to the larger river, however, they are not likely to be inundated at high tide, and should not be considered inundated in the model. LIDAR data provides excellent high-resolution elevation data, but it does not account for culverts and underground water connections. If there is a culvert connecting the larger river to a seemingly non-contiguous adjacent area, then that area would be inundated in the same way as the larger river. While Scenic Hudson recognizes these inaccuracies in our current model, it was infeasible to conduct a thorough analysis to identify hydrologic connections/disconnections not represented in the data. Future efforts to identify, verify, and incorporate hydrologic connectivity in the model would improve the accuracy and usability of the results.

Credits:

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Online Resource:

Linkage:

http://www.scenichudson.org/sealevelrise

Name:

Scenic Hudson's Sea Level Rise webpage

Description:

Information on Scenic Hudson's sea level rise work. Includes link to online Sea Level Rise Mapper and downloadable data package.

Attributes:

Field:

Value

Description:

Increment of potential sea level rise, calculated as the difference between LIDAR dry-land elevation values and MHHW tidal datum elevation surface, reported in 1" integer values from 0 to 120. A dummy value of 254 indicates current (2002) inundation areas, which are not included in inundation depth attribute fields calculations. This field can be used to map inundation extent due to potential sea level rise.

Field:

InundationDepth_SLRXX

Description:

The depth, in integer inches, of expected inundation resulting from potential sea level rise of XX". A dummy value of 254 indicates current (2002) inundation areas, which are not included in inundation depth attribute fields calculations.

Citation:

Dates:

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