

# Digital Elevation Model of Destin, Florida: Procedures, Data Sources, and Analysis

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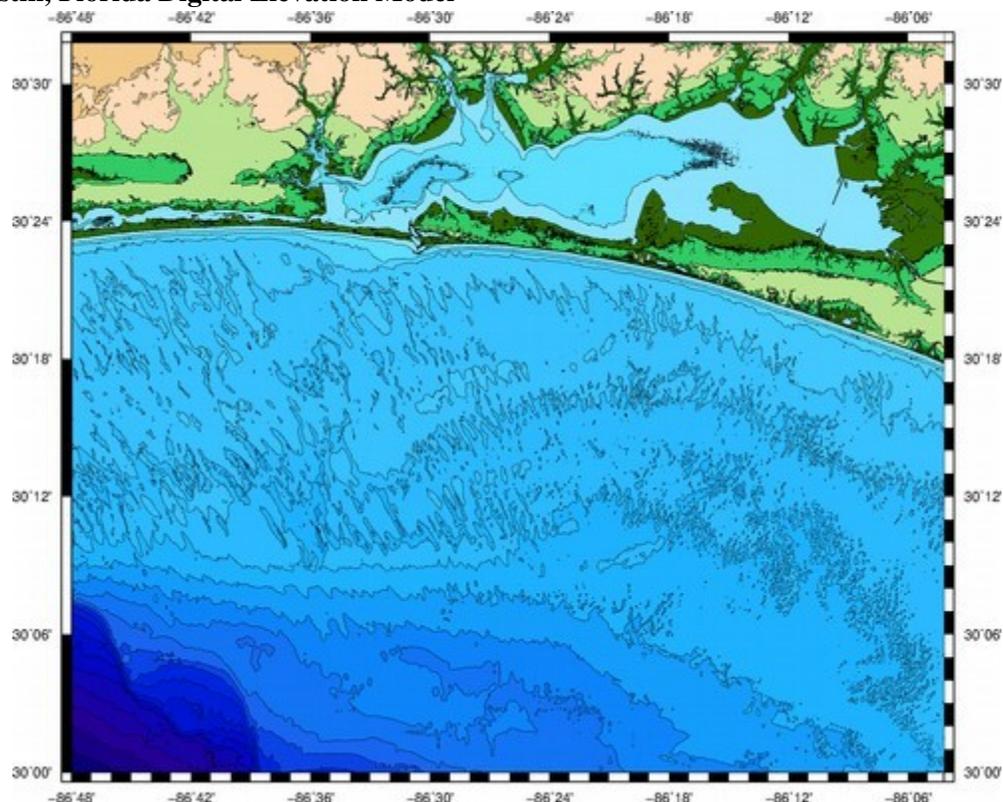
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## Summary

In March of 2016, NOAA's National Centers for Environmental Information (NCEI) developed a topographic-bathymetric digital elevation model (DEM) of Destin, Florida (Figure 1) for the National Tsunami Hazard Mitigation Program (NTHMP). The 1/3 arc-second DEM will be used to support improving the coastal tsunami inundation forecasts, storm surge modeling, community preparedness and hazard mitigation. This DEM covers the coastal area of Destin, Florida. The extents of this DEM, procedures, data sources, and analysis are described below.

The Destin, Florida DEM covers the area surrounding the city of Destin, Florida (Fig. 2). The city of Destin, Florida is situated between Pensacola and Panama City, Florida.

**Figure 1. Destin, Florida Digital Elevation Model**



# DEM Specifications

The Destin, Florida DEM was built to the specifications listed in Table 1. Figure 2 shows the 1/3 arc-second boundary in red. The best available digital data were obtained by NCEI and shifted to common horizontal and vertical datums: World Geodetic System of 1984 (WGS 84) and Mean High Water (MHW). Data were gathered in an area slightly larger (~5%) than the DEM extents. This data “buffer” ensures that gridding occurs across rather than along the DEM boundaries to prevent edge effects. Data processing and evaluation, and the DEM assembly and assessment are described in the following subsections.

**Table 1. Specifications for the Destin, Florida DEM.**

<b>Grid Area</b>	Destin, Florida
<b>Coverage Area</b>	-86.8° to -86.07° W, 30° to 30.53° N
<b>Coordinate System</b>	Geographic decimal degrees
<b>Horizontal Datum</b>	World Geodetic System 1984 (WGS 84)
<b>Vertical Datum</b>	Mean High Water (MHW)
<b>Vertical Units</b>	Meters
<b>Cell Size</b>	1/3 arc-seconds
<b>Grid Format</b>	ASCII raster grid

**Figure 2. Map image of the DEM boundary for the Destin, Florida DEM in red.**



## Data Sources and Processing

The digital coastline used in developing the Destin, Florida DEM was generated by editing the Global Self-consistent, Hierarchical, High-resolution Geography Database (GSHHG) shoreline based on the Google satellite imagery layer. The digital coastline was converted into a polygon for use in masking topography and eliminating interpolated data.

Bathymetric data (Fig. 3) used in the compilation of the Destin, Florida DEM included sounding data from the National Oceanic Survey (NOS) as well as completed datasets from NCEI (Table 2).

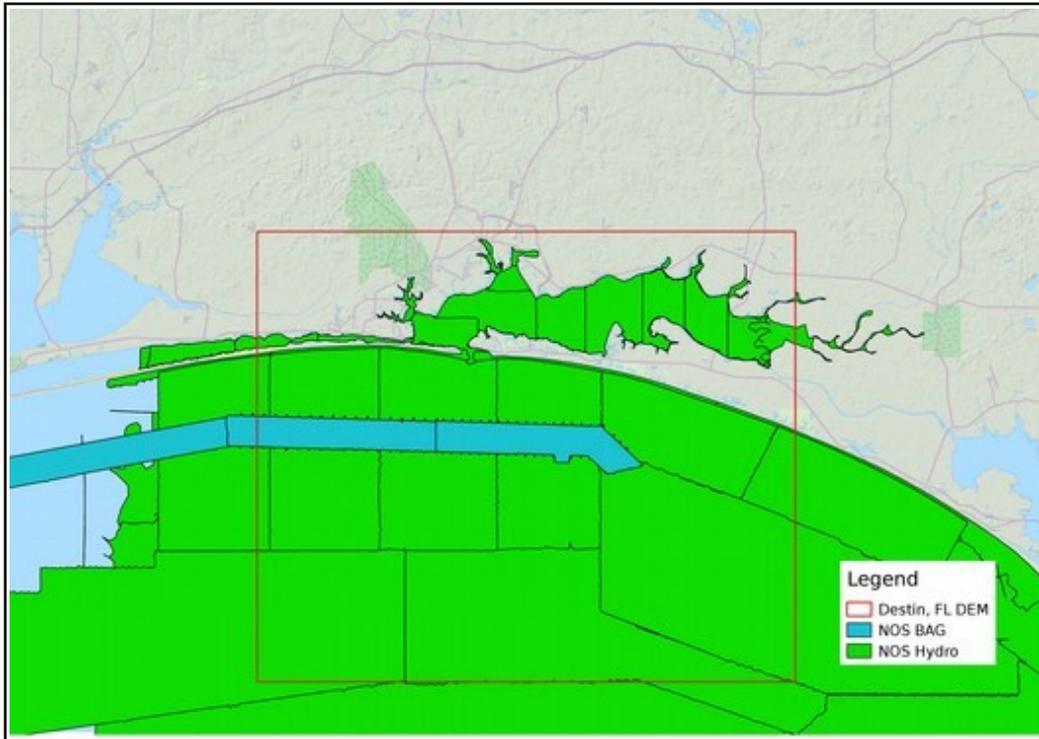
Topographic data (Fig. 4) used in the compilation of the Destin, Florida DEM included lidar data obtained from NOAA's Office of Coastal Management (OCM).

**Table 2: Bathymetric and Topographic Data Sources used in compiling the Destin, Florida DEM.**

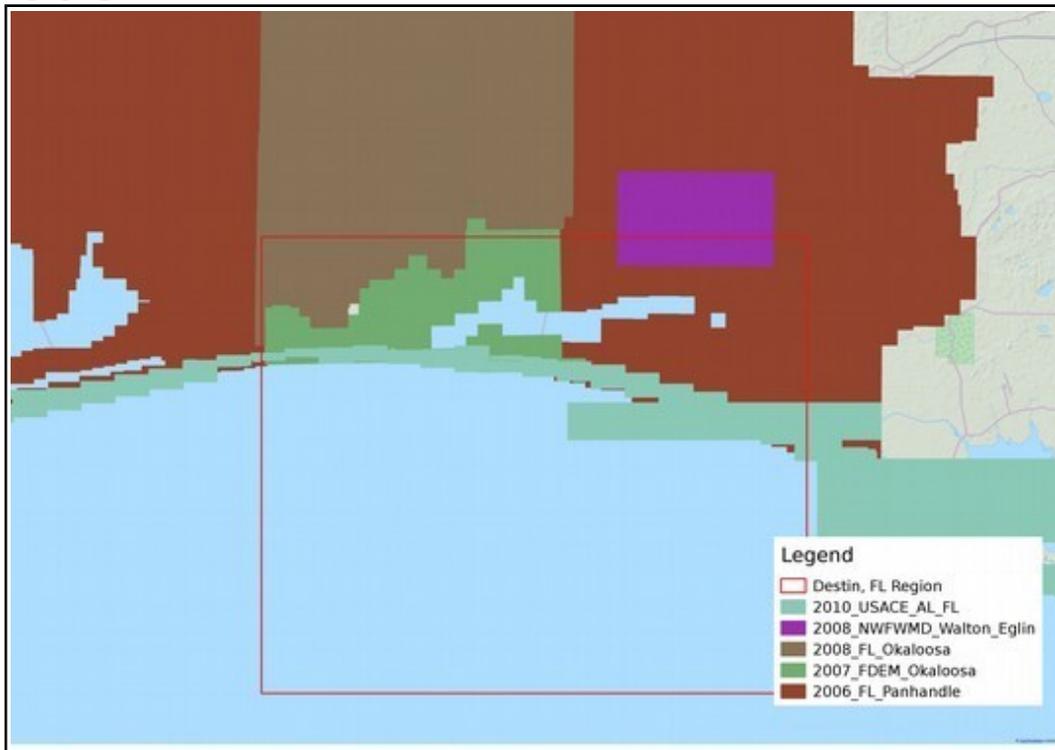
Source/Title	Date	Data Type	Resolution	Horizontal Datum	Vertical Datum
Florida Panhandle	2006	Topographic Lidar	< 1 meter	WGS84 Geographic	NAVD88
FDEM Okaloosa	2007	Topographic Lidar	< 1 meter	WGS84 Geographic	NAVD88
NFWFMD: Inland Okaloosa	2008	Topographic Lidar	< 1 meter	WGS84 Geographic	NAVD88
NFWFMD Walton Eglin	2008	Topographic Lidar	< 1 meter	WGS84 Geographic	NAVD88
USACE: Alabama and Florida	2010	Topographic Lidar	< 1 meter	WGS84 Geographic	NAVD88
NOS BAG	2010	Bathymetric Soundings	1 – 10 meters	WGS84 Geographic	Mean Lower Low Water (MLLW)
NOS Hydro	1930 - 2010	Bathymetric Soundings	1 meter to several kilometers	WGS84 Geographic	MLLW
Pensacola, FL DEM	2015	Topographic/Bathymetric DEM	10 meters	WGS84 Geographic	MHW

The bathymetric data were transformed from their original datums to a horizontal datum of WGS 84 and a vertical datum NAVD88 prior to DEM development using vertical transformation parameters provided by NOAA's Vdatum software. Topographic data were transformed from their original horizontal datums to a horizontal datum of WGS 84. All topographic data originated in NAVD88 prior to development, so no added vertical transformations were needed.

**Figure 3. Bathymetric data sources used in the Destin, Florida DEM.**



**Figure 4. Topographic data sources used in the Destin, Florida DEM.**



# DEM Development

After the bathymetric data were transformed to common horizontal and vertical datums, they were visually reviewed for consistency and errors. Where more recent, higher resolution bathymetric data existed, older data were superseded. The edited and evaluated bathymetric data were then converted to ASCII xyz format using GDAL then gridded at 1/3 arc-second using Generic Mapping Tools (GMT). The GMT 'surface' tool was used to generate a bathymetric surface which provided full data coverage of the DEM area. The surface was then clipped using the digital coastline to create the final bathymetric DEM. The final bathymetric DEM was then converted to ASCII xyz format for use as input in generating the final DEM.

After the topographic data were transformed to common horizontal datums, the areas of overlap were visually reviewed for consistency and errors.

MB-System was used to create the 1/3 arc-second Destin, Florida DEM. MB-System is an NSF-funded open source software application specifically designed to manipulate submarine multibeam sonar data, though it can utilize a wide variety of data types, including generic xyz data. The MB-System tool 'mbgrid' was used to apply a tight spline tension to the xyz data, and interpolate values for cells without data. The data hierarchy used in the 'mbgrid' gridding algorithm, as relative gridding weights, is listed in Table 3. The resulting binary grid was converted to an Arc ASCII grid using the GMT tool 'gdreformat' to create the final 1/3 arc-second Destin, Florida DEM.

**Table 3: Data hierarchy used to assign gridding weight in MB-System**

Data-set	Relative Gridding Weight
Generated Bathymetry Surface	10
Lidar datasets	100
NOS BAG Data	100
NOS Hydrographic Data	10
NCEI DEMs	.1

## Generating the MHW DEM

The Destin, Florida 1/3 arc-second MHW DEM was generated by adding a NAVD88-to-MHW conversion grid to the NAVD88 DEM generated using transformation parameters provided by NOAA's VDatum software.

## **Recommendations**

Recommendations to improve the Destin, Florida 1/3 arc-second DEM are listed below:

- Conduct bathymetric lidar surveys of near-shore coastal areas.
- Conduct high-resolution bathymetric surveys of all inlets and bays.

## **References**

Love, M.R., K.S. Carignan , B.W. Eakins, M.G. Sutherland, and S.J. McLean, 2013. Digital Elevation Model of Pensacola, Florida: Procedures, Data Sources and Analysis, National Geophysical Data Center, Boulder, CO, 4 pp.

Wessel, P., and W. H. F. Smith, A Global Self-consistent, Hierarchical, High-resolution Shoreline Database, J. Geophys. Res., 101, #B4, pp. 8741-8743, 1996.