Biscayne Bay, FL (S200) Bathymetric Digital Elevation Model(30 meter resolution) Derived From Source Hydrographic SurveySoundings Collected by NOAA

Identification Information

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Originator: Department of Commerce (DOC), National Oceanic andAtmospheric Administration (NOAA), National Ocean Service (NOS),Special Projects (SP)

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Abstract: Bathymetry for Biscayne Bay was derived from twelve surveys containing149,227 soundings. The overlap from three older, less accurate surveys wasomitted before tinning the data. The twelve surveys used dated from 1930 to1993. Approximately 60 percent of the surveys were from 1934. Surveys from1980 to 1993 cover the eastern portion of the bay. The total range of soundingdata was 0.6 meters to -10.4 meters at mean low water. Mean high water valuesbetween 0.1 and 0.6 meters were assigned to the shoreline. Fourteenpoints were found that were not consistent with the surrounding data.These were removed prior to tinning. DEM grid values outside theshoreline (on land) were assigned null values (-32676).Biscayne Bay has fifteen 7.5 minute DEMs and a single one degreeDEM. The 1 degree DEMs were generated from the higher resolution 7.5minute DEMs which covered the estuary. A Digital Elevation Model(DEM) contains a series of elevations ordered from south to northwith the order of the columns from west to east. The DEM isformatted as one ASCII header record (A- record), followed by aseries of profile records (B-records) each of which include a shortB-record header followed by a series of ASCII integer elevations(typically in units of 1 centimeter) per each profile. The lastphysical record of the DEM is an accuracy record (C-record).The 7.5-minute DEM (30- by 30-m data spacing) is cast on theUniversal Transverse Mercator (UTM) projection. It provides coveragein 7.5- by 7.5-minute blocks. Each product provides the samecoverage as a standard USGS 7.5-minute quadrangle but the DEMcontains over edge data. Coverage is available for many estuaries ofthe contiguous United States but is not complete.

Purpose: Bathymetric DEM's can be used as layers in GeographicInformation Systems (GIS) for earth science analysis. DEM's can alsoserve as tools for volumetric analysis, for site location ofstructures, or for drainage basin delineation. The source soundingsare collected by the NOS Office of Coast Survey (OCS).

Progress: Completed

Frequency: Irregular

Time Period of Content

Date Range

Begin Date: 1930

End Date: 1993

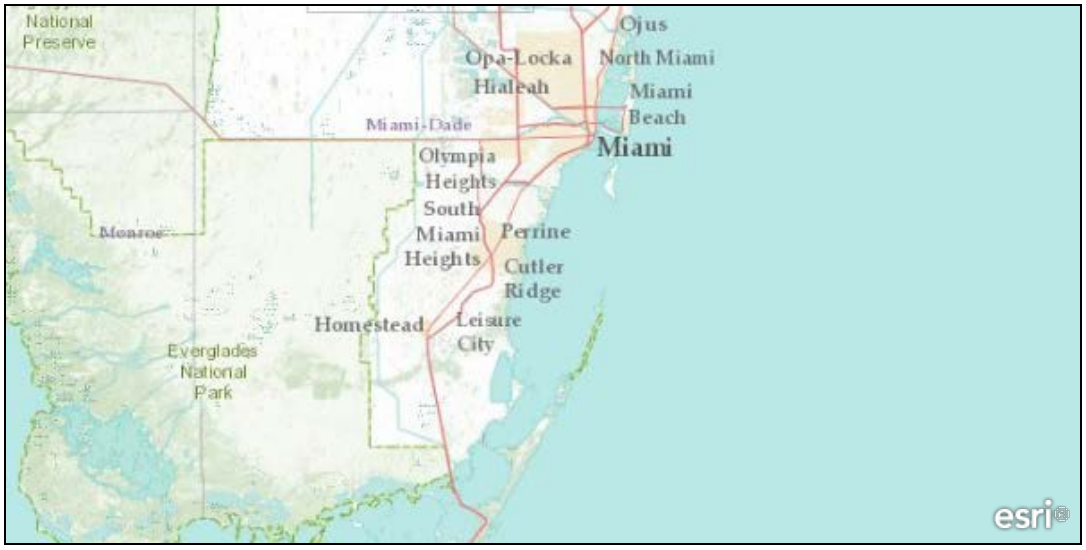
Currentness: ground condition

West Bounding Longitude: -80.434538

East Bounding Longitude: -80.120829

North Bounding Latitude: 25.929548

South Bounding Latitude: 25.177281



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Constraints

Access: none

Use: Not to be used for Navigation.Acknowledgment of the National Oceanic and AtmosphericAdministration- Nation Ocean Service would be appreciated in productsderived from these data.The datum for these bathymetric DEMs is not the same as that used bythe US Geological survey (USGS) for land based DEMs which results ina discontinuity if the two datasets are merged together. Moreover,the shoreline for the USGS DEMs is indeterminate and not the same asthat used for the Bathymetric DEMs. The data within the bathymetry file is floating point. When using the data within a GIS care must be taken to ensure that the data are being read as floating point and not integer data.

Theme Keywords

Theme Reference: none

Theme Topics: DEM, digital elevation model, digital bathymetric model, digital terrain model, bathymetry, altitude, height, depth, Elevation and Derived Products, hydrographic survey, estuary, estuarine bathymetry, marine navigation

Keywords

Theme Reference: ISO 19115 Topic Category

Theme Keywords: oceans, elevation, ImageryBaseMapsEarthCover

Place Keyword Thesaurus: None

Place Keyword: Biscayne Bay, FL, Florida, United States

Data Quality Information

Logical Consistency Report: The fidelity of the relationships encodedin the data structure of the DEM are automatically verified using aNOAA-NOS software program upon completion of the data productioncycle. The test verifies full compliance to the DEM specification.

Completeness Report: The DEM is visually inspected for completeness on a DEM view and editsystem for the purpose of performing a final quality control and ifnecessary, edit of the DEM. The physical format of each DEM isvalidated for content completeness and logical consistency duringproduction quality control.Due to the variable orientation of the 7 1/2 minute quadrilateral inrelation to the Universal Transverse Mercator (UTM) projection grid,profiles that pass within the bounds of the DEM quadrilateral may bevoid of elevation grid points and are not represented in the DEM.This condition occurs infrequently and is always the first or lastprofile of the dataset.DEM's may contain void areas caused by elevations being above MeanHigh Water or on non-tidal land. Void elevations are assigned thevalue of -32,767. In addition, suspect elevation areas may exist inthe DEM but are not specifically identified.Only available data digitized before 1997 were used in this project.Additional sounding information may exist for areas which have holesin the bathymetric data set, but was not available at the time thisproject was completed. No additional updates or error corrections areplanned for this data set.

Positional Accuracy

Horizontal Positional Accuracy Report: The horizontal accuracy of theDEM is expressed as an estimated root mean square error (RMSE). Theestimate of the RMSE is based upon horizontal accuracy tests of thesource soundings used to generate the DEM. As a first approximationthe locational accuracy of the source soundings are 0.0015 m atsource "Smooth Sheet" scale (120 m @ 1:80,000 to 15 m @ 1:10,000).Smooth Sheets are maps generated as a principle product of each(historic) hydrographic survey with fully corrected soundings plottedon them.

Accuracy Value: 3

Accuracy Explanation: Digital elevation models comply with the National Map AccuracyStandards (NMAS) accuracy requirements.

Vertical Positional Accuracy Report: The vertical RMSE statistic is used to describe the vertical accuracyof a DEM. It encompasses both random and systematic errors introducedduring production of the data. The RMSE is encoded in element number5 of record C of the DEM. This accuracy estimate includes componentsrelated to quantization of the source soundings (1.3 to 0.15 m), thesystematic editing of the source data (1percentor 0.10m), un-sampledbathymetric features (estimated at less than 5percentof depth), timerelated changes (erosion, deposition, and seismic shifts), anddredging operations (cut and fill).It is estimated that the accuracy of the Bathymetric DEMs is2percentof depth or 1 meter for depths grater than 20 meters and 2percentof depth or 0.20 meters for depths shallower than 20 meters.THESE DEMs SHOULD NOT BE USED FOR NAVIGATION.There are three types of DEM vertical errors: blunder, systematic,and random. These errors are reduced in magnitude by editing butcannot be completely eliminated. Blunders are errors of majorproportions and are easily identified and removed during interactiveediting. Systematic errors follow some fixed pattern and areintroduced by data collection procedures and systems. Systematicerror artifacts include vertical unsampled elevation shifts, relativespacing of the source soundings, misinterpretation of terrain surfacecaused by softness or poor reflectivity and by the resolution of thecollected soundings (feet, feet and fractions, fathoms, fathoms andfractions, meters, tenths of meters etc.). Random errors result fromunknown or accidental causes. The 1 degree (DSQ) DEMs are generatedfrom 30 m grids on UTM projection. The RMSE difference between thesesurfaces is an estimate of the vertical accuracy of the DSQ DEMs.

Processing Steps

Step 1 Process Description: The production procedures, instrumentation, hardware, and softwareused in the collection of standard National Oceanic and AtmosphericAdministration (NOAA) Bathymetric Digital Elevation Models (DEM's)vary depending on systems used at the time of the survey.Logsheets were kept at all stages of processing to track file names,dates, hydrographic survey coverage, and soundings or hydrographicsurveys that were deleted as part of the quality control process. Ashort summary of the processing steps for each estuary is availableon the individual data pages. In addition, a list of each of thesurveys which were included is accessible through the individual datapages.Original hydrographic data from the National Ocean Service and itpredecessors was used exclusively as source data. Processing wasperformed on desktop computers using a variety of commercial

andcustom software systems. The two main software systems used wereDigital Optimization of Grid Systems (DOGS) version 1.5x softwaredeveloped by NOAA and MapInfo Professional version 4.5 published byMapInfo augmented by a MapInfo add-on named Vertical Mapper publishedby Northwood Geosciences. The processing sequence for each estuarystarted with the generation of a comprehensive source data set fromthe NOS archives, These source sounding were quality controlled toeliminate outliers and superseded surveys, optimized to reduce thenumber of data values, augmented with points representing the MeanHigh Water shoreline, and then gridded. The gridded data sets wereconverted from the internal proprietary grid format to DigitalElevation Model (DEM) format for public distribution.Creating Point Sets of Hydrographic Survey Data:Sounding data obtained from Hydrographic Surveys were extracted usingDOGS from the GEODAS CD distributed by the National Geophysical DataCenter using each estuary's shoreline as a clipping boundary. Largeestuaries were broken into several overlapping regions and subsets ofpoints were extracted and processed. Most historic hydrographicsurveys are included on the GEODAS CD. For those regions which weremissing data (parts of southern Florida and Chesapeake Bays only),soundings were digitized from a hard copy Smooth sheets generated bythe Hydrographic Surveys.Editing and Quality Control of Bathymetry Point Data:The first step of the quality control was to review the data usingthe DOGS software. The data were first examined for surveys or partsof surveys that are redundant. For many areas there are more surveysthan are actually useful. Entire surveys or large portions ofsurveys were deleted for the following reasons:- Another more recent survey fully covers the same area.- The survey has questionable values which can not be fixed by way offiguring out a mathematical update value for the entire survey, andthere are too many bad points to pick out probable "good" values.- Sections of surveys were omitted if they were overlapped by moreaccurate surveys or by similar yet denser coverage.The second step was to display the data by depth values and to removestray points that were obvious outliers from the surrounding datavalues.Optimizing the Bathymetry Point Data using DOGS:The data was first triangulated in DOGS in order to optimize the setof points. The computer program DOGS can analyze a large set ofbathymetric data and create from it a smaller set of optimized pointswhich describes the bathymetry of a geographic region to within auser defined error. This smaller data set then can be used on itsown as a representation of the area's bathymetry, or as input intoother computer programs or Geographical Information Systems.There are two calculation options for triangulation in DOGS: relativeand absolute. Bathymetry point files were cut into sections forseparate processing based on mean depth of 10 meters. A relativeheight error criteria of 0.01 was used for the triangulation ofregions whose depths averaged above 10 meters. An absolute heighterror criteria of 0.1 meters was used for areas with average depthsless than 10 meters. The two resultant files were saved as textfiles. After combining these files, the vertical error associatedwith the optimized data set was 1percentof depth or 0.1 meters,whichever was greater. The optimized DOG file was imported intoMapInfo's MapInfo Professional desktop mapping software.Augmenting the data set with Shoreline Points:The final bathymetry was clipped to NOAA's 1:250,000 CoastalAssessment Framework (CAF) shoreline. A copy of the shoreline filewas edited to create a point file from the vector vertices andoptimized using DOGS to produce a more workable, smaller file, withlittle compromise to the shape of the shoreline. Mean High Watertide level was assigned to the shoreline points to give them aheight. These Shoreline data points were added to the set ofbathymetry points before doing the final triangulation in MapInfo.Generation of a Gridded Bathymetry Dataset:Linear triangulation of the combined point files were done in MapInfousing the Vertical Mapper 2.0 partner product software. Theresultant TIN file was then used to create a continuous grid filewith 30 meter resolution on a UTM projection using a NAD27horizontal datum. A second grid was created from the first byaggregating the 30 meter grid values to 90 meter resolution andexporting the 90m center points. A new TIN was created afterreattaching the shoreline pts. The triangle side lengths andcoincident point distances were small enough to disallowinterpolation outside the 90m distance, so as to emulate arectangular interpolation and still allow the shoreline to berepresented without averaging out the values. The result of the newfile is a geographic 3 arc second resolution grid. Both grids werecut to the estuary boundary shoreline. 7.5 minute and 1 degreesections were then created from these grids. The 7.5 minute gridshave 30 meter resolution in a UTM projection using the NAD27 datum.The 1 degree grids have a 3 arc second resolution in a geographicprojection (Latitude/Longitude) using the NAD27 datum. In theirnative form, both of these grids are in proprietary formats.Creating DEM files:The MapInfo grid files were converted to a public domain USGS formatDEM files using the NOAA DEM maker software. The formats availablefor downloading are 30 meter and 3 arc second DEMs in USGS DEMformat. DEM's are viewed on interactive editing systems to identify andcorrect blunder and systematic errors. DEM's are verified forphysical format and logical consistency.

Step 1 Process Date: Unknown

Entity And Attribute Information

Overview: The digital elevation model iscomposed of a elevation value linked to a grid cell locationrepresenting a gridded form of a bathymetric map overlay. Each gridcell entity contains a 6-character integer value between -32,767 and32,768. The grid is generated from profiles of data each containingheader information (profile identifier, starting point, relativedatum for profile values (deepest value within the DEM), number ofvalues, etc) followed by profile values relative to the relativedatum for the profile. All non-null values in the profile arepositive.

Detail Citation: U.S. Department of theInterior, U.S. Geological Survey, 1992, Standards for digitalelevation models: Reston, VA, is available at: http://rockyweb.cr.usgs.gov/nmpstds/demstds.html

Spatial Reference Information

Geodetic Model

Horizontal Datum Name: North American Datum Of 1927

Ellipsoid Name: Clarke 1866

Semi-major Axis: 6378206.4

Denominator of Flattening Ratio: 294.98

Distribution Information

Resource Description: Downloadable Data

Distribution Liability: These data were prepared by an agency of theUnited States Government. Neither the United States Government norany agency thereof, nor any of their employees, make any warranty,expressed or implied, or assumes any legal liability orresponsibility for the accuracy, completeness, or usefulness of anyinformation, apparatus, product, or process disclosed in this report,or represents that its use would not infringe privately owned rights.Reference therein to any specific commercial product, process, orservice by trade name, trademark, manufacturer, or otherwise does notnecessarily constitute or imply its endorsement, recommendation, orfavoring by the United States Government or any agency thereof. Anyviews and opinions of authors expressed herein do not necessarilystate or reflect those of the United States Government or any agencythereof. Although all data have been used by NOAA, no warranty,expressed or implied, is made by NOAA as to the accuracy of the dataand/or related materials. The act of distribution shall notconstitute any such warranty, and no responsibility is assumed byNOAA in the use of these data or related materials.

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/NOSDataExplorer/rest/document?f=html&id=%7B020DA09D-DEB9-441D-8807-CB1FDBD5CDE5%7D