NOAA Technical Memorandum NOS CS 27

VDATUM FOR THE COASTAL WATERS FROM THE FLORIDA SHELF TO THE SOUTH ATLANTIC BIGHT: TIDAL DATUMS, MARINE GRIDS, AND SEA SURFACE TOPOGRAPHY

Silver Spring, Maryland
May 2012

noaa National Oceanic and Atmospheric Administration

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National Ocean Service
Coast Survey Development Laboratory

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VDATUM FOR COASTAL WATERS FROM THE FLORIDA SHELF TO THE SOUTH ATLANTIC BIGHT: TIDAL DATUMS, MARINE GRIDS, AND SEA SURFACE TOPOGRAPHY

Zizang Yang and Edward P. Myers
Office of Coast Survey, Coast Survey Development Laboratory, Silver Spring, MD

Inseong Jeong and Stephen A. White
National Geodetic Survey, Silver Spring, MD

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF FIGURES (Cont.)

LIST OF TABLES

ABSTRACT

The VDatum is a vertical datum transformation software tool, which provides spatially-varying conversions between tidal, orthometric, and ellipsoid-based 3D reference frames. The present study developed the tool for an area covering most of the Florida shelf and nearly the entire South Atlantic Bight. The area encompasses coastal waters of part of Florida, Georgia, South Carolina, and part of North Carolina.

The tidal datums fields were derived from tidal simulations using the Advanced Circulation model, a finite element hydrodynamic model which uses unstructured triangular grids. A grid consisting of 352,705 nodes and 620,658 cells was created for this project. The model was forced with nine tidal constituents (M_2, S_2, N_2, K_2, K_1, P_1, O_1, Q_1, and M_4) and integrated for 60 days. Various tidal datum fields, including mean lower low water (MLLW), mean low water (MLW), mean high water (MHW), and mean higher high water (MHHW), were derived using the water level time series from the final 40 days of the simulation. Model results were validated by comparing with observations at 516 water level stations maintained by the NOAA's Center for Operational Oceanographic Products and Services (CO-OPS). Discrepancies between model results and observational datums were attributed to model errors and interpolated over the whole model domain using TCARI (Tidal Constituent And Residual Interpolation), a spatial interpolation tool based on solution of Laplace's equation. The error fields were applied to the direct model results to derive corrected tidal datums on the model grid. These final tidal datum fields were interpolated onto a regularly structured marine grid to be used by the VDatum software.

The Topography of Sea Surface, defined as the elevation of NAVD88 relative to local mean sea level, was developed based on interpolation of bench mark data maintained by CO-OPS and the National Geodetic Survey (NGS). The NAVD88-to-LMSL values were derived by fitting tidal model results to tidal bench marks leveled in NAVD88. Results by both methodologies were coupled to create the final TSS grids using spatial interpolation.

Key Words: tides, tidal datums, Florida shelf, South Atlantic Bight, circulation model, mean sea level, bathymetry, coastline, spatial interpolation, marine grid, North American Vertical Datum of 1988

1. INTRODUCTION

NOAA's National Ocean Service (NOS) has developed software tool called VDatum to transform elevation data among approximately 30 vertical datums (Gill and Schultz, 2001; Hess et al., 2003; Milbert, 2002; Parker, 2002; Myers et al., 2005; Spargo et al., 2006b). Once VDatum has been established for a region, data sets referenced to different vertical datums can be integrated through transformations to a common vertical datum (Parker et al., 2003). VDatum allows all bathymetric and topographic data to be integrated in this manner through its inherent geoidal, ellipsoidal, and tidal datum relationships.

To be applicable over coastal waters, VDatum requires spatially varying fields of the tidal datums and the Topography of Sea Surface (TSS). The former involves datums such as MHHW, MHW, MLW, MLLW, Mean Tide Level (MTL), and Diurnal Tide Level (DTL) defined relative to local mean sea level (LMSL). The latter refers to the elevation of the North American Vertical Datum of 1988 (NAVD88) relative to LMSL.

The VDatum tool software is currently available for Tampa Bay (Hess, 2001), Puget Sound (Hess and Gill, 2003; Hess and White, 2004), central/northern North Carolina (Hess et al., 2005), the Strait of Juan de Fuca (Spargo et al., 2006a), Delaware and Chesapeake Bays (Yang et al., 2008a), Long Island Sound and New York Bight and Harbor (Yang et al., 2008b; Yang et al., 2010b), the northeast Gulf of Mexico (Dhingra et al., 2008), southern California (Yang et al., 2009), the eastern Louisiana and Mississippi coastal waters (Yang et al., 2010a), and the Pacific Northeast region (Xu et al., 2010).

This report describes the development of VDatum for an area covering the coastal waters of the Florida (FL) shelf and nearly the entire South Atlantic Bight (SAB). The area encompasses coastal waters of Florida as far west as Cape San Blas, Georgia, South Carolina, and North Carolina to Onslow Bay (Figure1). In Figure 1, black lines represent the MHW coastline and the green line denotes the 25-nautical mile offshore demarcation. Tidal datums for VDatum are generally developed for water areas between the coastline and the 25-nm offshore limit. Also, when this VDatum becomes operational, it will replace the existing Tampa Bay Vdatum (Hess, 2001).

Development of VDatum begins with tidal simulations using the ADvanced CIRCulation (ADCIRC) model (Westerink et al., 1993). Various tidal datum fields (MHHW, MHW, MLW, and MLLW) were derived using the simulated water level time series. The tidal datums were verified by comparing with observational data, and error corrections were made based on these comparisons. Regularly structured VDatum marine grids were created and populated with corrected tidal datums. Finally, for the same marine grid, the NAVD88-to-LMSL field was derived by either fitting tidal model results to tidal bench marks leveled in NAVD88 or calculating orthometric-to-tidal datum relationships at NOAA tidal gauges.

This technical report is organized as follows: After an introduction in Section 1, Section 2 discusses data input needed to set up the hydrodynamic model run and the validation of the model results. Such data inputs include digital coastline, bathymetry, and tidal datums derived from observational data. Section 3 details tidal datum simulation procedures, including an introduction of the tidal hydrodynamic model, its setup, validation of results, and error corrections. Section 4 discusses creation of the regularly structured marine grid required for the VDatum software tool and its population with error-corrected model datums. In Section 5, creation of the TSS for the area is described. Finally, a summary is given in Section 6.

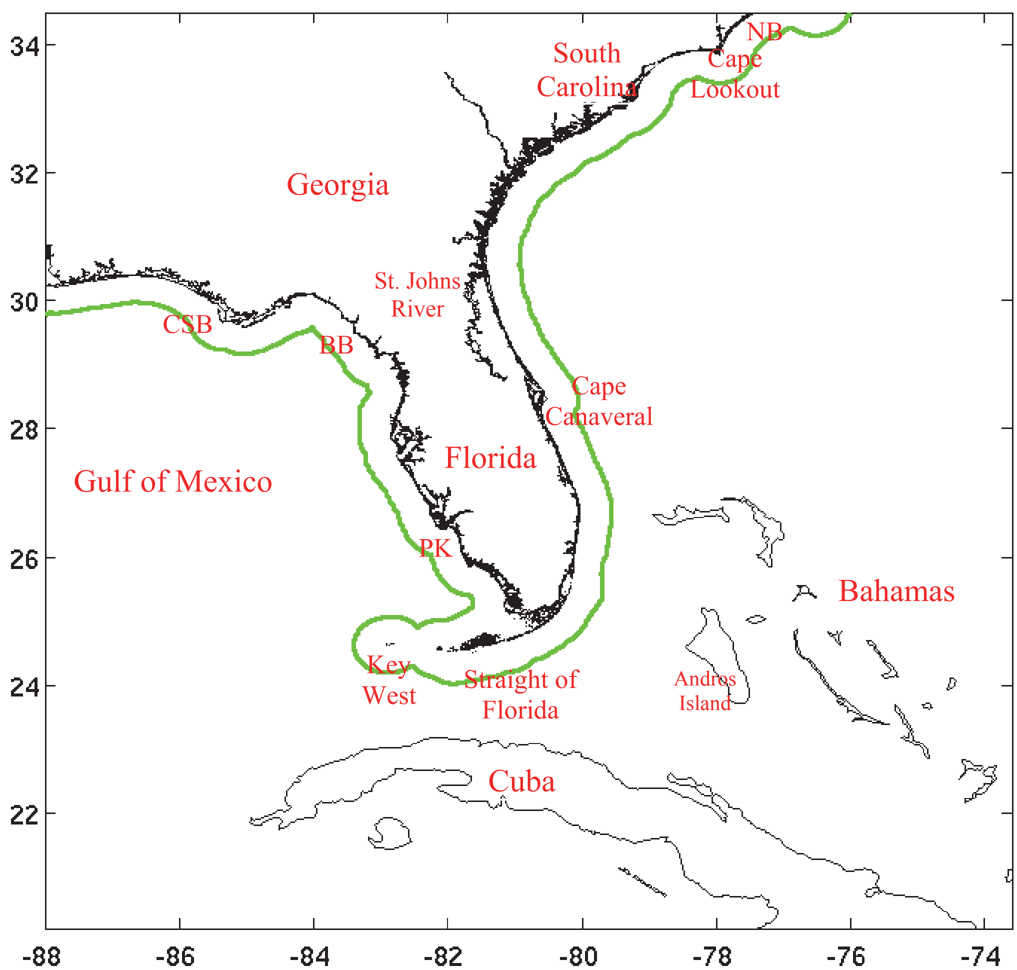


Figure 1. Map of the coastal areas of the FL shelf and the SAB. Black lines illustrate the MHW shoreline. The green line denotes a distance 25-nautical miles offshore. In the figure, the site abbreviations are CSB: Cape San Blas, BB: the Big Bend, PK: Pavillion Key, and OB: Onslow Bay.

2. COASTLINE, BATHYMETRIC, AND WATER LEVEL DATA

VDatum requires an accurate representation of spatially varying tidal datum fields (Milbert and Hess, 2001). To achieve this, VDatum applications are developed using a combination of observational data, hydrodynamic models, and spatial interpolation techniques (Spargo et al., 2006b); Yang et al., 2005; Yang and Myers, 2007; Spargo and Woolard, 2005). For this VDatum application for the FL and the SAB coastal waters, a tide model was first set up to compute spatially varying tidal datums. The modeled tidal datums were next compared with those derived from CO-OPS observational data. Finally, spatial interpolation techniques were used to create a correction field, which was then applied to the model results to derive a corrected field of tidal datums that are consistent with the observations.

For the tidal simulations, coastline data are required for delineating land-water boundaries so as to define hydrodynamic model domains. In addition, bathymetric data are needed to provide the model grid bathymetry. Numerical model results may not exactly match CO-OPS observations, and therefore observational data are needed to validate and correct the model results.

2.1. Digital Coastline

For VDatum the mean high water shoreline is used as the coastline to delineate the land-water boundaries (Parker, 2002). The shoreline data used in the present study were mainly based on the Electronic Navigational Chart (ENC) shoreline from the NOS Office of Coast Survey (OCS). However, in certain areas the ENC shoreline appears to be incomplete or inaccurate in terms of the existence of dangling shoreline segments or confusing outlines of artificial constructs. The erroneous MHW depictions were corrected using computer-aided techniques to match the MHW coastlines illustrated on satellite imagery. In Figure 1, the black line illustrates the final corrected coastline.

2.2. Bathymetric Data

Bathymetric data used in this study were from three sources: (1) the NOS soundings, (2) the NOAA Electronic Navigational Charts (ENCs) bathymetry, and (3) a regional ADCIRC model grid bathymetry. The first were from the NOS/OCS hydrographic database maintained at the National Geophysical Data Center (NGDC); the second were based on the NOAA ENCs, and the third source is from the bathymetry of the 2001 version of the U.S. East Coast ADCIRC model, called EC2001 (Mukai et al., 2002). Figures 2-4 illustrate the spatial coverage of the soundings, ENC, and EC2001 model bathymetric data, respectively.

The NOS sounding data include surveys conducted between 1852 and 2005. In the areas where data from multiple years were available, those from more recent years were used. The datums were referenced to either MLW or MLLW, depending on the years of data collection. The ENC data were referenced to MLLW. The horizontal and vertical accuracy standards for NOAA surveys are listed in Table A.1 of Appendix A.

The NOS soundings possess a higher spatial distribution density than the ENC data. However, neither of them provides complete coverage for the whole study area. Hence, they were blended for a better regional coverage.

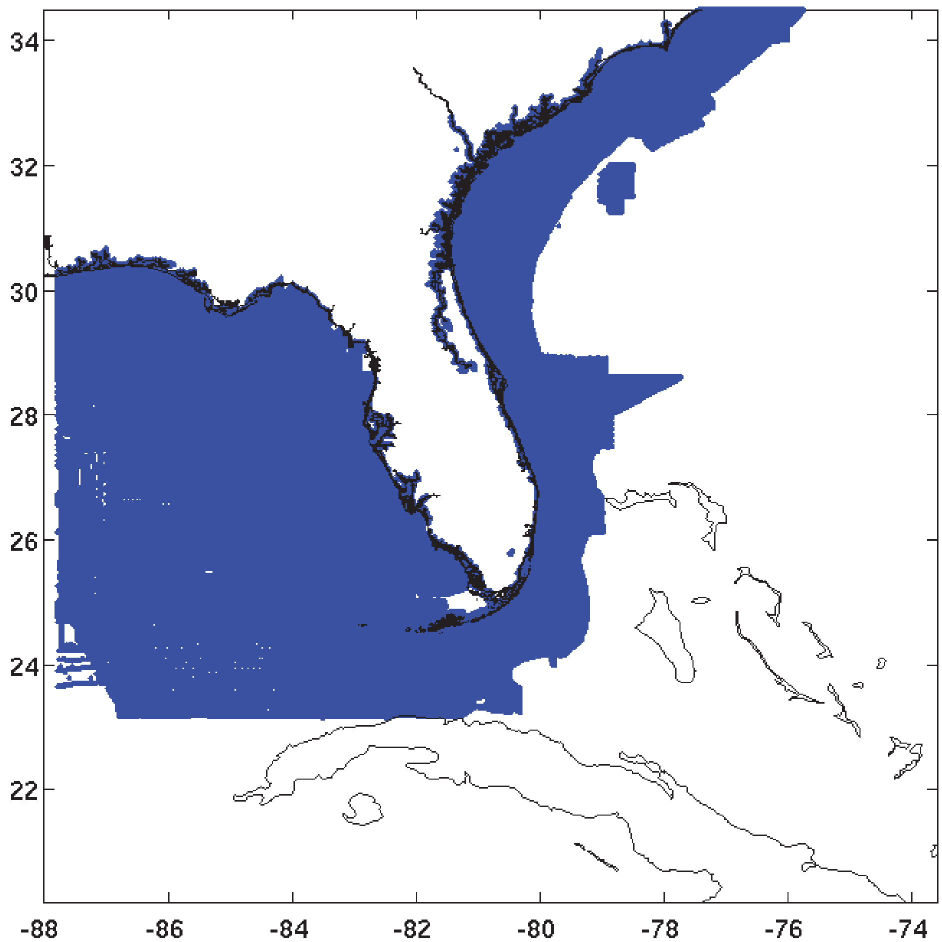


Figure 2. Locations of NOS sounding data (points in blue).

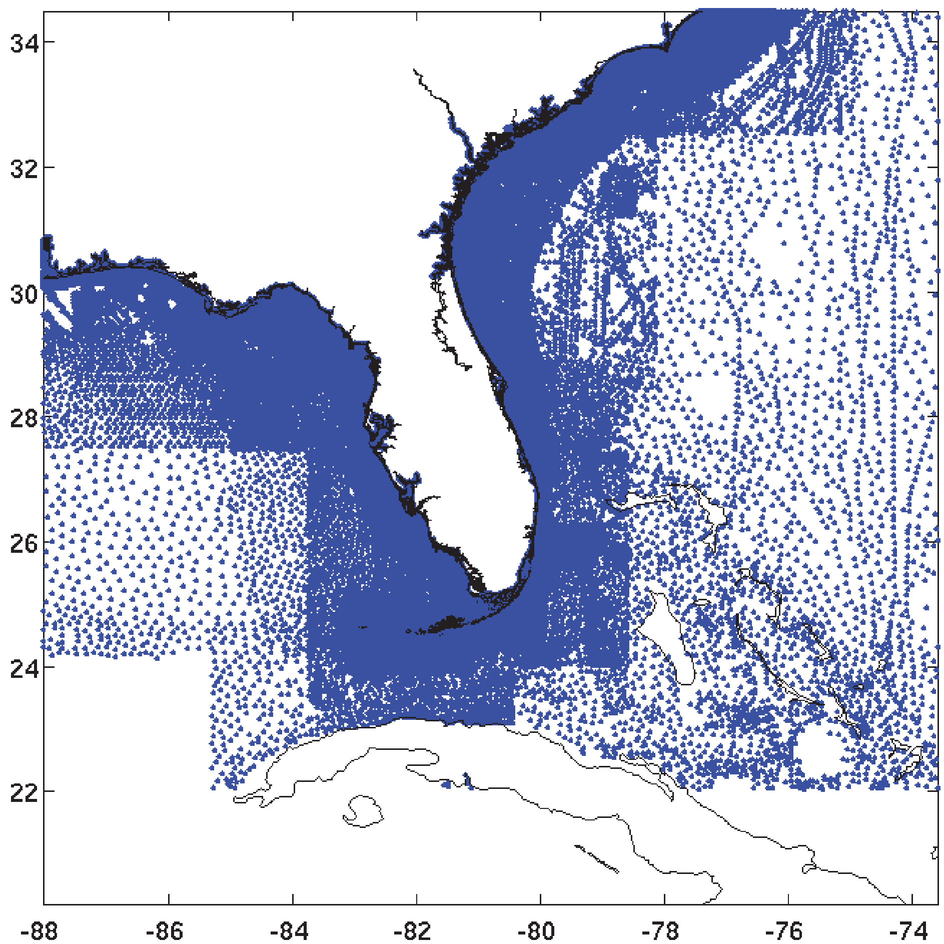


Figure 3. Locations of ENC bathymetric data (points in blue).

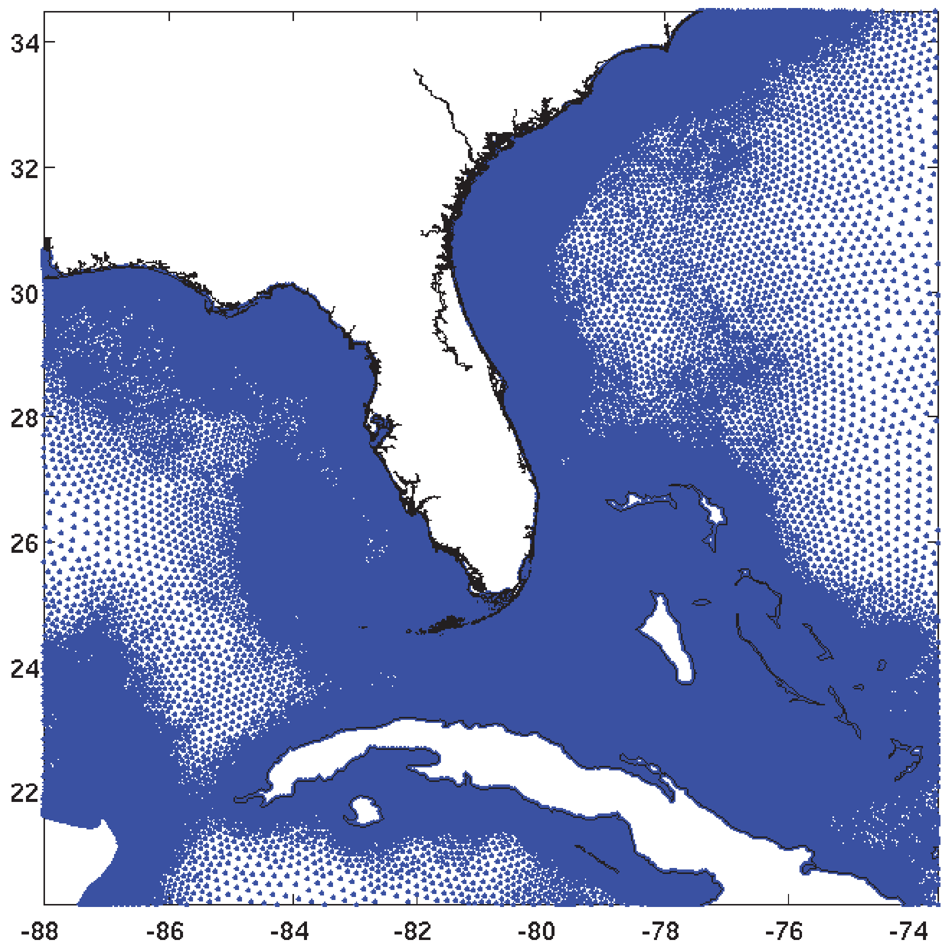


Figure 4. EC2001 model grid where bathymetric data (points in blue) had been interpolated.

2.3. Tidal Datum Elevations

Tidal datums from CO-OPS water level stations were used for verifying and correcting model results. These observational data are available online and correspond to the 1983-2001 National Tidal Datum Epoch (NTDE).

Many stations are located within either embayments or near obstructions not mapped by the present model grid (Section 3.2), or at upper reaches of riverine areas where datums exhibit strong seasonal variability. These observations were determined to be unsuitable for validating model results and were therefore discarded. Data from 516 stations were selected for use in the model validations. Tables B.1 and B.2 in Appendix B list the station and tidal datum information used for this particular model.

3. TIDAL DATUM SIMULATION

3.1. Hydrodynamic Model

The ADCIRC model was used to simulate tidal water level time histories. The ADCIRC model is an unstructured grid hydrodynamic circulation model. It solves the shallow water equations and has been used in modeling tides in various ocean, coastal and estuarine environments (Westerink et al., 1993; Luettich et al., 1999; Mukai et al., 2002). The ADCIRC model provides a variety of options for users to specify input parameters and execution modes. For instance, the model may be run in either 2- or 3-dimensonal modes, serial or parallel execution, linear or quadratic bottom friction formulation with constant or variable friction coefficients, etc. More details on the model setup such as model grid generation, bathymetry definitions, and parameter specifications are addressed in following sections.

3.2. Model Grid

The model domain for this VDatum application is shown in Figure 5. It spans from eastern Gulf of Mexico (GOM) across the Straits of Florida (SFL) to the South Atlantic Bight (SAB). A high-resolution, unstructured grid of 352,705 nodes and 620,658 triangular elements was created to map the domain up to the MHW shoreline. The spacing between grid nodes ranges from around 16 m to 41 km. In general, finer elements were created for nearshore areas compared to those in deep waters, so as to accurately resolve fine coastline features and the bathymetric-dependent variability of the tidal wavelengths.

Figures 6a-c show close-up views of three sections (from west to east) of the model grid. They correspond to the water areas of the Tampa Bay and Charlotte Harbor (Figure 6a), the Pavilion Key, Florida Bay, and Key West (Figure 6(b), and the northern SAB coast (Figure 6c).

Note that the present model domain goes far beyond the area in which the present VDatum development is concerned. This is for the sake of ensuring model computational stability and pursuing accurate tidal simulations. In areas far away from the shoreline, tidal currents are relatively weak and tidal fields exhibit rather gradual variability, both of which are beneficial for open ocean boundary conditions.

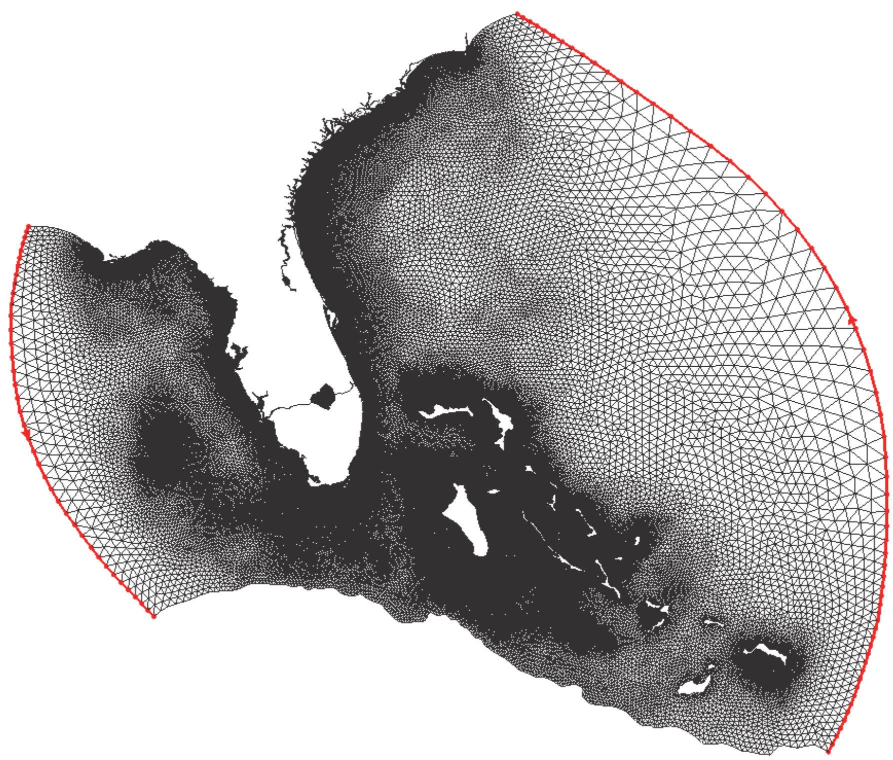


Figure 5. Finite element grid for the entire model domain. The two red lines denote the model's two open ocean boundaries.

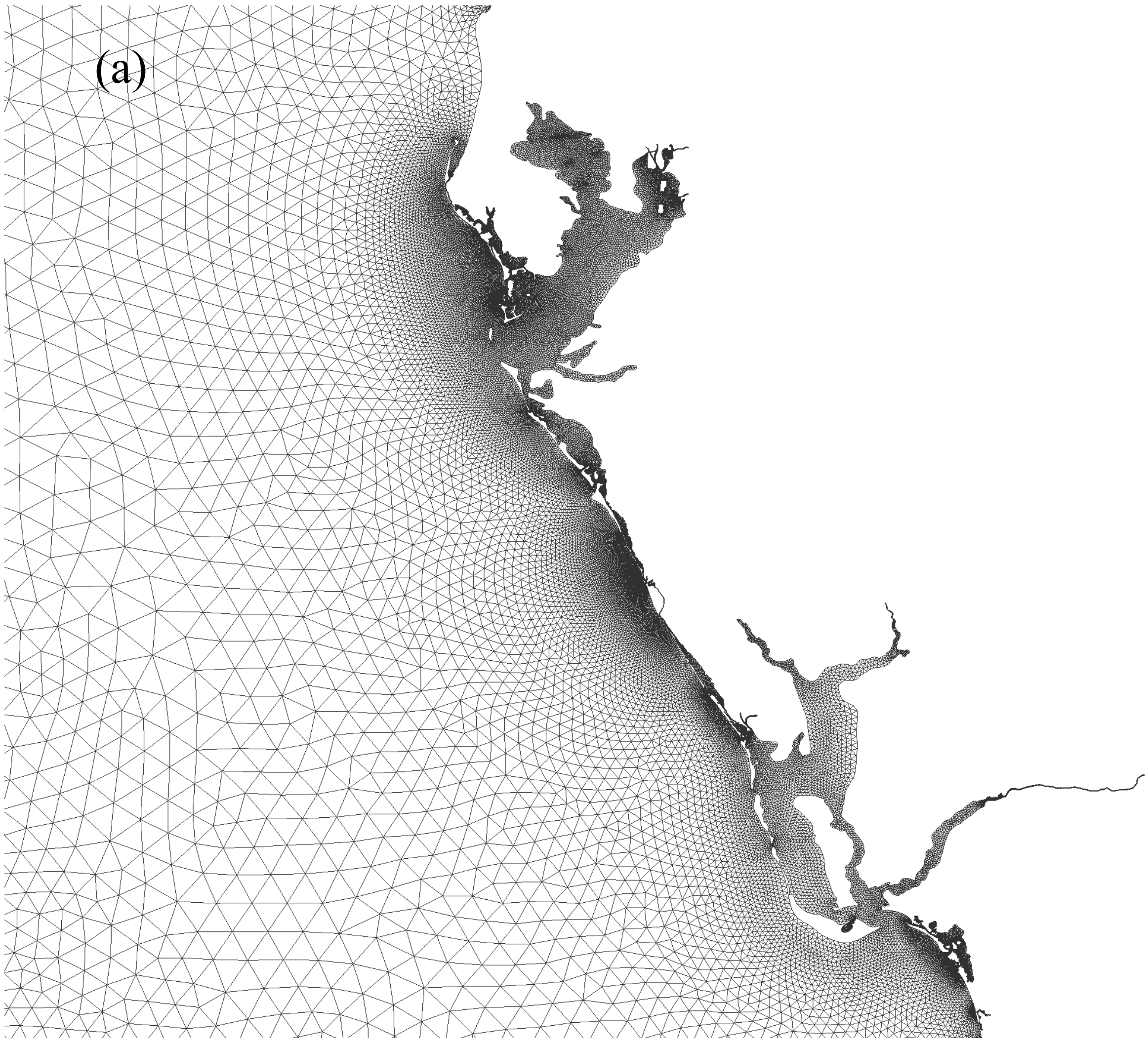


Figure 6(a). Close-up views of the model grid for the Tampa Bay and Charlotte Harbor.

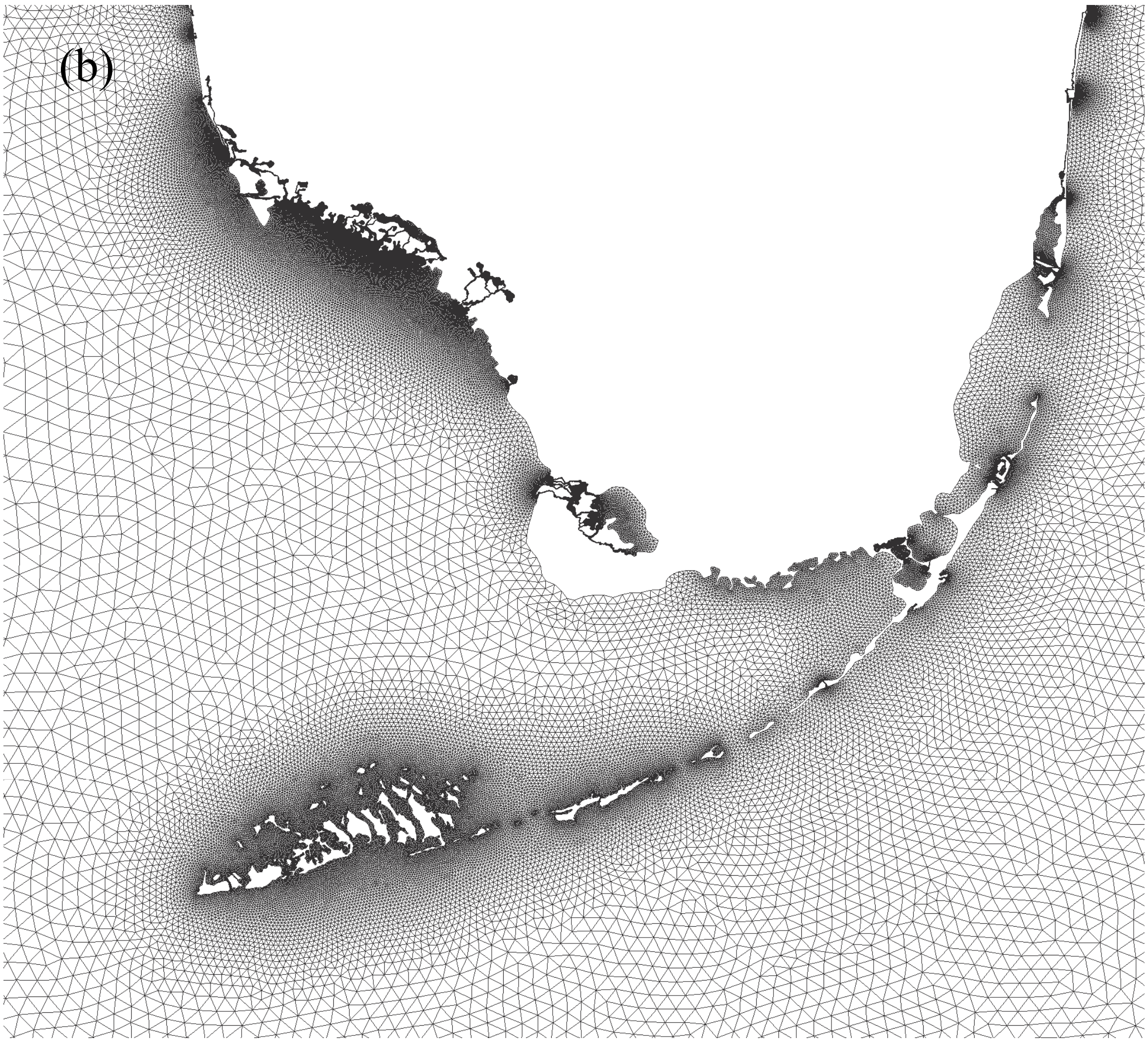


Figure 6(b). Close-up views of the model grid for the Pavilion Key, Florida Bay, and Key West.

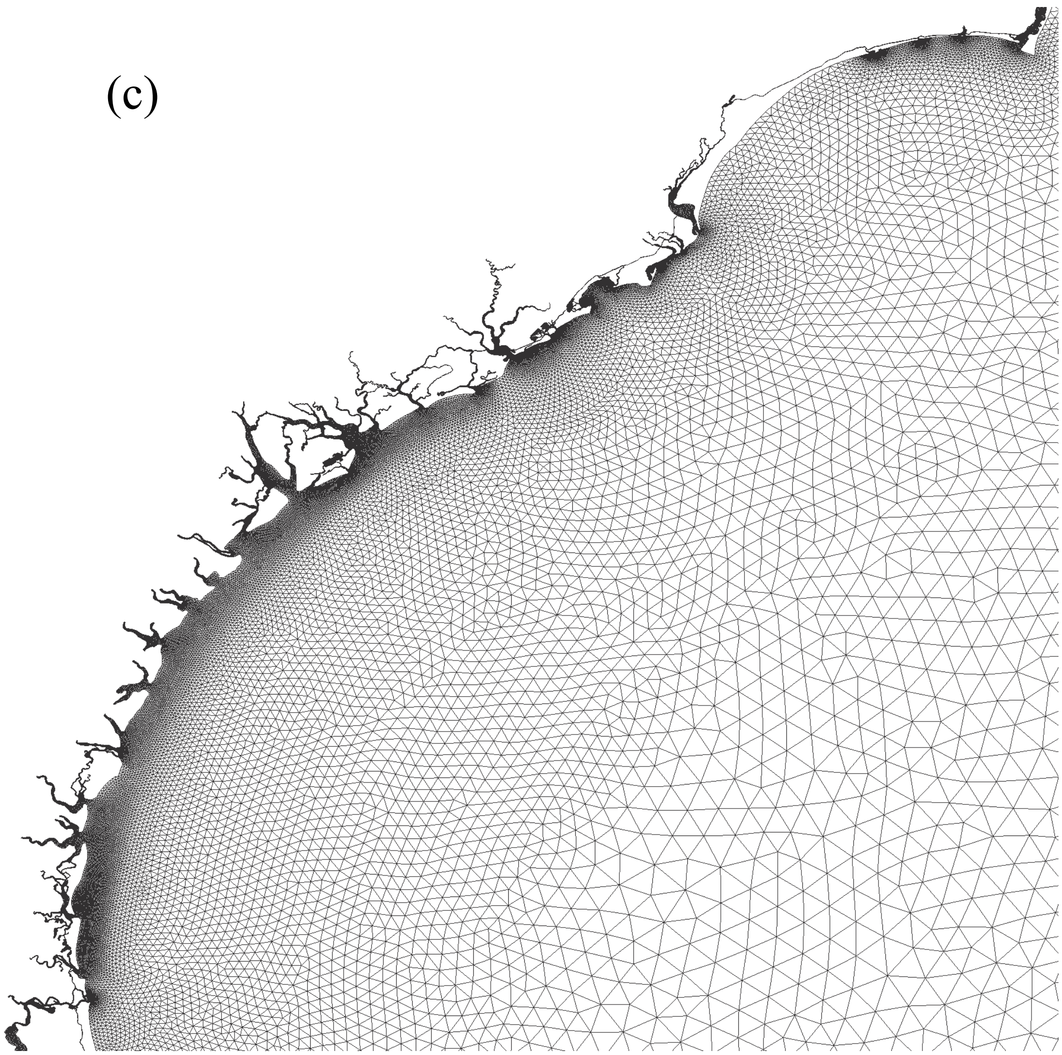


Figure 6(c). Close-up views of the model grid along the northern SAB coast.

3.3. Bathymetry of Model Grid

The bathymetry datasets described in Section 2.2 were used to specify the model grid bathymetry. Note that NOS soundings and ENC data were of different spatial resolution and coverage. As for the soundings alone, bathymetry may be referenced to either MLW or MLLW. Hence, they were categorized into two groups and applied to the grid separately. In short, the bathymetry data were first classified into three groups: (1) MLLW NOS soundings (2) MLW NOS soundings, and (3) MLLW ENC data. The three groups were interpolated onto the model grid separately, resulting in three meshes corresponding to the three bathymetric datasets.

The algorithm used for interpolating bathymetry onto the three meshes was the same. Bathymetry at each model node represents an average of data points within the node's surrounding elements. Since element size changes throughout the model domain, the searching range for bathymetric data points varies from node to node. As the element size is smaller in coastal waters, bathymetry data for nodes near the coastline were from more locally distributed data points compared to those in deep waters.

As none of the three data sets provided complete coverage of the model domain, each of the three meshes left numerous unpopulated nodes. Hence, the three meshes were combined to obtain more complete coverage. At nodes where bathymetric data were available in more than one mesh, an arithmetic average was taken; otherwise, the value from the one available mesh was taken. After merging the three meshes, there still remained some nodes without filled values of bathymetry. These nodes were populated by either averaging bathymetry from adjacent nodes or assigned bathymetry values from referencing NOAA's raster nautical chart bathymetry

It is worthwhile to note that the bathymetry of the three meshes had two different reference datums: MLW and MLLW. Setup of the tidal model requires the grid bathymetry to be referenced to the model zero (MZ), a geopotential surface. It is therefore necessary to adjust the reference datum from MLLW/MLW to MZ prior to any data blending. However, the *(MZ – MLLW/MLW)* values are unknown prior to the model runs. The adjustment was accomplished by iteratively updating the $\Delta_{MLLW} = (MZ\text{-}MLLW)$ and $\Delta_{MLW} = (MZ\text{-}MLW)$ fields based on model results from a series of simulations. The initial sets of the Δ_{MLLW} and Δ_{MLW} values prior to any model runs were estimated based on a TCARI interpolation of the observed tidal datums at the water level stations (Section 2.3). However, since the observations are referenced to MSL, MZ is replaced with the MSL in computing Δ_{MLLW} and Δ_{MLW} at the first iteration. Following each model run, new sets of tidal datum fields were derived and used to update the Δ_{MLLW} and Δ_{MLW} fields by accounting for the computed MZ-to-MSL difference. Multiple runs were conducted until invariant Δ_{MLLW} and Δ_{MLW} values were achieved. Multiple iterations were made to meet a convergence criteria of both $|\Delta_{MLLW}|$ and $|\Delta_{MLW}|$ less than 5×10^{-3} m. Figure 7 shows the bathymetry used in the final model run.

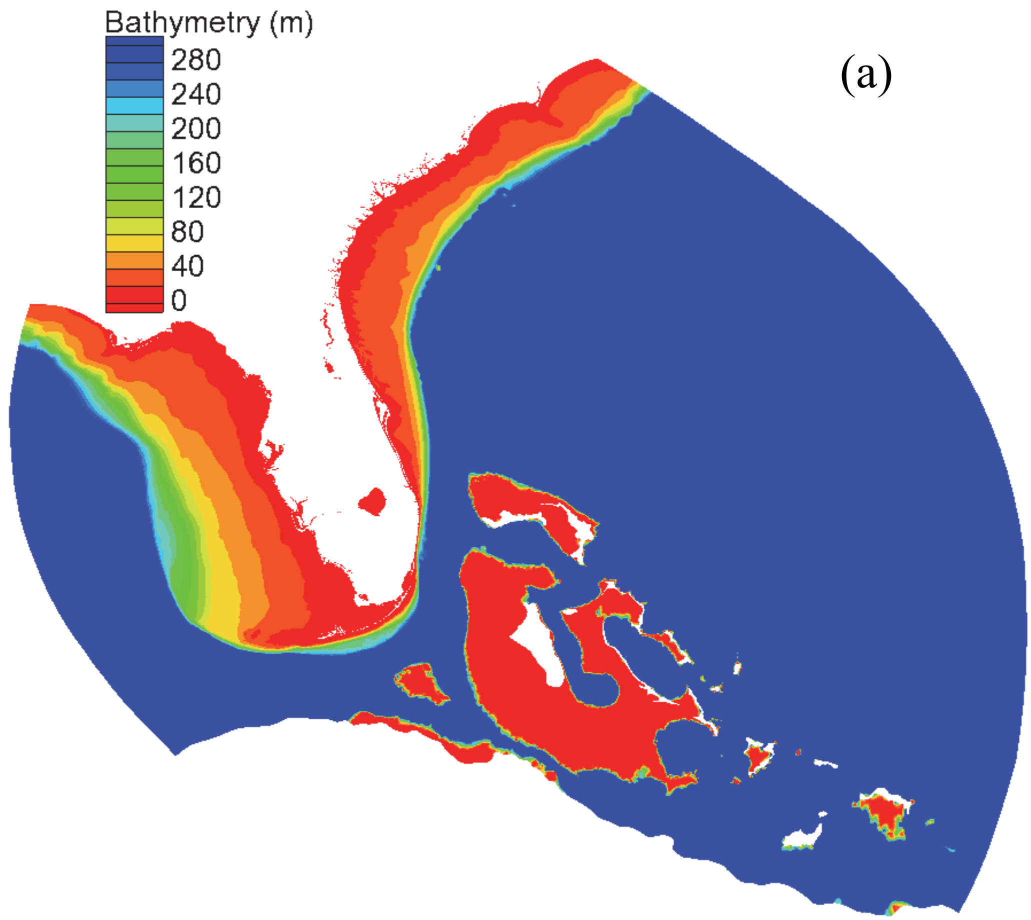


Figure 7(a). Model grid bathymetry in [0, 300] m. The bathymetry beyond 300 m is shown in the same color as that of the 300-m bathymetry.

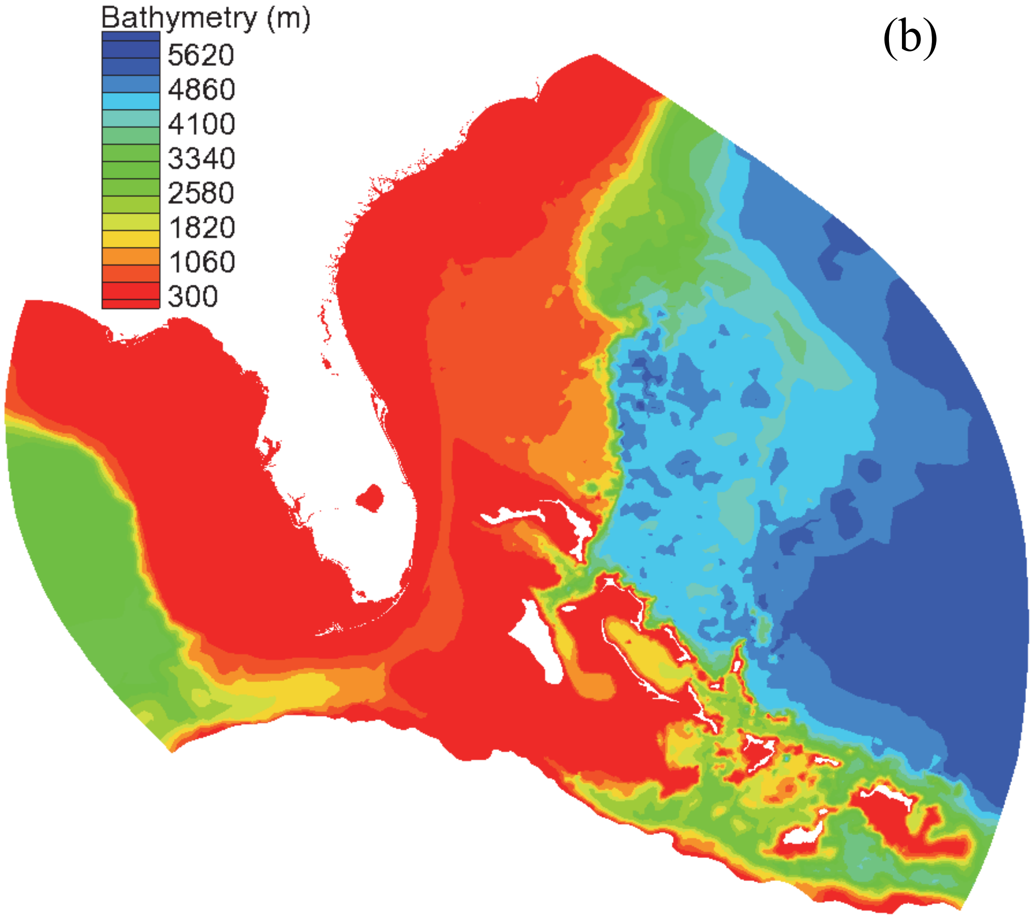


Figure 7(b). Model grid bathymetry in [300, 6000] m. Bathymetry less than 300 m is shown in the same color as that of the 300-m bathymetry.

3.4. Model Parameters and Setup

In the present study, model parameters were set up to solve the shallow water equations in Two-Dimensional Depth-Integrated (2DDI) mode with finite amplitude and convection terms and the wetting and drying option activated. Lateral viscosity was set as a constant, 5.0 m s^{-2}, throughout the model domain. A quadratic friction scheme with a spatially-varying coefficient (C_f) was specified to calculate bottom friction. Multiple runs were conducted to test various C_f values in an attempt to mitigate model-data discrepancy in terms of tidal datums, especially in the Florida Keys and coastal Georgia and South Carolina. Figure 8 shows the values derived for the final tidal simulations. For most of the model grid, a value of 2.0×10^{-3} was used for C_f.

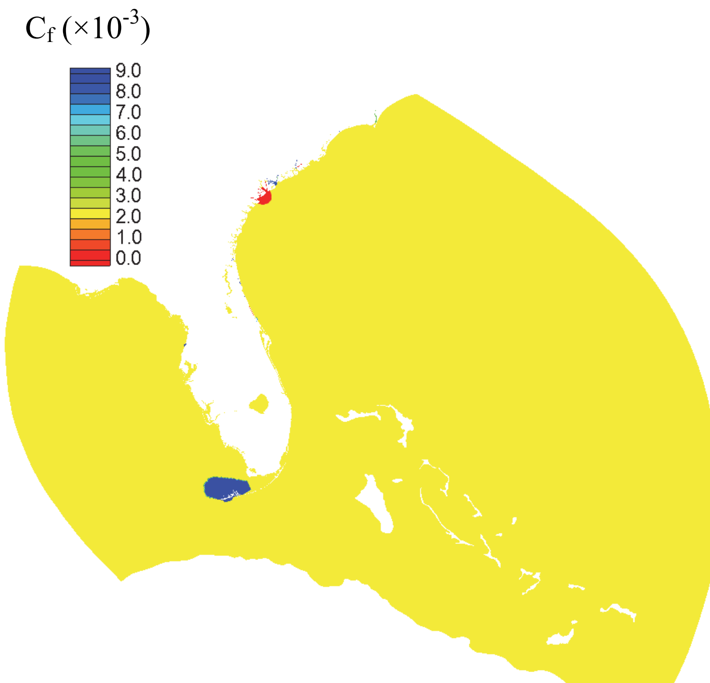


Figure 8. Spatially-varying bottom friction coefficient (C_f).

The nine most significant astronomical tidal constituents (M_2, S_2, N_2, K_2, K_1, P_1, O_1, Q_1, and M_4) in the area were chosen to drive the model on its two open boundaries. Corresponding harmonic constants were interpolated based on a tidal database derived from the EC2001 model (Mukai et al., 2002).

A time step of 1 second was used to ensure computational stability. The simulation covered a period of 60 days. First, the amplitude of the boundary forcing was ramped up for 10 days with a hyperbolic tangent function. The model equations were then run for another 10 days to allow for the tidal field to reach an equilibrium state. Afterwards, 6-

minute interval water level time series were recorded at each node for 40 days to derive the tidal datums.

The parallel version of ADCIRC model was adopted and the model run was conducted on 96-processors on the JET computer at NOAA's Earth System Research Laboratory. It took approximately 12 hours to complete the 60-day simulation.

3.5. Tidal Datum Computation and Results

From the modeled water time series, tidal datums including MSL, MHHW, MHW, MLW, and MLLW at each model grid node were derived relative to the MZ. The latter four were then adjusted to be referenced to the modeled MSL. Note that MTL is defined as the algebraic average of MHW and MLW, and DTL is the algebraic average of MHHW and MLLW. These two fields were not computed until error-corrected MHHW, MHW, MLW, and MLLW fields were obtained (Section 4.2).

Figures 9(a)-(d) display the model derived tidal datum fields for MHHW, MHW, MLW, and MLLW, respectively. As expected, the four fields exhibit a similar spatial pattern. They all exhibit considerable variability across the entire model domain. Over the east Florida shelf (EFS), the tidal range exhibits a maximum of 2.4 m in the middle SAB and gradually decreases to about 0.6 m near the eastern SFL. Across the SFL, it further reduces to less than 0.3 cm in the eastern GOM. Along the west Florida shelf (WFS), two local maximums (roughly 1.2 m) are revealed around the Big Bend and Pavillion Key, FL (Figure 1). Between the two areas, tidal range exhibits a much smaller magnitude, ~0.6 m. The Florida Bay has a tidal range of around 0.2 m.

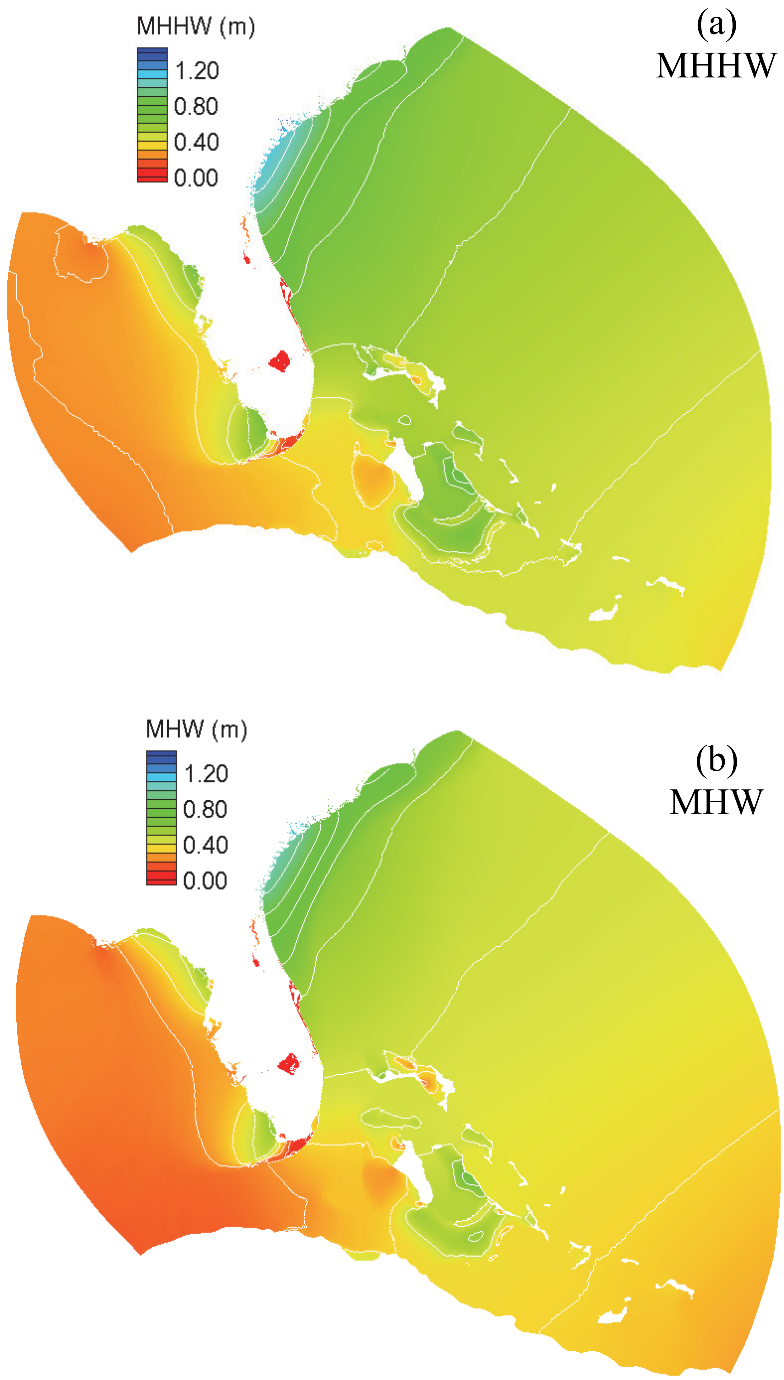
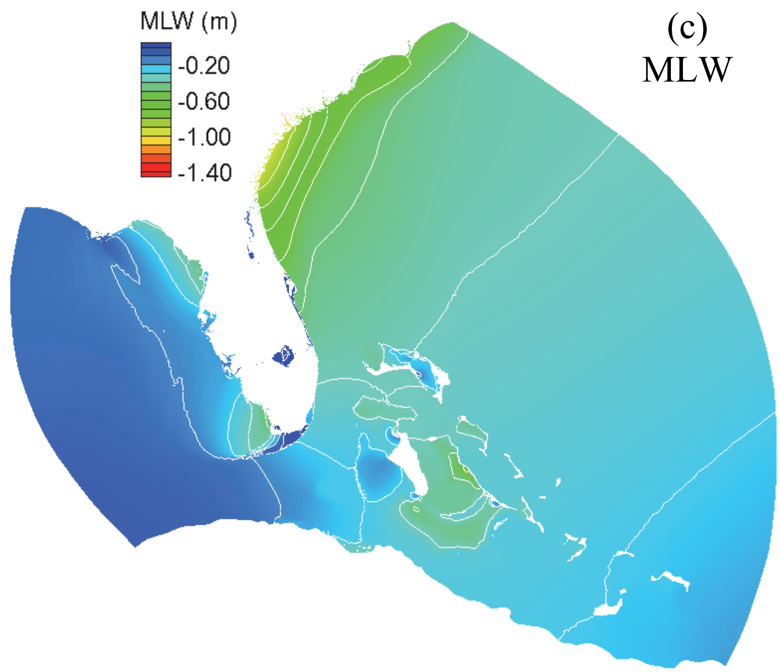


Figure 9. Model-derived tidal datum fields, (a) MHHW, (b) MHW, (c) MLW, and (d) MLLW. Color bars are in meters.



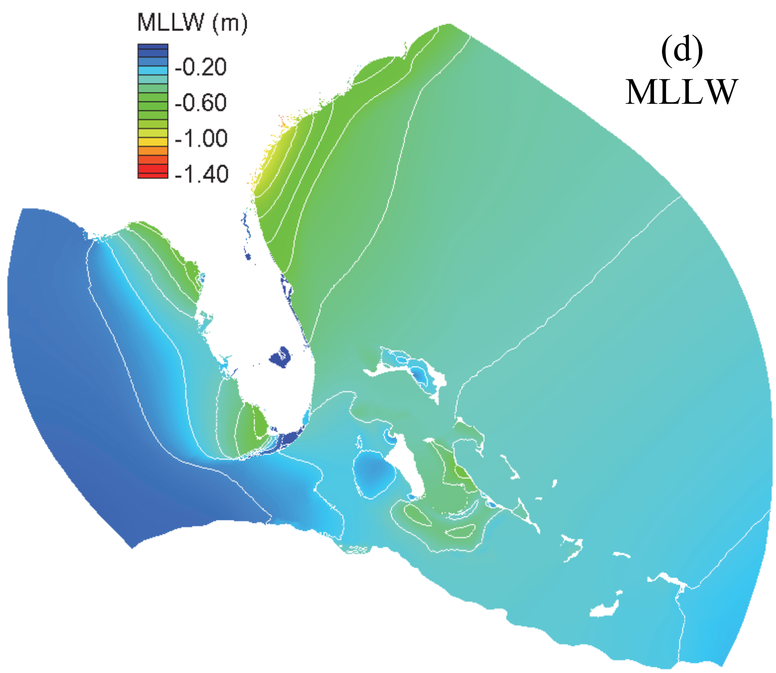


Figure 9. (Continued)

3.6. Validation and Error Corrections

3.6.1. Comparisons with Observations

To validate model results, modeled tidal datums were compared with those from 516 CO-OPS water level gauges in the region (Appendix B). Figures 9(a)-(d) display model-data contrasts for MHHW, MHW, MLW, and MLLW, respectively. In general, the results show favorable model-data agreement. Over the 516 stations, average magnitudes of the model-data differences are 2.5 cm, 2.0 cm, 1.4 cm, and 1.9 cm for MHHW, MHW, MLW, and MLLW, respectively. The model-data correlation coefficients are between 0.98-0.99 for all four tidal datums.

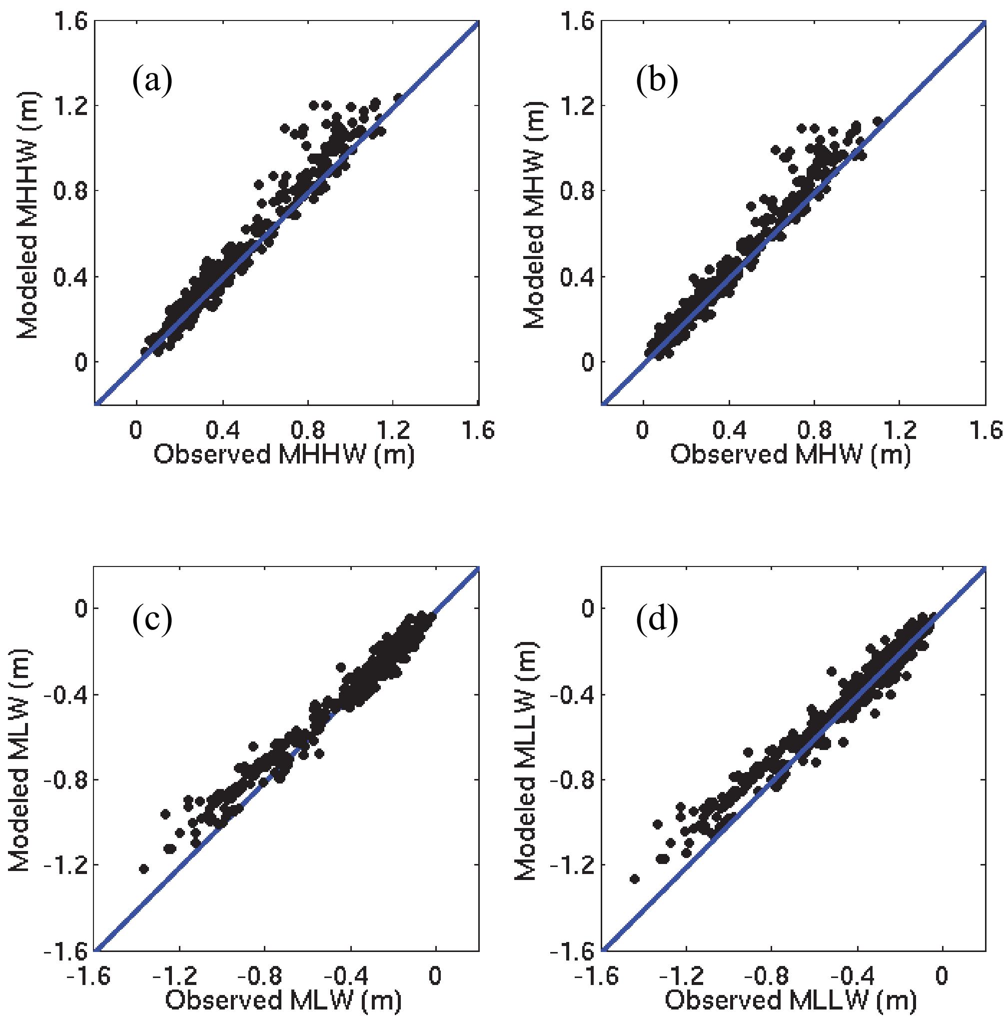


Figure 10. Comparisons of the modeled and observed datums for (a) MHHW, (b) MHW, (c) MLW, and (d) MLLW.

Table 1. Statistics of model-data differences. Std is standard deviation.

	MHHW (cm)	*MHW (cm)*	*MLW (cm)*	*MLLW (cm)*
Mean (Δ_{md})	2.5	2.0	1.4	1.9
Mean Absolute ($\lvert\Delta_{md}\rvert_{avg}$)	4.2	3.6	4.0	4.8
std (Δ_{md})	5.6	5.4	5.8	6.7

For each individual station, average absolute values ($\lvert\Delta_{md}\rvert_{avg}$) of model-data differences (Δ_{md}) for the four datums are examined. Figure 10 illustrates $\lvert\Delta_{md}\rvert_{avg}$ scaled in color-coded symbols. Table 1 lists the mean and standard deviation (std) of the $\lvert\Delta_{md}\rvert_{avg}$ for MHHW, MHW, MLW, and MLLW over the 516 stations.

It is noted that the model-data discrepancy appears to be abnormally large in tributaries along the South Carolina coast (Figure 11f) compared with those in the other regions. This might result from sophisticated coastline features in the area. The highly irregular coastlines cause complicated tidal dynamics which makes the present model set up difficult to catch accurately. Following the common procedures of VDatum development, model results were corrected to reach an exact match with observations using the TCARI method (Section 3.6.3). Section 3.6.3 describes details of the TCARI practice and displayed error-corrected datum fields. Especially, closed-up views of the error-corrected fields for the coastal South Carolina area are displayed to illustrate quality assured results in the area.

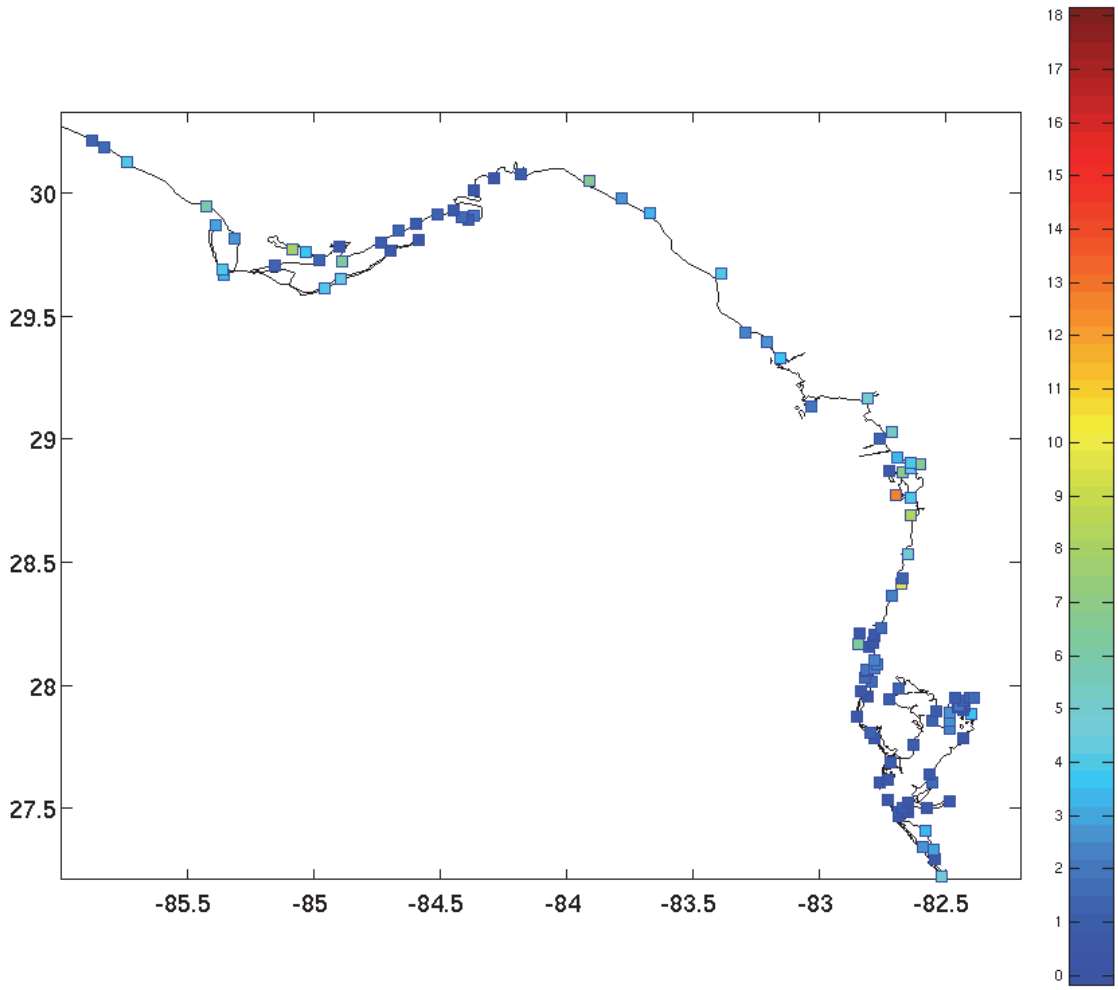


Figure 11(a). Color-scaled average model-data errors ($|\Delta_{md}|_{avg}$) for the west FL shelf. Color bar is in cm.

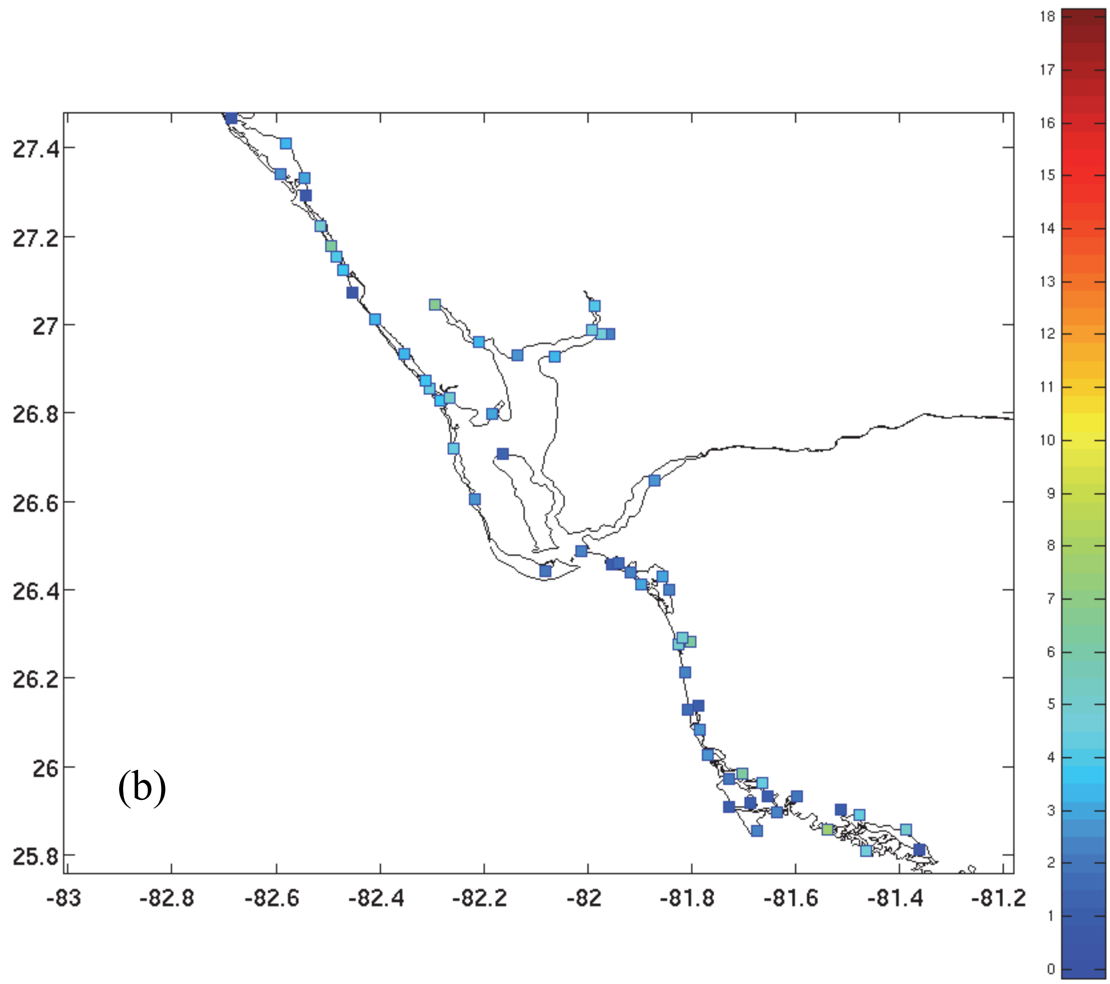


Figure 11(b). Color-scaled average model-data errors ($|\Delta_{md}|_{avg}$) for the middle west FL shelf. Color bar is in cm.

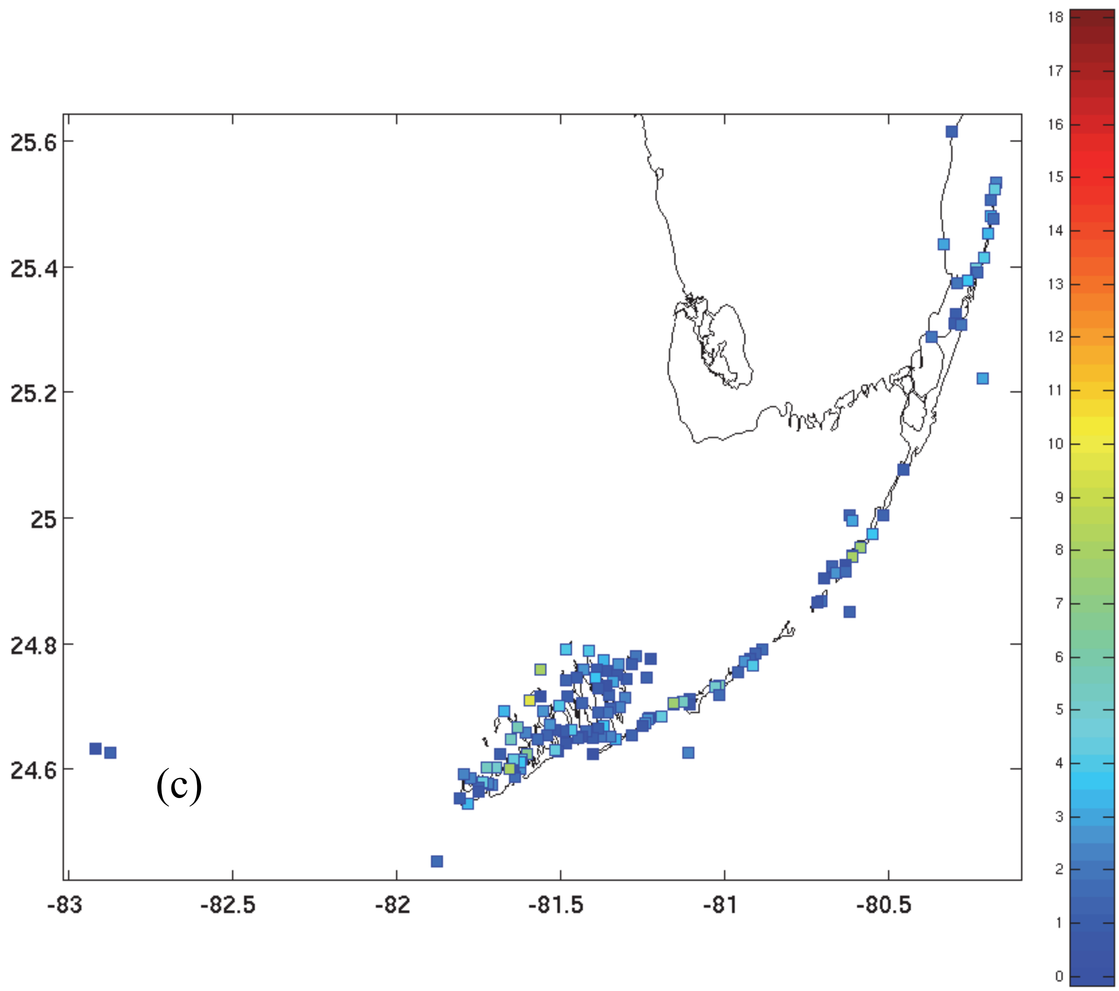


Figure 11(c). Color-scaled average model-data errors ($|\Delta_{md}|_{avg}$) for the south FL shelf and Key West. Color bar is in cm.

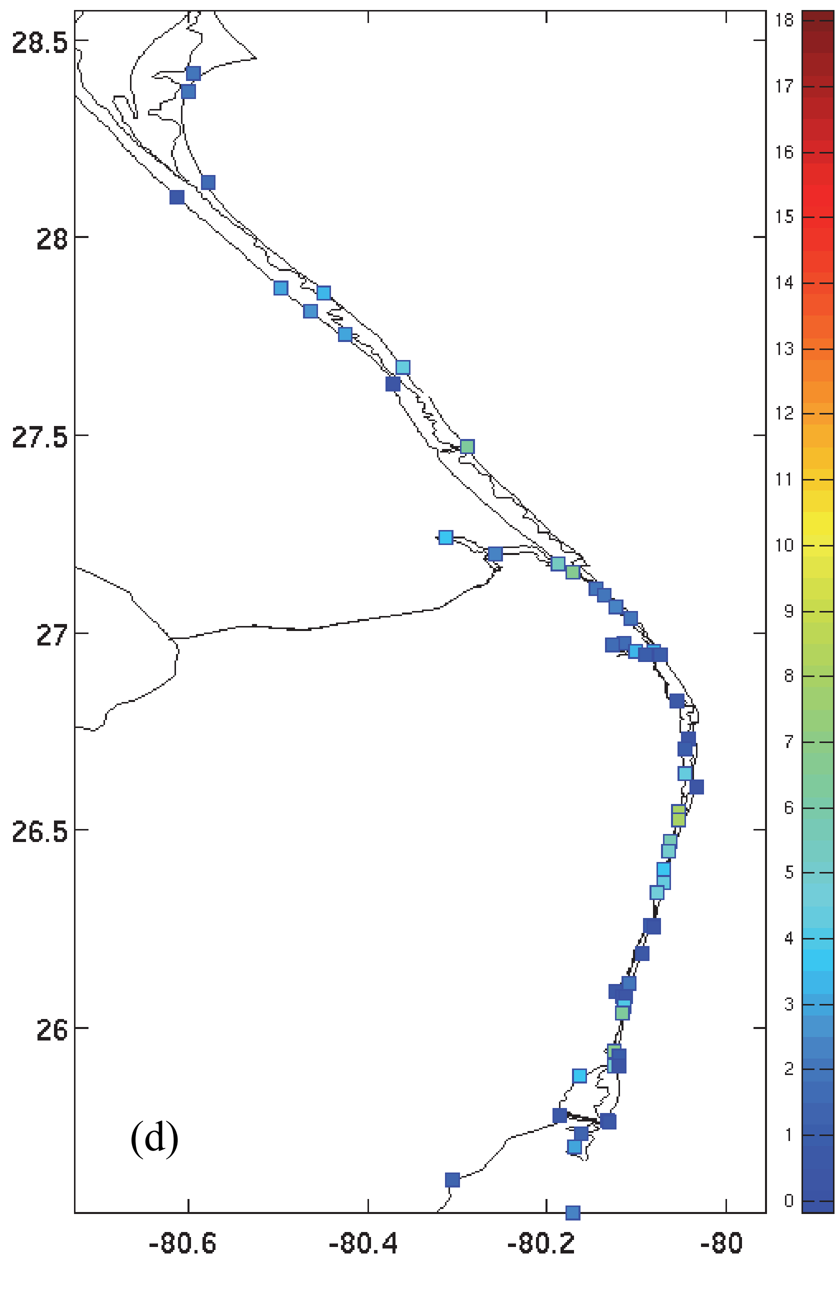


Figure 11(d). Color-scaled average model-data errors ($|\Delta_{md}|_{avg}$) for the east FL shelf. Color bar is in cm.

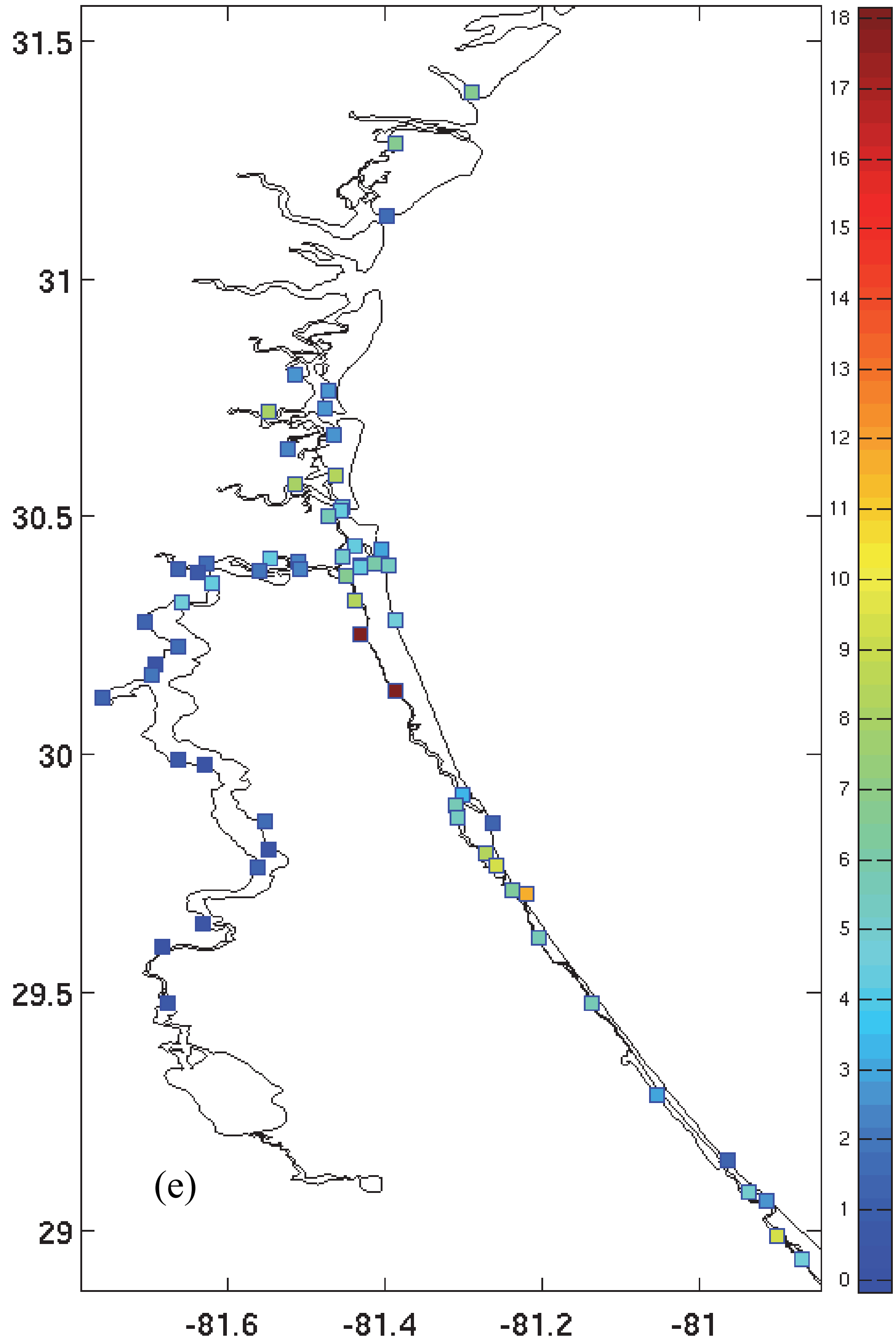


Figure 11(e). Color-scaled average model-data errors ($|\Delta_{md}|_{avg}$) for the SAB area. Color bar is in cm.

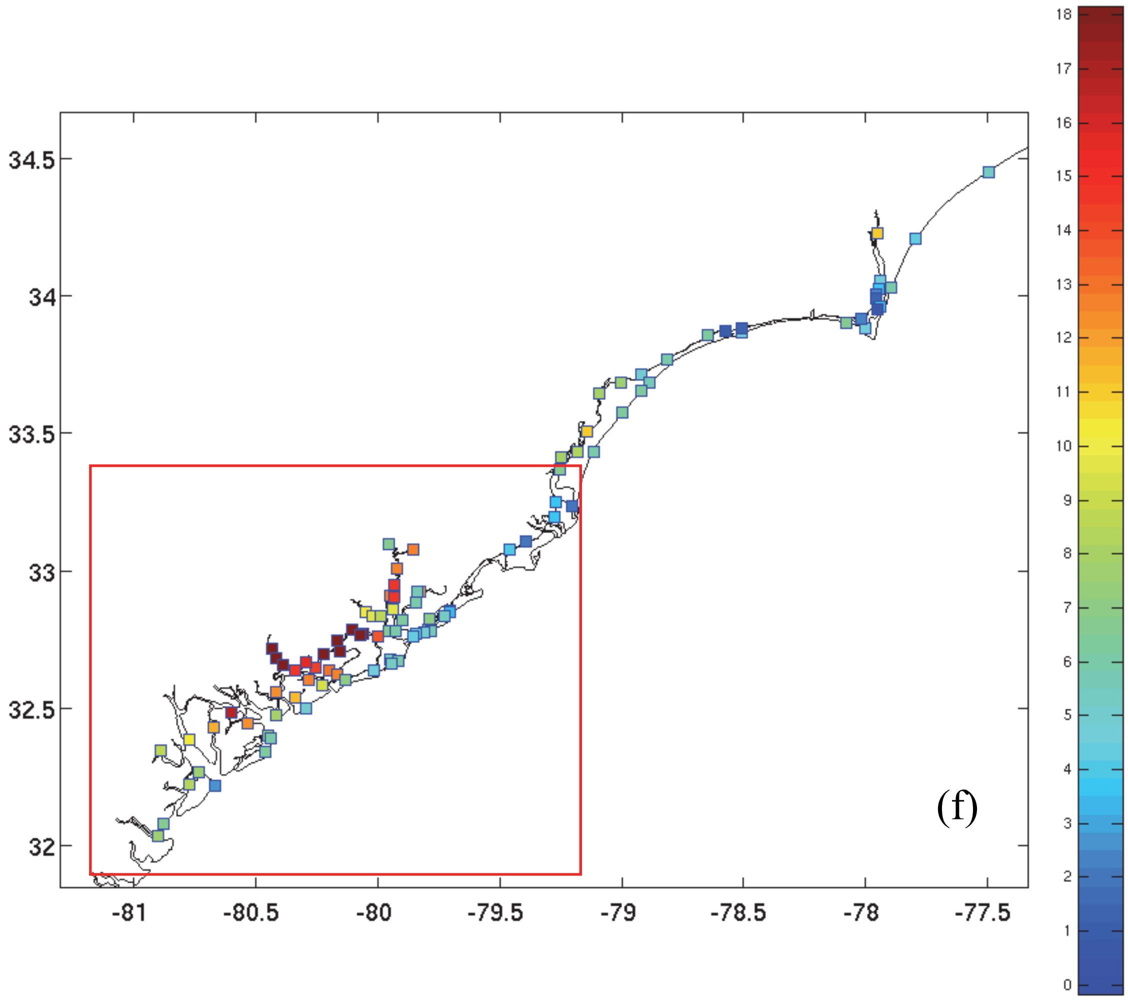


Figure 11(f). Color-scaled average model-data errors ($|\Delta_{md}|_{avg}$) for the costal South Carolina area. Color bar is in cm. Red lines delineate a region in which model-data discrepancy is abnormally large compared with the other regions.

3.6.2. Match with Tidal Datums in Adjacent areas

The present model domain overlaps with two previously developed VDatum application regions (Figure 12): (1) the Gulf of Mexico and Alabama Bays (Dhingraet al., 2008) in the west and (2) the Coastal Central North Carolina in the east (Hess et al., 2005). In reality, tidal datum fields should be matched seamlessly across domain boundaries. However, this is not necessarily engendered when the two tidal datum fields were developed separately with different model setups in terms of tidal boundary forcings, magnitudes of the bottom friction coefficients, etc. It is therefore worthwhile to examine discrepancies and work out ways to reach seamless matches if needed.

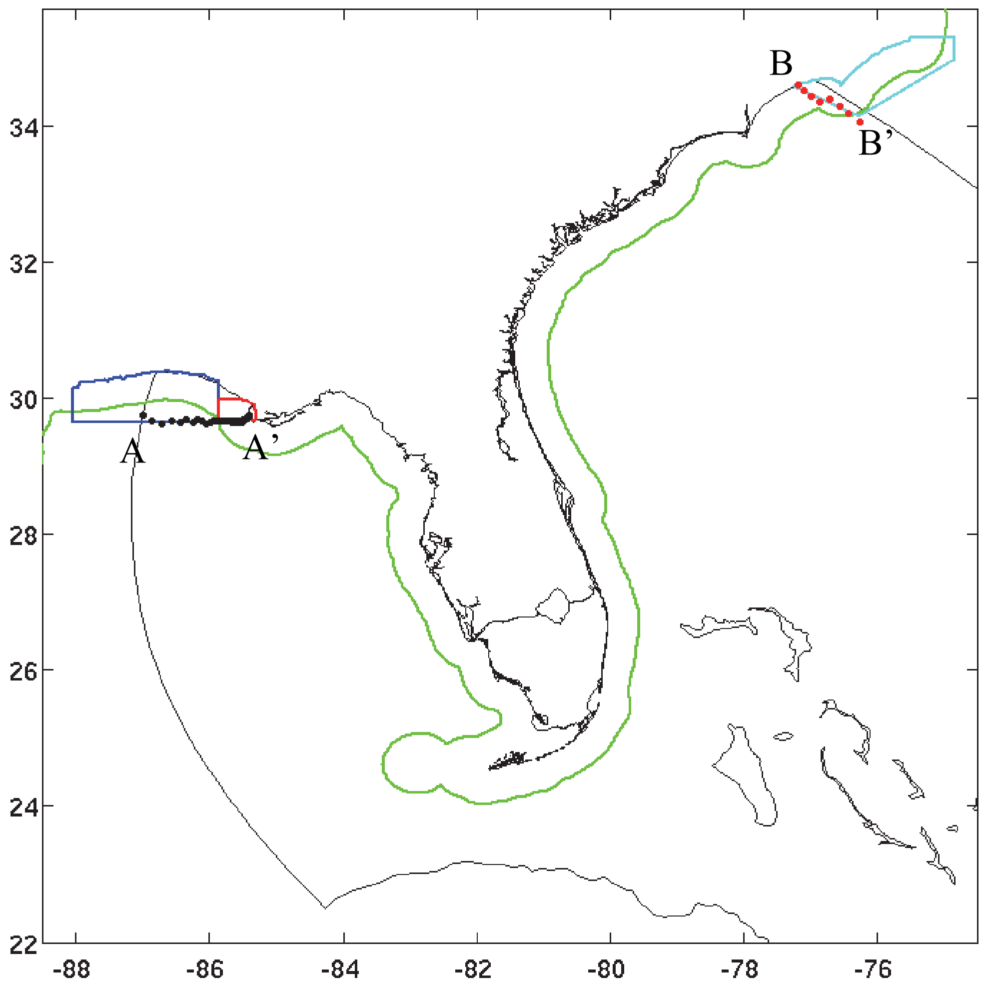


Figure 12. An illustration of overlapping areas between the present model domain and previously developed VDatum regions. Transects AA' and BB' mark locations at which the present and previous tidal datum results are compared. The green line delineates locations 25-nm offshore. The blue, red, and the cyan lines denote, respectively, the bounding polygons for the Northeast Gulf of Mexico, St. Joeseph Bay, and Coastal Central North Carolina VDatum areas.

Comparisons between the present model results and those of the Gulf of Mexico and Alabama Bays, and Coastal Central North Carolina VDatum applications were made along transects AA' and BB' (Figure 12). Black and red dots denoting the transects correspond to the ADCIRC model grid. The comparison results are displayed in Figures 13 and 14, respectively. Table 2 (page 32) lists the statistics of the tidal datum differences.

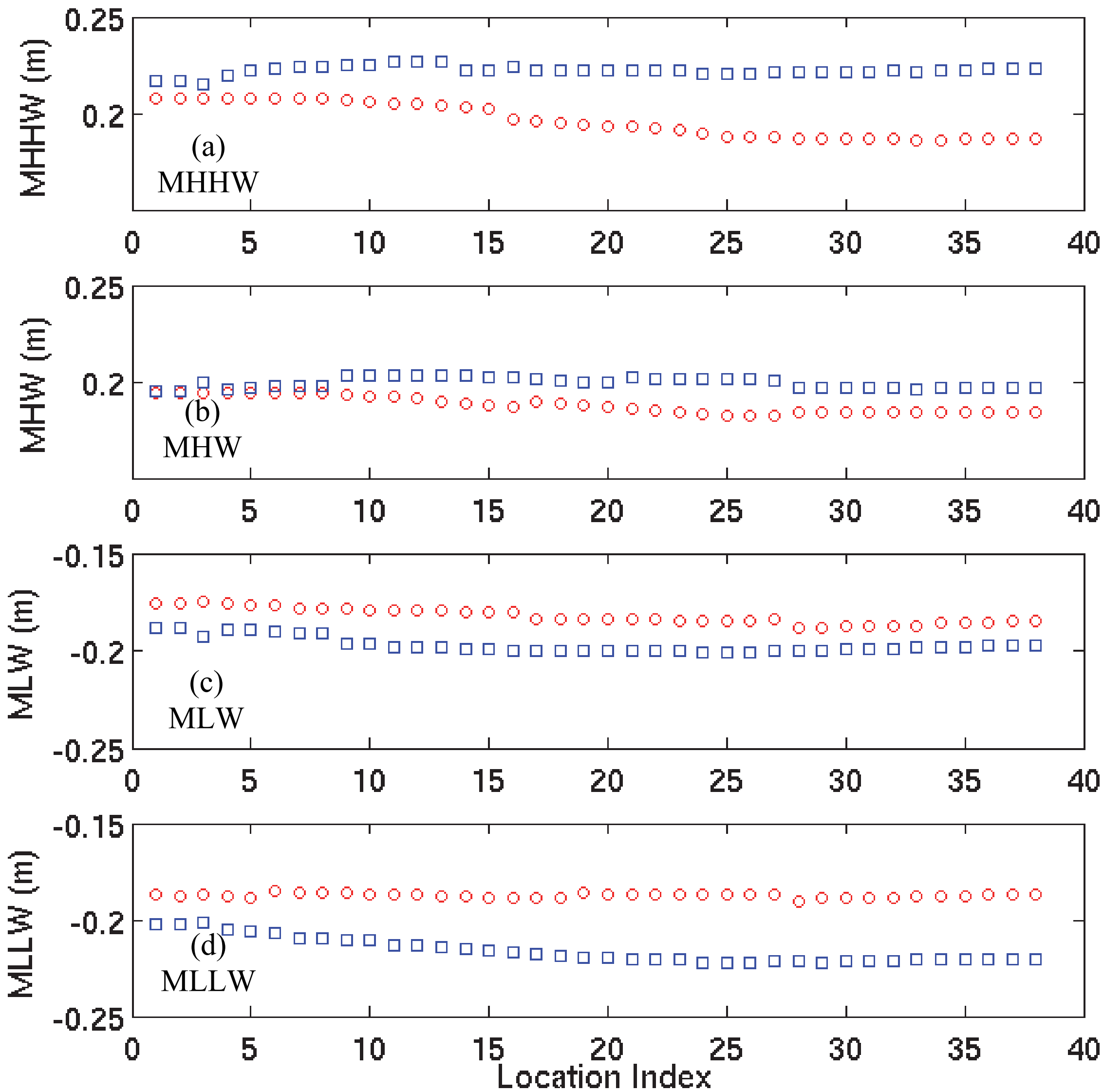


Figure 13. Comparisons of tidal datums (a) MHHW, (b) MHW, (c) MLW, and (d) MLLW along transect AA' (black circles in Figure 12). The abscissa, Location Index, is from A to A'. Blue squares are from the Gulf of Mexico and St. Joseph Bay results and red circles are the present results.

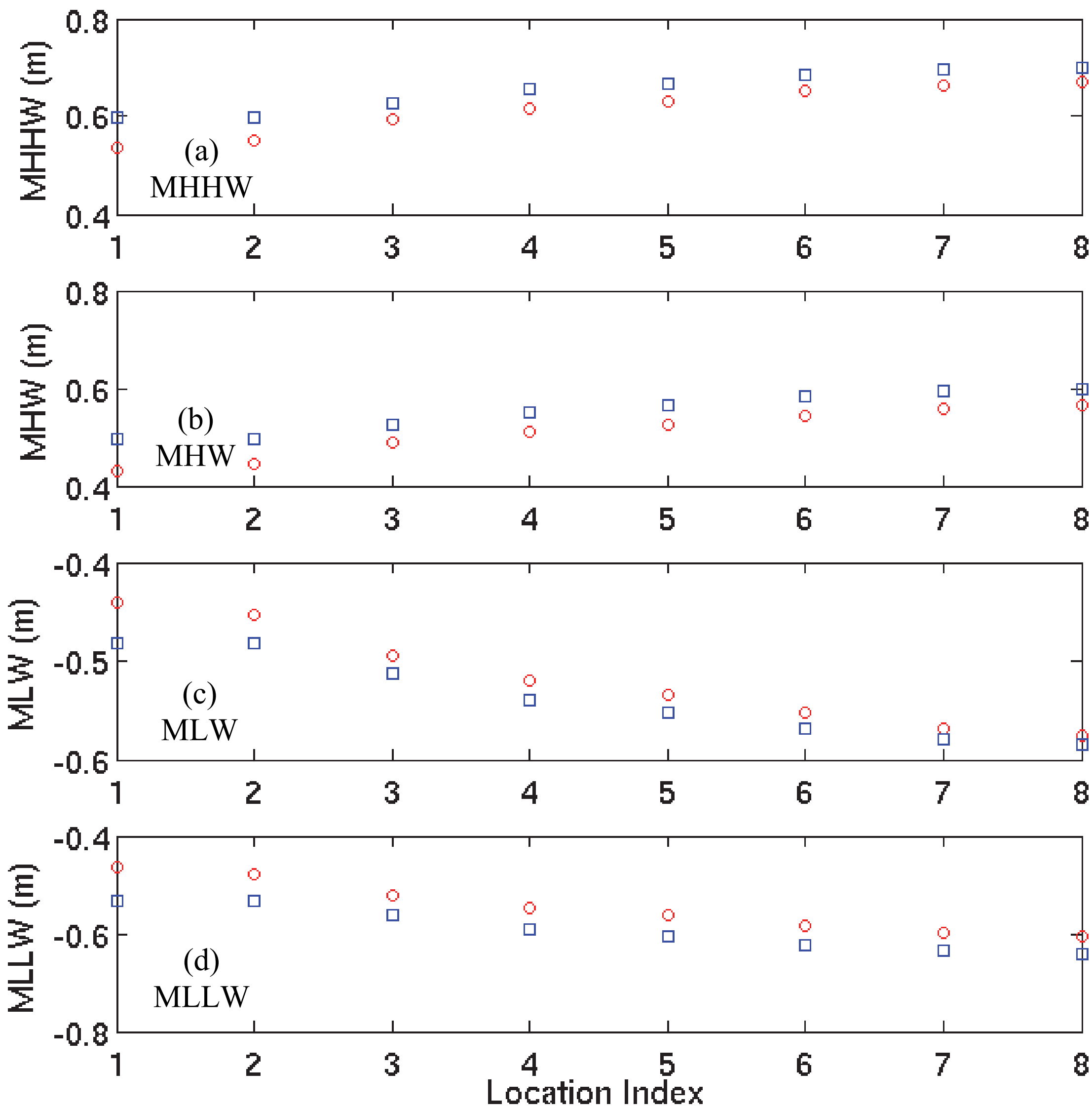


Figure 14. Comparisons of tidal datums (a) MHHW, (b) MHW, (c) MLW, and (d) MLLW along transect BB' (red circles in Figure 12). The abscissa, Location Index, is from B to B'. Blue squares are from the Coastal Central North Carolina results and red circles are the present results.

Table 2. Statistics of tidal datum differences (Δ) between the present model results and those from the previous VDatum applications along transects AA' and BB' (Figures 13 and 14).

	MHHW (cm)	*MHW (cm)*	*MLW (cm)*	*MLLW (cm)*
Transect AA'				
mean(Δ)	-2.59	-1.16	1.49	2.84
Standard deviation (Δ)	0.90	0.51	0.29	0.64
Transect BB'				
mean(Δ)	-3.91	-4.20	2.03	4.56
Standard deviation (Δ)	1.08	0.92	1.10	1.03

As illustrated in Table 2, the magnitude of the average differences for MHHW and MLLW ranges from 1.16 to 4.6 cm, whereas the standard deviation of the differences ranges from about 0.3 to 1.1 cm. It was therefore necessary to make adjustments to the present model results so as to reach a seamless match of tidal datums between different adjacent regions. This was accomplished by using TCARI, the details of which are described in the next section.

3.6.3. Corrections

Tidal datum corrections were developed to eliminate model-data differences at observational stations (Section 3.6.1) as well as to minimize datum discrepancies across boundaries of different VDatum domains (Section 3.6.2). This was achieved using the TCARI method (Hess, 2002; Hess, 2003). TCARI was used to spatially interpolate the error fields defined at a number of individual control stations onto the whole domain by solving Laplace's equation. TCARI has been developed for use with both structured and unstructured model grids, and a version of the latter was employed in this study.

To run TCARI, both the observational stations and the domain boundary stations were treated as control stations. For each tidal datum, both model-data differences (at 516 tidal stations) and across-boundary discrepancies were computed and merged into one dataset for input to TCARI. Figures 15a-d display the TCARI interpolated error fields for MHHW, MHW, MLW, and MLLW, respectively.

After applying TCARI, error fields for MHHW, MHW, MLW, and MLLW were derived that matched the tidal datum differences at the 516 control stations. The initial model results (Section 3.5) were then corrected by subtracting the error fields over the entire model grid. Figures 16a-d display the final corrected tidal datum fields for the entire model domain.

Figure 11f in Section 3.6.1 displays abnormally large magnitudes of the model-data discrepancy in the tributary area along the South Carolina coast. At some stations, average model-data errors reach as large as 18 cm. To reveal details of the error-corrected fields, Figures 17a-d display closed-up views for MHHW, MHW, MLW, and MLLW, respectively. Plots demonstrate smooth datum field transitions from coastal area to upper tributaries. Quantitative model-data comparisons indicate that the error-corrected model results match exactly with observations.

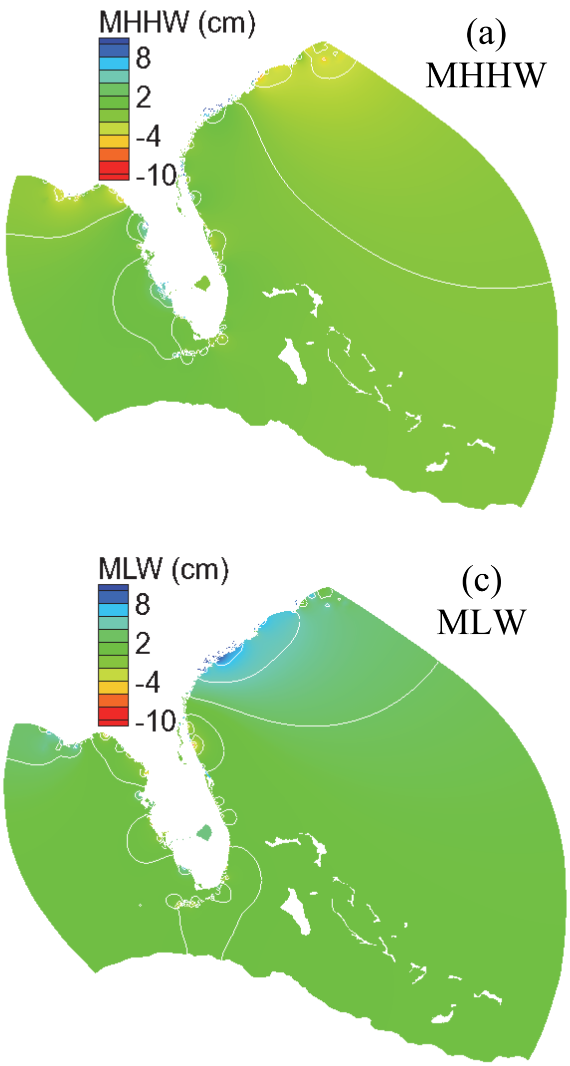


Figure 15. TCARI interpolated error fields for (a) MHHW, (b) MHW, (c) MLW, and (d) MLLW, respectively. To enhance patterns of the error fields, each field is displayed with a color bar range of [-10, 10] cm; values beyond are displayed as either -10 cm or +10 cm.

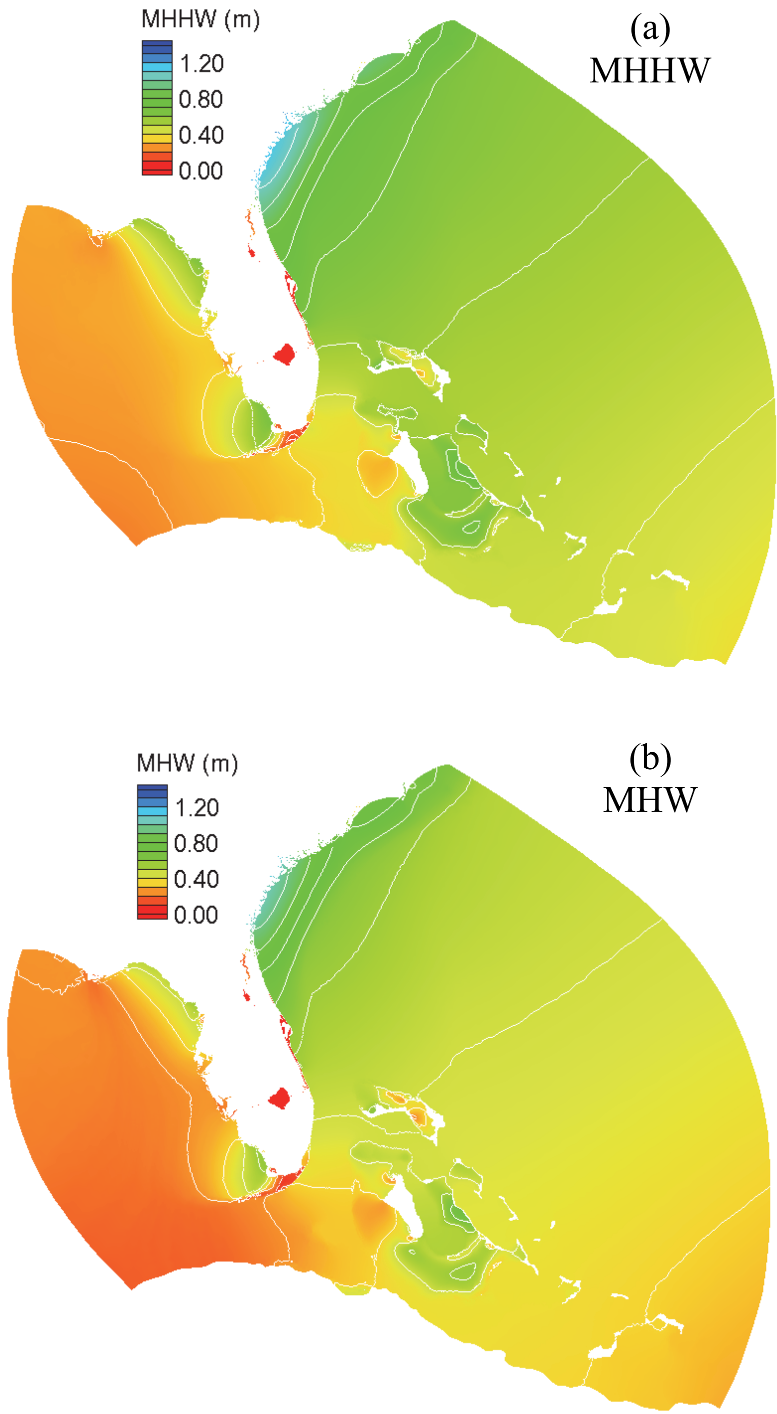
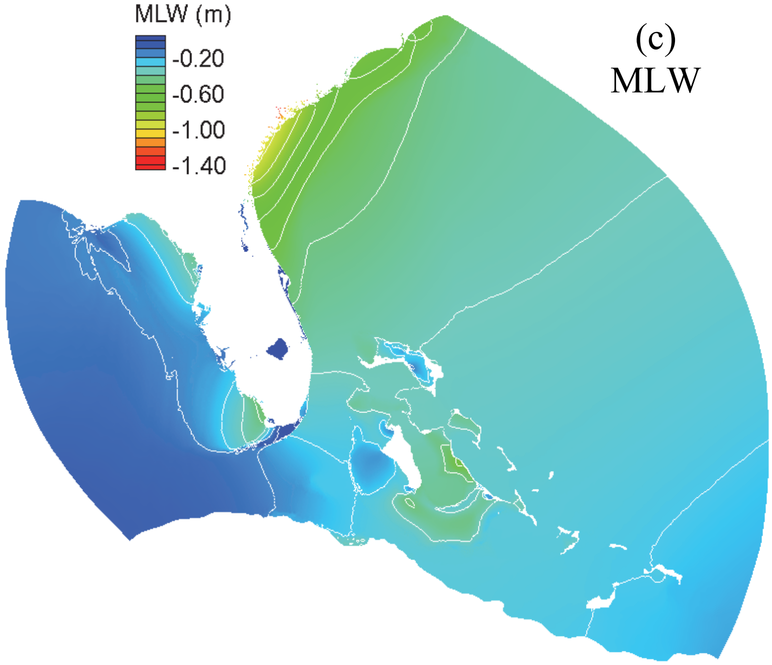


Figure. 16. Error-corrected tidal datum fields, (a) MHHW, (b) MHW, (c) MLW, and (d) MLLW.



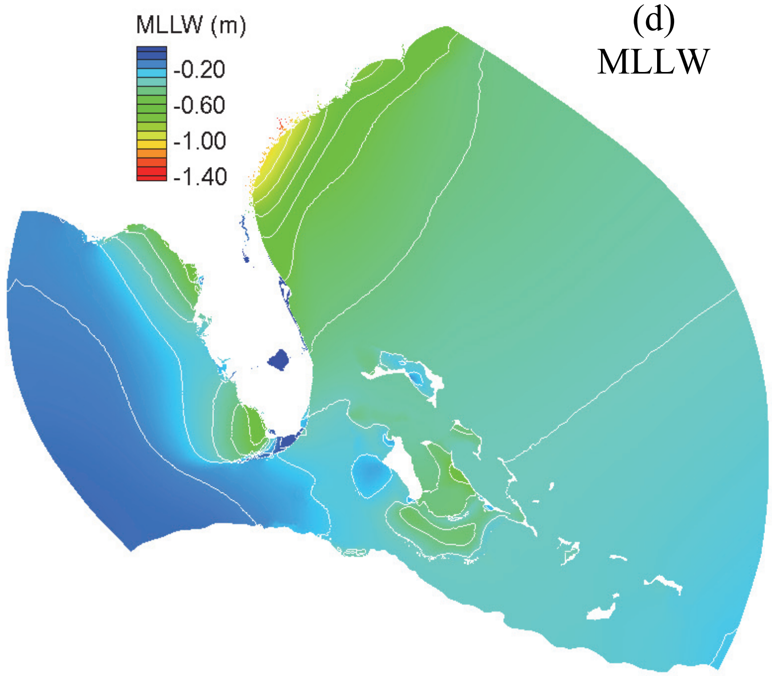


Figure 16. (Continued)

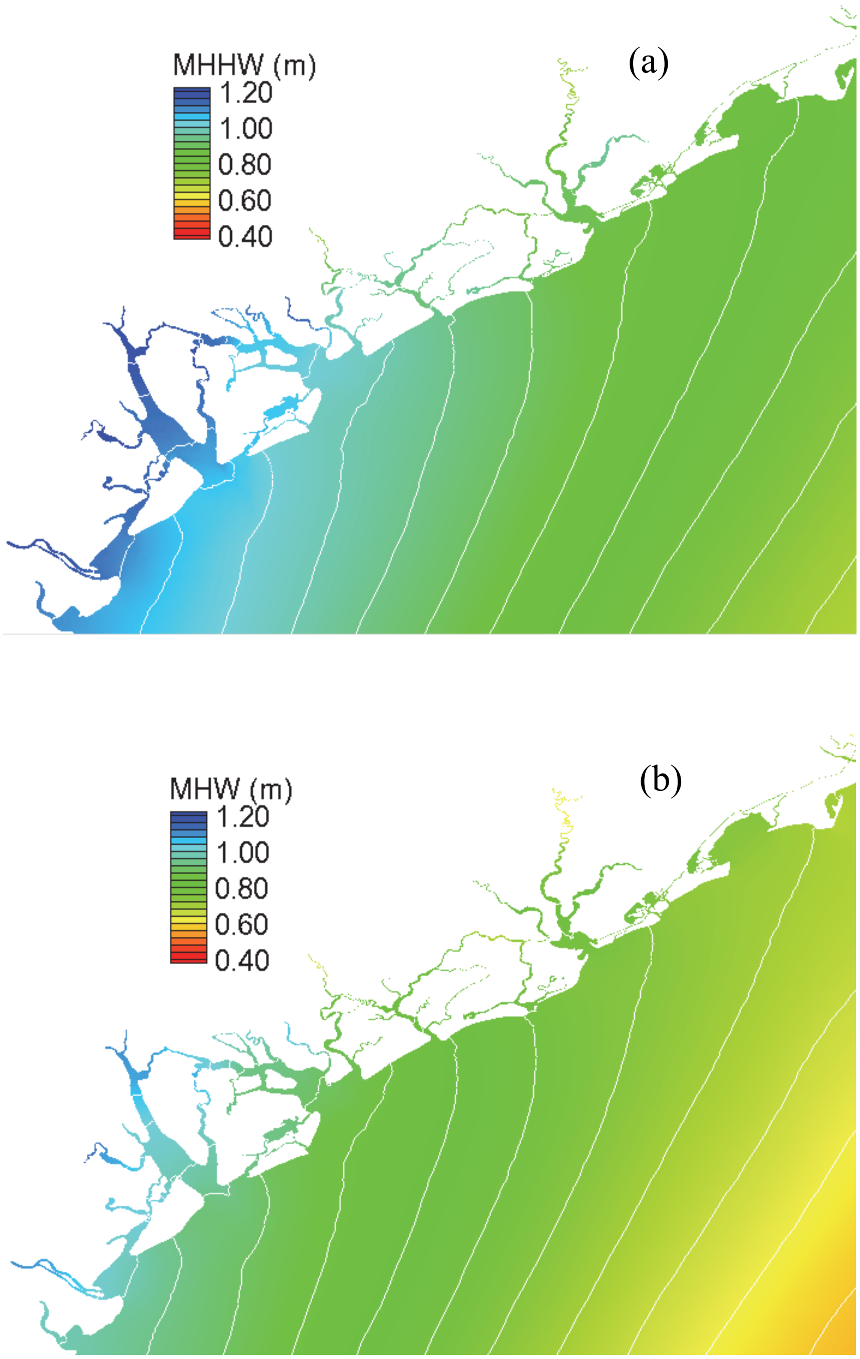
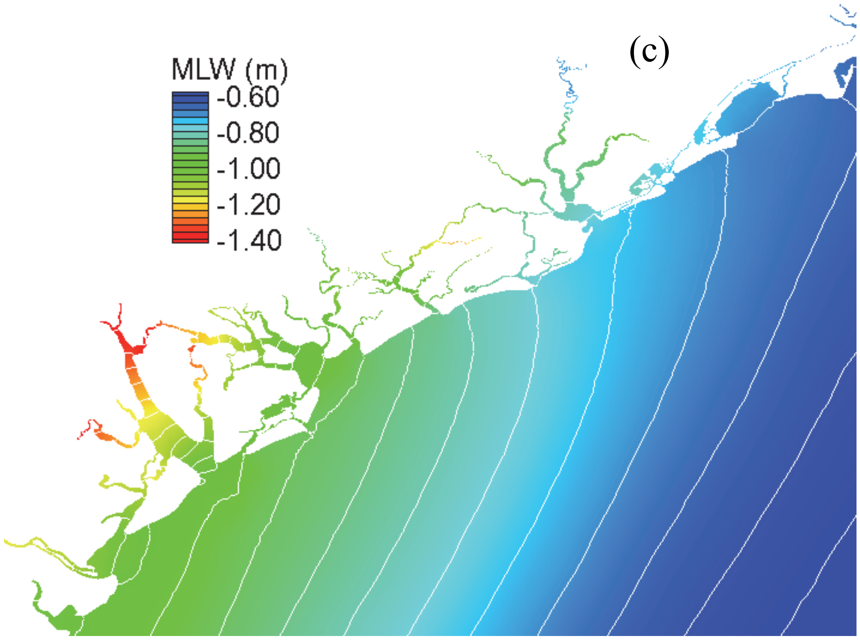


Figure 17. Closed-up views of error-corrected tidal datum fields over the coastal South Carolina area (a) MHHW, (b) MHW, (c) MLW, and (d) MLLW. The geographical coverage of each plot corresponds the rectangular area delineated by red lines in Figure 11(f).



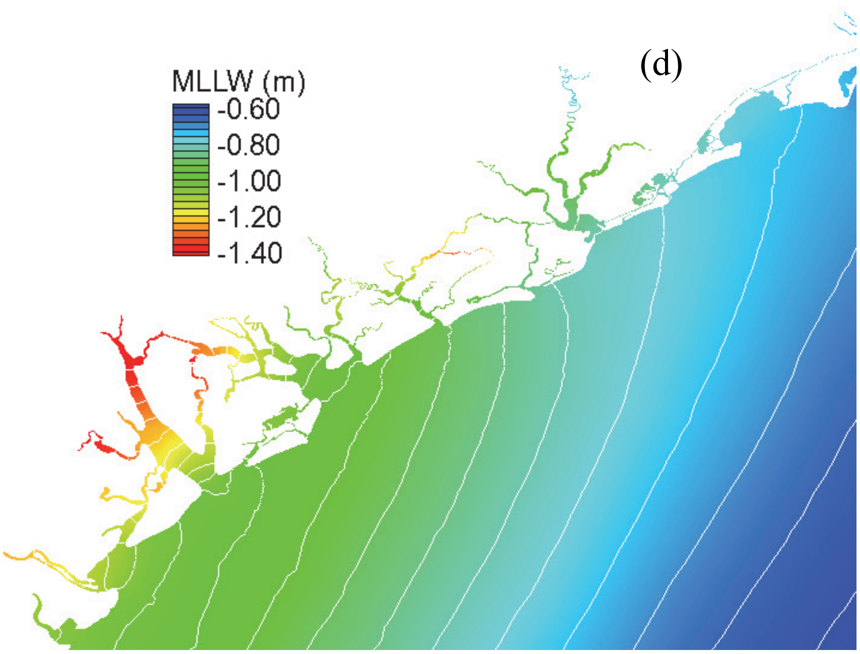


Figure 17. (Continued)

4. CREATION AND POPULATION OF THE MARINE GRID

4.1. Creation of VDatum Marine Grid

Tidal datums in the VDatum software are defined on a regularly structured grid, referred to as the marine grid (Hess and White, 2004). Hence, it is necessary to convert the tidal datum fields from the unstructured grid onto the equally-spaced raster VDatum marine grid. Nodes in the marine grid were specified as either water points or land points. The water nodes are to be populated with valid tidal datum values and the land nodes are assigned with null values.

Assume the coordinate of the grid's southwest corner is *($longitude_0$, $latitude_0$)*. For a point at the *i*-th row and *j*-th column relative to the point, its location *(longitude_i, latitude_j)* is defined as,

$$Longitude\_i = longitude_0 + (i-1)\times del\_lon, \ \ i=1, \ldots, N\_lon,$$
$$Latitude\_j = latitude_0 + (j-1) \times del\_lat, \ j=1, \ldots, N\_lat,$$

where *del_lon*, and *del_lat* denote separation between neighboring points along the meridional and zonal directions, respectively; *N_lon* and *N_lat* represent, respectively, the longitude and latitude dimensions of the raster data set. It is noted that the *del_lon* and *del_lat* are prescribed parameters representing the expected grid resolutions, while *N_lon* and *N_lat* are derived parameters according to

$$N\_lon = 1 + (longitude_1 - longitude_0)/del\_lon$$
$$N\_lat = 1 + (latitude_1 - latitude_0)/del\_lat$$

where *($longitude_1$, $latitude_1$)* are the coordinate at the raster region's northeast corner. It is noted that *$longitude_1$* and *$latitude_1$* are selected to ensure that both *($longitude_1$ - $longitude_0$)/del_lon* and *($latitude_1$ - $latitude_0$)/del_lat* end up as intergers.

For the present SAB and coastal FL project, the entire area of interest is covered with a combination of five VDatum grids mainly due to the concern of VDatum data file sizes. The division into smaller regions helps constrain file sizes such that the VDatum software can efficiently handle data retrieval and interpolation computation. Each of the give regions is represented by a separate VDatum marine grid. Table 3 lists region names and parameters used to define each marine grid.

The specification of water/land nodes in each grid was made in a two-step procedure. The first step is to create a preliminary version using the high-resolution MHW coastline (Section 2.1) and a bounding polygon (Figure 17). The bounding polygon was set up to guide the delineation of water/land nodes. Only nodes within the bounding polygons or within up to one half of a cell size outside (inland of) the coastline are delineated as water nodes; those outside of the bounding polygons or those more than one half of a cell size away from the coastline are marked as land nodes.

Table 3. Marine grid parameters

	Region Name	*Longitude$_0$ (degree)*	*Latitude$_0$ (degree)*	*del_lon (degree, ×10^3)*	*del_lat (degree, ×10^3)*	*N_lon*	*N_lat*
RA	Florida: Apalachicola Region	-86.515	28.132	1.5	1.5	2681	1381
RB	Florida: Tampa Bay to Cape Coral	-83.513	26.152	0.75	0.75	2542	2681
RC	Florida: South Florida	-83.503	23.942	1.5	1.5	2746	1500
RD	Florida - Georgia: Fort Lauderdale to Georgia	-81.805	26.155	1.5	1.5	1614	3572
RE	North Carolina - South Carolina - Georgia: North Georgia to New River, North Carolina	-81.386	31.429	1.5	1.5	3366	2114

The second step is to further manually refine the water/land node specification using the aerial imagery of the coastline acquired by NGS. Compared with the aforementioned MHW coastline (Section 2.1), the imagery of the coastline areas is more recently updated and gives a more realistic coastline representation. By comparing with the NGS coastline, the nearshore water-land node specifications in the original marine grid were adjusted, while the definitions of the marine grid parameters (Table 3) were retained. This NGS marine grid was then used to populate the tidal datums.

4.2. Population of VDatum Grid with Tidal Datums

Tidal datums on the VDatum marine grid were populated by interpolating the TCARI-corrected tidal datums (Section 3.6) following the algorithm of Hess and White (2004). Datums at each grid point were computed by averaging or linearly interpolating those values within a user-specified searching radius or the closest user-specified number of points. Marine points were populated differently depending on whether a point was inside/outside of the ADCIRC model grid elements. If it was inside an element, datums were calculated using an interpolation of the 3 nodes of the element; otherwise, datums were computed using the inverse distance weighting of the closest two node values. Figures C.1(a)-(e) in Appendix C display the populated tidal datums, MHHW, MHW, MLW, MLLW, MTL, and DTL, respectively.

As a quality control procedure, the tidal datum fields were further verified against those from the water level stations (Section 3.6.1). The test gave a maximum absolute model-data error less than 0.2 cm and an RMS error less than 0.1 cm for all four datums (MHHW, MHW, MLW, and MLLW).

In addition, the datum consistency along the two border transects AA' and BB' (Figure 12) between the present and the previous VDatum applications (Section 3.6.2) were tested. A good agreement was achieved: For each of MHHW, MHW, MLW, and MLLW, the maximum absolute differences were less than 0.1 cm.

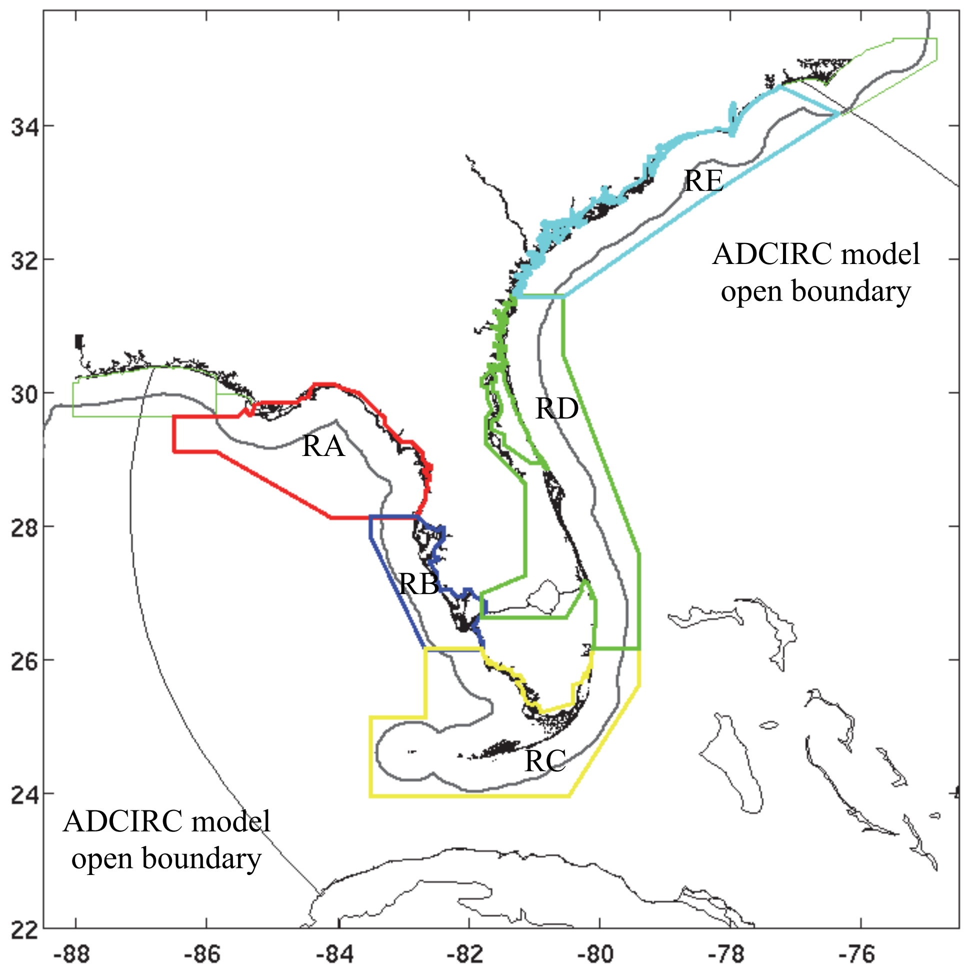


Figure 17. Illustrations of five marine grid bounding polygons for VDatum regions RA to RE (see Table 3 for details). The thick grey line denotes locations 25 nautical miles offshore. The three polygons in thin green lines (two close to region RA in the northwest and one close to region RE in the northeast) plotted for reference. They are respectively, for the Vdatum regions of the St. Joeseph Bay, Northeast Gulf of Mexico, and Coastal Central North Carolina (Section 3.6.2). Also shown are the open boundaries (grey lines) of the ADCIRC model.

5. TOPOGRAPHY OF THE SEA SURFACE

5.1. Generation of TSS field

The Topography of the Sea Surface (TSS) is defined as the elevation of the North American Vertical Datum of 1988 (NAVD88) relative to local mean sea level (LMSL). This grid provides compensation for the local variations between a mean sea level surface and the NAVD88 geopotential surface over the Cape San Blas, Florida to New River, North Carolina VDatum regions. A positive value specifies that the NAVD88 reference value is further from the center of the Earth than the local mean sea level surface. All data are based on the most recent National Tidal Datum Epoch (1983-2001). The locations of tide gauges used are illustrated in Figure 18.

The direct method of obtaining NAVD88-to-LMSL values includes calculating orthometric-to-tidal datum relationships at NOAA tide gauges where elevation information has been compiled. Data for the direct method were supplied by CO-OPS and NGS.

Next, a continuous surface for each VDatum region was generated representing inverse sea-surface topography (Figure 19). A mesh covering the entire area of benchmarks and water level stations with a spatial resolution similar to that of the tidal marine grids was created. Breaklines are inserted to represent the influence of land. A sea surface topography field is generated using the Surfer© software's minimum curvature algorithm to create a surface that honors the data as closely as possible. The maximum allowed departure value used was 0.0001 meters. To control the amount of bowing on the interior and at the edges of the grid, an internal and boundary tension of 0.3 was utilized. Once the gridded topography field was generated, null values were obtained from the marine tidal grids and inserted to denote the presence of land.

5.2. Validation

The data used to compile TSS grids was compared against the TSS grid product, to generalize internal consistency. The difference (delta) between the modeled and observed NAVD88-to-MSL values for each tide station utilized for creation of the TSS is depicted for the Cape San Blas, Florida to New River, North Carolina VDatum region in Table D.1 of Appendix D. The mean and standard deviations for these delta values between NAVD88 and MSL for the Cape San Blas, Florida to New River, North Carolina regions are listed in Table D.2 of Appendix D.

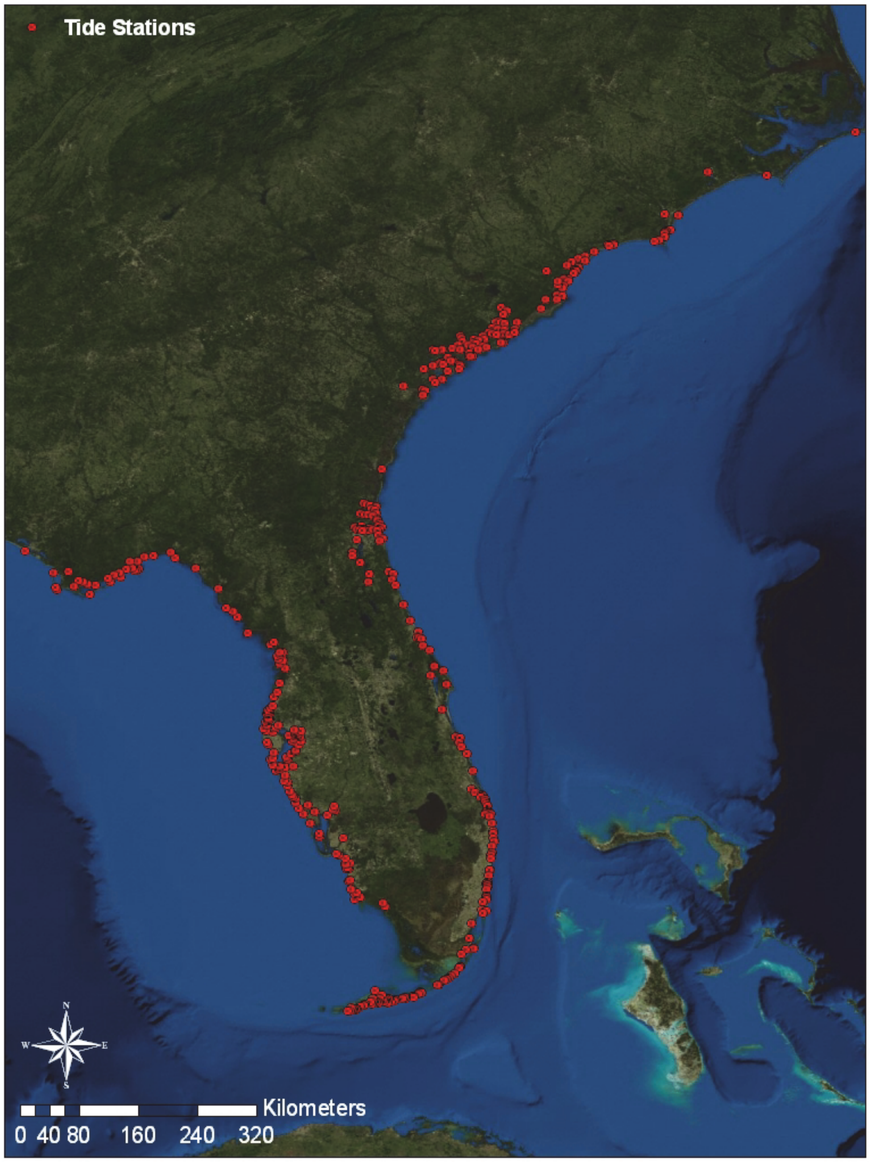


Figure 18. Location of tide stations used to compute the Cape San Blas, Florida to New River, North Carolina VDatum TSS grid.

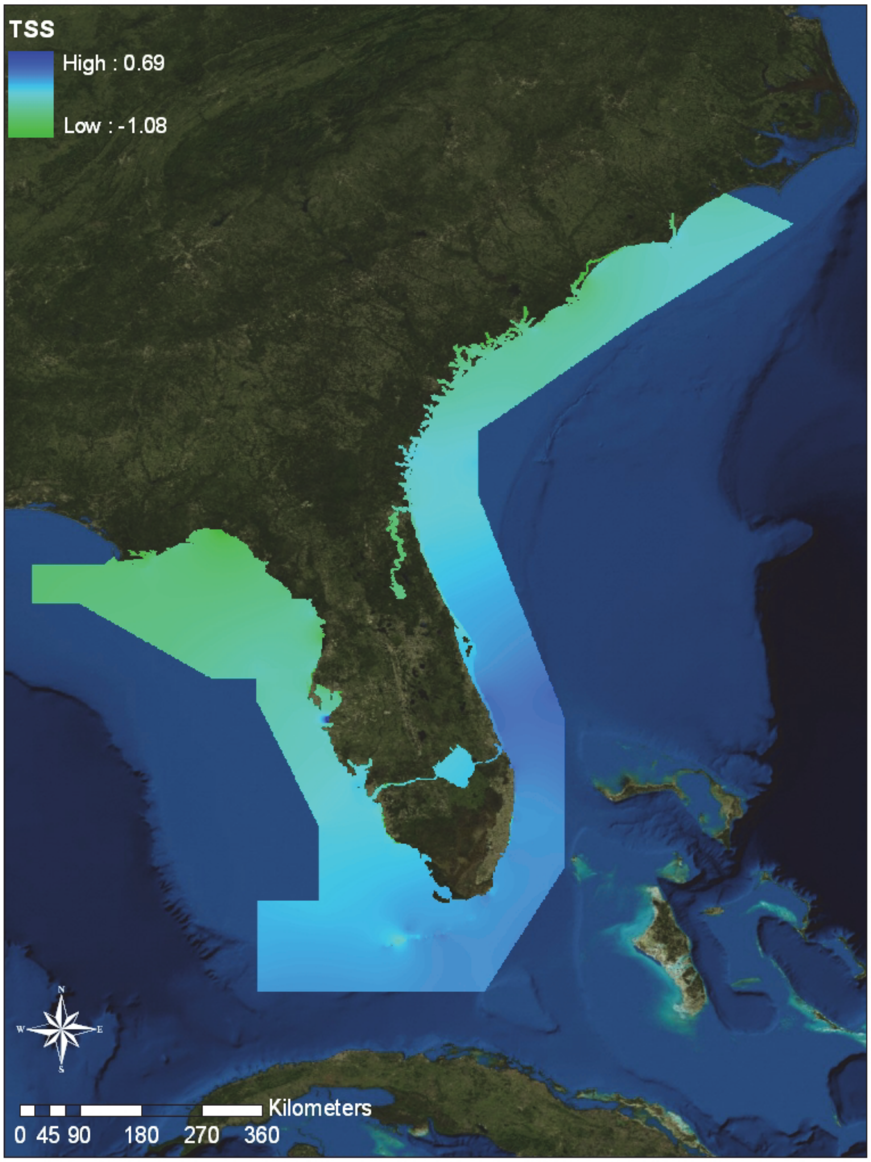


Figure 19. Topography of the Sea Surface for the Cape San Blas, Florida to New River, North Carolina region.

6. SUMMARY

VDatum tidal datum and TSS fields for the coastal waters of the Florida shelf and the South Atlantic Bight were developed in this study. Creation of VDatum begins with development of tidal datums with numerical tidal simulations using the ADCIRC model. A triangular finite-element grid consisting of 352,705 nodes and 620,658 cells was created. The model was forced with nine tidal constituents (M_2, S_2, N_2, K_2, K_1, P_1, O_1, Q_1, and M_4) and run for 60 days. Various tidal datum fields, including mean lower low water (MLLW), mean low water (MLW), mean high water (MHW), and mean higher high water (MHHW), were derived using the modeled water level time series from the final 40 days of the simulation. Model results were validated by comparing with observations at 516 water level stations maintained by NOAA's CO-OPS. Discrepancies between model results and observational datums were attributed to model errors and interpolated over the whole model domain using the TCARI technique. The error fields were applied to the original model results to achieve error-corrected tidal datums on the model grid. Finally, tidal datum fields were interpolated onto a regular VDatum marine grid.

A regular VDatum marine grid was created to be used as input to the VDatum software tool. Tidal datums defined on the unstructured grid were interpolated onto the regular grid to form the final datums as input to the VDatum tool.

The TSS fields were derived by fitting tidal model results to tidal bench marks leveled in NAVD88. Results from the two methods were coupled to create the final TSS grids and incorporated into the VDatum tool.

ACKNOWLEDEGEMENTS

Digital coastline and bathymetric data sets were provided by OCS' Julia Skory and Cuong Hoang, respectively. OCS' Dr. Kurt Hess developed the software for the VDatum grid generation, tidal datum population, and final product quality control tests. The authors would like to express genuine gratitude for their time and effort.

REFERENCES

Dhingra, E. A., K. W. Hess, and S. A. White, 2008: VDatum for the Northeast Gulf of Mexico from Mobile Bay, Alabama, to Cape San Blas, Florida: Tidal Datum Modeling and Population of the marine Grids. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Memorandum** NOS CS 14, 64 pp.

Gill, S. K., and J. R. Schultz, 2001: Tidal Datums and Their Applications. Silver Spring, Maryland: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD. **NOAA Special Publication** NOS CO-OPS 1, 111 pp + appendix.

Hess, K. W, 2001: Generation of Tidal Datum Fields for Tampa Bay and the New York Bight. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Report** NOS CS 11, 43 pp.

___, 2002: Spatial interpolation of tidal data in irregularly-shaped coastal regions by numerical solution of Laplace's equation. **Estuarine, Coastal and Shelf Science**, 54(2), 175-192.

___, 2003: Water level simulation in bays by spatial interpolation of tidal constituents, residual water levels, and datums. **Continental Shelf Research**, 23(5), 395-414.

___, D. G. Milbert, S.K. Gill, and D.R. Roman, 2003: Vertical Datum Transformations for Kinematic GPS Hydrographic Surveys. **Proceedings, U.S. Hydrographic Conference**, March 24 – 27, 2003. Biloxi, MS. 8 pp.

___, and S. K. Gill, 2003: Puget Sound Tidal Datums by Spatial Interpolation. **Proceedings, Fifth Conference on Coastal Atmospheric and Oceanic Prediction and Processes**. Am. Meteorological Soc., Seattle, August 6-8, 2003. Paper 6.1, 108 - 112.

___, and S. A. White, 2004: VDatum for Puget Sound: Generation of the Grid and Population with Tidal Datums and Sea Surface Topography. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Memorandum** NOS CS 4, 27 pp.

Hess, K.W., E. A. Spargo, A. Wong, S. A. White, and S. K. Gill, 2005 : VDatum for Central Coastal North Carolina: Tidal Datums, Marine Grids, and Sea Surface Topography. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Report** NOS CS 21, 46 pp.

Leuttich, Jr., R. A., J. L. Hench, C. W. Fulcher, F. E. Werner, B. O. Blanton, and J. H. Churchill, 1999: Barotropic tidal and wind driven larval transport in the vicinity of a barrier island inlet. **Fisheries Oceanography,** 33 (April), 913 – 932.

Milbert, D. G. and K. W. Hess, 2001: Combination of Topography and Bathymetry Through Application of Calibrated Vertical Datum Transformations in the Tampa Bay Region. **Preceedings of the 2nd Biennial Coastal GeoTools Conferences**, Charleston, SC.

Milbert, D.G., 2002: Documentation for VDatum (and VDatum Tutorial): Vertical datum transformation software. Ver. 1.06 (nauticalcharts.noaa.gov/bathytopo/ vdatum.htm).

Mukai, A. Y., J. J. Westerink, R. A. Luettich Jr., and D. Mark, 2002, Eastcoast 2001: A tidal constituent database for the western North Atlantic, Gulf of Mexico and Caribbean Sea, **US Army Engineer Research and Development Center, Coastal and Hydraulics Laboratory, Technical Report**, ERDC/CHL TR-02-24, September 2002, 201 pp.

Myers, E. P., A. Wong, A., K. Hess, S. White., E. Spargo, J. Feyen, Z. Yang, P. Richardson, C. Auer, J. Sellars, J. Woolard, D. Roman, S. Gill, C. Zervas, and K. Tronvig, 2005: Development of a National VDatum, and its Application to Sea Level Rise in North Carolina. **Proceedings of the 2005 Hydro Conference**, San Diego, CA.

Parker, B. P., 2002: The integration of bathymetry, topography, and shoreline, and the vertical datum transformations behind it. **International Hydrographic Review** (3) 3 (November 2002).

Parker, B., K. W. Hess, D. Milbert, and S. K. Gill, 2003: A national vertical datum transformation tool. **Sea Technology**, v. 44. no. 9 (Sept. 2003), 10 - 15.

Spargo, E.A., K.H. Hess, and S.A. White, 2006a: VDatum for the San Juan Islands and Juan de Fuca Strait with Updates for Southern Puget Sound: Tidal Datum Modeling and Population of the VDatum Marine Grids. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Report** NOS CS 25, 50 pp.

Spargo, E.A., Hess, K.H., Myers, E.P., Yang, Z., and A.Wong, 2006b: Tidal Datum Modeling in support of NOAA's Vertical Datum Transformation Tool. **Proceedings of the 9th International Conference on Estuarine and Coastal Modeling**, October 31-November 2, 2005, Charleston, SC. p. 523-536.

Westerink, J.J., R. A. Luettich, and J. C. Muccino, 1993: An Advanced Three-Dimensional Circulation Model for Shelves, Coasts, and Estuaries, Report 3: Development of a Tidal Constituent Database for the Western North Atlantic and Gulf of Mexico, **Technical Report DRP-92-6**, U.S. ACE Waterways Experiment Station, Vicksburg, MS.

Yang, Z., K.W. Hess, Myers, E.P., Spargo, E.A., Wong, A., and J. Feyen, 2005: Numerical Simulation of Tidal Datum Fields for the Long Island Sound, New York Bight, and Narragansett Bay Area. **Proceedings of the 9th International Conference on Estuarine and Coastal Modeling**, October 31-November 2, 2005, Charleston, SC. p. 548-567.

Yang, Z., and E. Myers , 2007. "Barotropic Tidal Energetics and Tidal Datums in the Gulf of Maine." **Proceedings of the 10th International Conference on Estuarine and Coastal Modeling**. November 5-7, Newport, RI. p. 74-94.

Yang, Z., E. P. Myers, A. Wong, and S. A. White, 2008a: Vdatum for Chesapeake Bay, Delaware Bay, and Adjacent Coastal Water Areas: Tidal Datums and Sea surface Topography. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Memorandum** NOS CS 15, 110 pp.

Yang, Z., K. Hess, E. Spargo, A. Wong, S. A. White, and E. P. Myers, 2008b: "VDatum for the Long Island Sound, Narragansett Bay, and New York Bight and New York Harbor: Tidal Datums, Marine Grids, and Sea Surface Topography." U.S.

Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Memorandum** NOS CS 16, 62 pp.

Yang, Z., E. P. Myers, A. Spargo, A. Wong, A. Wong, and S. A. White, 2009: "Vdatum for Coastal Waters of Southern California: Tidal Datums and Sea Surface Topography." U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Memorandum** NOS CS 17, 59 pp.

Yang, Z., E. P. Myers, and S. A. White, 2010a: "Vdatum For Eastern Louisiana And Mississippi Coastal Waters: Tidal Datums, Marine Grids, And Sea Surface Topography." U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Memorandum** NOS CS 19, 56 pp.

Yang, Z., E. P. Myers, and S. A. White, 2010b: "Vdatum for Great South Bay, New York Bight And New York Harbor: Tidal Datums, Marine Grids, And Sea Surface Topography." U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Memorandum** NOS CS 21, 55 pp.

Xu, J., E. P. Myers, and S. A. White, 2010: "Vdatum For the Coastal Waters Of North/Central California, Oregon and Western Washington: Tidal Datums And Sea Surface Topography." U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland, **NOAA Technical Memorandum** NOS CS 22, 68 pp.

APPENDIX A. HORIZONTAL AND VERTICAL ACCURACY STANDARDS FOR NOAA BATHYMETRIC SURVEYS

Table A.1. The required horizontal and vertical accuracy standards for NOAA surveys.

Survey Year*	Horizontal Accuracy	Vertical Accuracy	Standard
1998 – present	**Order 1** 1 – 100 m depth: 5.0 m + 5% of depth **Order 2** 100 – 200 m depth: 20 m + 5% of depth **Order 3** 100 – 200 m depth: 150 m + 5% of depth	**Order 1** 1 – 100 m depth: 0.5 – 1.4 m **Order 2** 100 – 200 m depth: 2.5 – 4.7 m **Order 3** > 100 m depth: same as Order 2	IHO S-44 [1] and NOAA [2]
1988 – 1998	95% probability that the true position lies within a circle of radius 1.5 mm, at the scale of the survey	0 – 30 m depth: 0.3 m > 30 m depth: 1% of depth	IHO S-44 [1] and NOAA [2]
1982 – 1988	probable error shall seldom exceed twice the plottable error (1.0 mm) at the scale of the survey	0 – 20 m depth: 0.3 m 20 – 100 m depth: 1.0 m > 100 m depth: 1% of depth	IHO S-44 [1] and NOAA [2]
1957 – 1982	maximum error of plotted positions shall seldom exceed 1.5 mm at the scale of the survey	0 – 20 m depth: 0.3 m 20 – 100 m depth: 1.0 m > 100 m depth: 1% of depth	IHC [3] NOAA [2] and IHO S-44 [1]
before 1957	undetermined	undetermined	undocumented

* end of field collection

[1] International Hydrographic Organization (IHO) Standards for Hydrographic Surveys, Special Publication 44, (First Edition, 1968; Second Edition, 1982; Third Edition, 1987; Fourth Edition, 1998).

[2] U.S. Department of Commerce Coast and Geodetic Survey Hydrographic Manual (1931, 1942, 1960, 1976) NOAA NOS Office of Coast Survey Specifications and Deliverables, 1999 – 2006. NOAA was established in 1970.

[3] International Hydrographic Conference, 1957.

APPENDIX B. WATER LEVEL STATION DATA

Table B.1. NOS Water Level Station Names

No.	Station ID	Station Name
1	8657419	OCEAN CITY FISHING PIER
2	8658120	WILMINGTON CAPE FEAR RIV
3	8658163	WRIGHTSVILLE BEACH
4	8658501	ORTON POINT CAPE FEAR RI
5	8658559	WILMINGTON BEACH
6	8658579	SUNNY POINT MOTSU NORTH
7	8658622	REAVES POINT MOTSU CENTE
8	8658654	MOTSU SOUTH WHARF #1 CAP
9	8658715	FEDERAL POINT
10	8658741	ZEKES ISLAND CAPE FEAR R
11	8658901	BALD HEAD ISLAND
12	8659084	SOUTHPORT
13	8659182	YAUPON BEACH ATLANTIC OC
14	8659897	SUNSET BEACH PIER ATLANT
15	8659898	SUNSET BEACH BRIDGE
16	8660098	LITTLE RIVER NECK
17	8660166	NIXON CROSSROADS LITTLE
18	8660642	NORTH MYRTLE BEACH
19	8660854	COMBINATION BRIDGE
20	8660983	SOCASTEE BRIDGE
21	8661000	MYRTLE BEACH
22	8661070	SPRINGMAID PIER ATLANTIC
23	8661139	BUCKSPORT WACCAMAW RIVER
24	8661437	GARDEN CITY PIER MURRELL
25	8661703	SANDY ISLAND THOROUGHFAR
26	8661991	HAGLEY WACCAMAW RIVER
27	8662006	PAWLEYS ISLAND PIER ATLA
28	8662549	SOUTH ISLAND FERRY WINYA
29	8662746	WINYAH BAY SOUTH ISLAND
30	8662796	MINIM CREEK
31	8662931	WACCAMAW RIVER ENTRANCE
32	8663461	CASINO CREEK
33	8663539	PIMLICO WEST BRANCH COOP
34	8663618	MC CLELLANVILLE JEREMY C
35	8663665	RICHMOND PLANTATION E. B
36	8664022	GEN. DYNAMICS PIER COOPE
37	8664515	EDWARDS PIER COOPER RIVE
38	8664545	COX'S PIER WANDO RIVER
39	8664561	CAINHOY WANDO RIVER
40	8664662	ARMY DEPOT COOPER RIVER
41	8664688	CLOUTER CREEK NORTH
42	8664782	HORLBECK CREEK WANDO RIV
43	8664941	SOUTH CAPERS ISLAND CAPE
44	8664945	CLOUTER CREEK SOUTH
45	8664992	NORTH DEWEE'S ISLAND
46	8665002	DRAYTON BEES FERRY ASHL
47	8665099	I-526 BRIDGE ASHLEY RIVE
48	8665101	COSGROVE BRIDGE ASHLEY R
49	8665111	SOUTH DEWEES ISLAND DEWE
50	8665167	HAMLIN SOUND
51	8665192	WANDO RIVER ENTRANCE
52	8665387	HAMLIN CREEK ISLE OF PAL
53	8665424	CROSBY'S DOCK FOLLY RIVE
54	8665475	LIMEHOUSE BRIDGE STONO R

No.	Station ID	Station Name
55	8665494	ISLE OF PALMS PIER
56	8665495	SOUTH ASHLEY BRIDGE ASHL
57	8665530	CHARLESTON COOPER RIVER
58	8665552	BREACH INLET
59	8665567	BEN SAWYER BRIDGE IWW
60	8665589	SANDBLASTERS PENNY'S CRE
61	8665599	PENNEYS CREEK W ENTRANCE
62	8665637	THE COVE FT MOULTRIE CH
63	8665641	WELCHES WHARF STONO RIVE
64	8666017	EDISTO RIVER SOUTH OF PE
65	8666217	YOUNGES ISLAND WADMALAW
66	8666367	WILLTOWN BLUFF
67	8666467	FOLLY RIVER NORTH
68	8666616	SOUTH EDISTO RIVER AT DAW
69	8666652	FOLLY RIVER SOUTH
70	8666699	BLUFF POINT WADMALAW RIV
71	8666767	SNAKE ISLAND STONO RIVER
72	8666775	LEADENWAH CREEK
73	8667075	STEAMBOAT CREEK LANDING
74	8667178	POINT OF PINES N. EDISTO
75	8667309	FENWICK ISLAND SOUTH EDI
76	8667630	EDISTO BEACH EDISTO ISLA
77	8667733	SAMS POINT LUCY POINT CR
78	8667783	OTTER ISLAND ST. HELENA
79	8667972	EDDINGS POINT CREEK
80	8667999	BEAUFORT
81	8668146	HARBOR RIVER BRIDGE ST.
82	8668223	BROAD RIVER BRIDGE
83	8668227	JOHNSON'S CREEK HARBOR I
84	8668482	BAILEYS LANDING OKATEE R
85	8668498	HUNTING ISLAND PIER FRIP
86	8668918	RIBAUT ISLAND SKULL CREE
87	8669133	SKULL CREEK SOUTH
88	8669167	PORT ROYAL PLTN. HILTON
89	8669801	BLOODY POINT NEW RIVER
90	8670870	FORT PULASKI SAVANNAH RI
91	8675622	OLD TOWER SAPELO ISLAND
92	8676329	MACKAY RIVER ICWW BUTTE
93	8677344	ST SIMONS LIGHTHOUSE ST
94	8679511	KINGS BAY
95	8679758	DUNGENESS SEACAMP DOCK
96	8679945	BEACH CREEK
97	8679964	ST. MARYS ST. MARYS RIVE
98	8720030	FERNANDINA BEACH AMELIA
99	8720051	LANCEFORD CREEK LOFTON
100	8720086	AMELIA CITY SOUTH AMELIA
101	8720098	NASSAUVILLE NASSAU RIVER
102	8720135	NASSAU RIVER ENTRANCE
103	8720137	SAWPIT CREEK ENTRANCE
104	8720143	SAWPIT CREEK
105	8720186	FORT GEORGE ISLAND
106	8720194	LITTLE TALBOT ISLAND
107	8720196	SISTERS CREEK
108	8720198	CLAPBOARD CREEK
109	8720203	BLOUNT ISLAND BRIDGE
110	8720211	WWTD MAYPORT NAVAL STA.
111	8720214	DEGAUSSING STRUCTURE MAY
112	8720215	JACKSONVILLE NAVY FUEL D

No.	Station ID	Station Name
113	8720217	MONCRIEF CREEK ENTRANCE
114	8720218	BAR PILOTS DOCK ST JOHNS
115	8720219	DAMES POINT ST. JOHNS RI
116	8720220	MAYPORT
117	8720221	FULTON ST. JOHNS RIVER
118	8720224	MAYPORT (FERRY DEPOT) ST
119	8720225	PHOENIX PARK
120	8720226	MAIN STREET BRIDGE ST JO
121	8720232	PABLO CREEK ENTRANCE
122	8720242	LONGBRANCH (USE-DDP) ST
123	8720267	PABLO CREEK
124	8720291	JACKSONVILLE BEACH
125	8720296	ORTEGA RIVER ENTRANCE
126	8720305	OAK LANDING
127	8720333	PINEY POINT ST. JOHNS RI
128	8720357	I-295 BRIDGE WEST END S
129	8720374	ORANGE PARK ST. JOHNS RI
130	8720398	PALM VALLEY ICWW
131	8720406	DOCTORS LAKE PEORIA POIN
132	8720496	GREEN COVE SPRINGS ST. J
133	8720503	RED BAY POINT ST JOHNS R
134	8720554	VILANO BEACH (ICWW)
135	8720576	ST. AUGUSTINE
136	8720582	STATE ROAD 312 MATANZAS
137	8720587	ST. AUGUSTINE BEACH ATLA
138	8720596	EAST TOCOI ST. JOHNS RIV
139	8720623	ANASTASIA ISLAND
140	8720625	RACY POINT ST JOHNS RIVE
141	8720651	CRESCENT BEACH MATANZAS
142	8720653	PALMETTO BLUFF ST. JOHNS
143	8720686	FORT MATANZAS
144	8720692	STATE ROAD A1A BRIDGE
145	8720757	BINGS LANDING MATANZAS R
146	8720767	BUFFALO BLUFF ST. JOHNS
147	8720774	PALATKA ST. JOHNS RIVER
148	8720832	WELAKA ST. JOHNS RIVER
149	8720833	SMITH CREEK FLAGLER BEAC
150	8720954	ORMOND BEACH
151	8721120	DAYTONA BEACH SHORES
152	8721138	HALIFAX RIVER PONCE INLE
153	8721147	PONCE DE LEON INLET SOUTH
154	8721191	EDGEWATER INDIAN RIVER
155	8721222	PACKWOOD PLACE
156	8721604	TRIDENT PIER PORT CANAVE
157	8721649	COCOA BEACH ATLANTIC OCE
158	8721804	CANOVA
159	8721832	MELBOURNE INDIAN RIVER
160	8721994	MICCO INDIAN RIVER
161	8722004	SEBASTIAN INLET
162	8722029	SEBASTIAN INDIAN RIVER
163	8722059	WABASSO INDIAN RIVER
164	8722105	VERO BEACH (OCEAN)
165	8722125	VERO BEACH INDIAN RIVER
166	8722212	FORT PIERCE SOUTH JETTY
167	8722334	NORTH FORK ST. LUCIE RIV
168	8722357	STUART ST. LUCIE RIVER
169	8722371	SEWALL POINT. ST. LUCIE R
170	8722381	GREAT POCKET ST. LUCIE IN

No.	Station ID	Station Name
171	8722404	PECK LAKE ST. LUCIE INLE
172	8722414	GOMEZ
173	8722429	HOBE SOUND BRIDGE HOBE S
174	8722445	HOBE SOUND STATE PARK
175	8722478	NORTH FORK LOXAHATCHEE R
176	8722481	LOXAHATCHEE RIVER
177	8722487	TEQUESTA NORTH
178	8722491	JUPITER SOUND SOUTH END
179	8722492	JUPITER WEST
180	8722495	JUPITER INLET
181	8722557	NORTH PALM BEACH
182	8722607	PALM BEACH
183	8722621	PALM BEACH BRAZILIAN DOC
184	8722654	WEST PALM BEACH
185	8722670	LAKE WORTH PIER ATLANTIC
186	8722706	BOYNTON BEACH
187	8722718	OCEAN RIDGE
188	8722746	DELRAY BEACH
189	8722761	SOUTH DELRAY BEACH
190	8722784	YAMATO
191	8722802	LAKE WYMAN
192	8722816	BOCA RATON
193	8722859	HILLSBORO
194	8722861	HILLSBORO INLET INSIDE
195	8722862	HILLSBORO INLET OCEAN
196	8722899	LAUDERDALE-BY-THE-SEA
197	8722939	FT. LAUDERDALE BAHIA YACH
198	8722951	PORT EVERGLADES LAKE MAB
199	8722956	SOUTH PORT EVERGLADES
200	8722957	NORTH DANIA SOUND
201	8722971	WHISKEY CREEK SOUTH ENTR
202	8722979	HOLLYWOOD BEACH
203	8723044	DUMFOUNDLING BAY
204	8723050	NORTH MIAMI BEACH
205	8723073	HAULOVER INSIDE
206	8723080	HAULOVER PIER N. MIAMI B
207	8723089	BISCAYNE CREEK INTRACOAS
208	8723165	MIAMI BISCAYNE BAY
209	8723170	MIAMI BEACH (CITY PIER)
210	8723178	MIAMI BEACH GOVERNMENT C
211	8723214	VIRGINIA KEY BISCAYNE BA
212	8723232	KEY BISCAYNE YACHT CLUB
213	8723289	CUTLER BISCAYNE BAY
214	8723350	RAGGED KEY #3
215	8723355	RAGGED KEY NO. 5 BISCAYN
216	8723372	SANDS KEY ELLIOTT KEY
217	8723391	COON POINT ELLIOTT KEY
218	8723393	ELLIOTT KEY (OUTSIDE)
219	8723409	ELLIOTT KEY HARBOR ELLIO
220	8723423	TURKEY POINT BISCAYNE BA
221	8723439	BILLY'S POINT ELLIOTT KE
222	8723453	ADAMS KEY
223	8723457	CHRISTMAS POINT ELLIOTT
224	8723465	EAST ARSENICKER CARD SOU
225	8723467	TOTTEN KEY BISCAYNE BAY
226	8723506	PUMPKIN KEY CARD SOUND
227	8723518	WEDNESDAY POINT KEY LARG
228	8723519	OCEAN REEF HARBOR KEY LA

No.	Station ID	Station Name
229	8723534	CARD SOUND BRIDGE
230	8723583	CARYSFORT REEF LIGHTHOUSE
231	8723693	GAGE A POINT CHARLES KE
232	8723746	CRANE KEY
233	8723747	TAVERNIER HAWK CHANNEL
234	8723752	EAST KEY FLORIDA BAY
235	8723769	PLANTATION KEY ATLANTIC
236	8723786	USCG STA. ISLAMORADA SN
237	8723795	WHALE HARBOR MARINA
238	8723797	ISLAMORADA WHALE HARBOR
239	8723807	SHELL KEY N.W.SIDE
240	8723808	UPPER MATECUMBE KEY FLORI
241	8723812	SHELL KEY CHANNEL
242	8723814	UPPER MATECUMBE KEY ATLAN
243	8723824	LIGNUMVITAE KEY EAST
244	8723851	LOWER MATECUMBE KEY HAWK
245	8723852	LOWER MATECUMBE KEY FLA.
246	8723861	ALLIGATOR REEF LIGHTHOUSE
247	8723906	LONG KEY CHANNEL WEST
248	8723912	TOM'S HARBOR CUT
249	8723918	TOM'S HARBOR CHANNEL
250	8723921	GRASSY KEY NORTH SIDE FL
251	8723927	DUCK KEY
252	8723933	GRASSY KEY ATLANTIC SIDE
253	8723949	FAT DEER KEY
254	8723950	MARTHON SHORES KEY VACA
255	8723962	KEY COLONY BEACH
256	8723970	VACA KEY FLORIDA BAY
257	8723971	BOOT KEY HARBOR
258	8723999	SOMBRERO KEY LIGHTHOUSE
259	8724008	KNIGHT KEY CHANNEL
260	8724032	PIGEON KEY ATLANTIC SIDE
261	8724033	PIGEON KEY (INSIDE)
262	8724062	MOLASSES KEY
263	8724093	LITTLE DUCK KEY
264	8724094	EAST BAHIA HONDA KEY
265	8724098	COCOANUT KEY
266	8724099	MISSOURI-LITTLE DUCK CHAN
267	8724107	MISSOURI-OHIO CHANNEL
268	8724112	OHIO-BAHIA HONDA CHANNEL
269	8724129	WEST BAHIA HONDA KEY
270	8724138	BAHIA HONDA KEY
271	8724139	HORESHOE KEYS
272	8724153	JOHNSON KEYS SOUTH
273	8724154	LITTLE PINE KEY SOUTH
274	8724168	NO NAME KEY
275	8724172	JOHNSON KEYS NORTH
276	8724177	LITTLE PINE KEY NORTH
277	8724178	SPANISH HARBOR VIADUCT B
278	8724189	WATER KEY BIG SPANISH CH
279	8724192	BIG PINE KEY COUPON BIGH
280	8724193	BOGIE CHANNEL LANDING BI
281	8724196	PORPOISE KEY
282	8724199	CRAWL KEY BIG SPANISH CH
283	8724201	DOCTORS ARM
284	8724205	MAYO KEY
285	8724209	LITTLE SPANISH KEY ISLAND
286	8724211	BIG PINE KEY VIADUCT

No.	Station ID	Station Name
287	8724215	NEWFOUND HARBOR
288	8724224	LITTLE TORCH KEY
289	8724226	BIG PINE KEY NORTH EAST
290	8724227	BIG PINE KEY WEST SIDE
291	8724229	ANNETTE KEY
292	8724231	BIG PINE KEY NORTH END
293	8724238	MUNSON KEY
294	8724239	RAMROD KEY SOUTHEAST
295	8724246	BIG SPANISH KEY
296	8724255	RAMROD KEY
297	8724257	HOWE KEY NE POINT
298	8724264	BIG TORCH KEY WEST SIDE
299	8724266	SUMMERLAND KEY EAST
300	8724273	WATER KEYS SOUTH END
301	8724276	SUMMERLAND KEY WEST SIDE
302	8724292	KEMP CHANNEL VIADUCT
303	8724302	KNOCKEMDOWN KEY
304	8724306	GOPHER KEY
305	8724307	CONTENT KEY GULF OF MEXIC
306	8724311	RACOON KEY
307	8724313	CUDJOE BAY
308	8724327	TARPON CREEK (OUTSIDE)
309	8724328	CUDJOE KEY NO. POINT
310	8724332	CUDJOE KEY PIRATES COVE
311	8724334	TARPON CREEK SUGARLOAF K
312	8724347	SUGARLOAF KEY EAST SIDE
313	8724353	PERKY LAKE SUGERLOAF KEY
314	8724368	SUGARLOAF KEY (NORTH END)
315	8724369	SAWYER KEY (INSIDE)
316	8724373	PUMPKIN KEY SUGARLOAF CH
317	8724378	PERKY SUGARLOAF SOUND
318	8724397	JOHNSTON KEY
319	8724405	SADDLEBUNCH CHANNEL NO. 3
320	8724409	INNER NARROWS
321	8724417	SADDLEBUNCH CHANNEL NO. 4
322	8724422	SIMILAR SOUND
323	8724423	SADDLEBUNCH CHANNEL NO. 5
324	8724427	MIDDLE NARROWS
325	8724436	BIRD KEY
326	8724438	SHARK KEY
327	8724441	O'HARA KEY NORTH POINT
328	8724448	WALTZ KEY
329	8724463	SNIPE POINT SNIPE KEYS
330	8724474	DUCK KEY POINT
331	8724485	BOCA CHICA LONG POINT
332	8724489	BIG COPPITT KEY
333	8724493	BOCA CHICA MARINA
334	8724503	STOCK ISLAND
335	8724507	CHANNEL KEY
336	8724517	KEY HAVEN WEST
337	8724527	COW KEY CHANNEL
338	8724529	RIVERIA CANAL KEY WEST
339	8724542	SIGSBEE PARK GARRISON BI
340	8724557	KEY WEST WHITE STREET PI
341	8724571	FLEMING KEY NORTH END
342	8724580	KEY WEST
343	8724635	SAND KEY LIGHTHOUSE
344	8724697	GARDEN KEY DRY TORTUGAS

No.	Station ID	Station Name
345	8724698	LOGGERHEAD KEY DRY TORTU
346	8724919	CHOKOLOSKEE
347	8724932	INDIAN KEY
348	8724947	CAPE ROMANO ISLAND
349	8724948	EVERGLADES CITY
350	8724951	PANTHER KEY
351	8724962	FAKAHATCHEE RIVER ENTRANC
352	8724964	COON KEY PASS GULLIVAN B
353	8724967	MARCO ISLAND CAXAMBAS PA
354	8724970	FAKA UNION BAY
355	8724971	DAVID KEY BARFIELD BAY
356	8724975	BLACKWATER RIVER ENTRANCE
357	8724979	BIG MARCO RIVER U.S. 92
358	8724991	MARCO BIG MARCO RIVER
359	8724992	ADDISON BAY
360	8724996	MCILVAINE BAY
361	8725019	KEEWAYDIN ISLAND INSIDE
362	8725079	DOLLAR BAY NORTH
363	8725110	NAPLES GULF OF MEXICO
364	8725114	NAPLES BAY NORTH
365	8725171	OUTER CLAM BAY
366	8725222	WATER TURKEY BAY
367	8725228	COCOHATCHEE RIVER U.S. 4
368	8725235	WIGGINS PASS INSIDE
369	8725319	COCONUT POINT ESTERO BAY
370	8725331	OSTEGO BAY ESTERO BAY
371	8725346	ESTERO RIVER ESTERO BAY
372	8725351	ESTERO ISLAND ESTERO BAY
373	8725362	TARPON BAY
374	8725366	MATANZAS PASS ESTERO ISL
375	8725368	HURRICANE BAY SAN CARLOS
376	8725391	PUNTA RASSA SAN CARLOS B
377	8725488	NORTH CAPTIVA ISLAND
378	8725520	FORT MYERS CALOOSAHATCHE
379	8725541	BOKELLIA CHARLOTTE HARBO
380	8725577	PORT BOCA GRANDE CHARLOT
381	8725649	TURTLE BAY
382	8725665	LITTLE GASPARILLA ISLAND
383	8725667	PLACIDA GASPARILLA SOUND
384	8725685	CUTOFF SOUTH
385	8725691	SOUTH LEMON BAY
386	8725744	PUNTA GORDA
387	8725745	LOCUST POINT HOG ISLAND
388	8725747	ENGLEWOOD LEMON BAY
389	8725769	EL JOBEAN MYAKKA RIVER
390	8725781	SHELL CREEK PEACE RIVER
391	8725782	SHELL CREEK SEABOARD RR
392	8725791	HARBOUR HEIGHTS PEACE RI
393	8725809	MANASOTA
394	8725835	LIVERRPOOL PEACE RIVER
395	8725837	MYAKKA RIVER US 41
396	8725858	VENICE GULF OF MEXICO
397	8725899	NOKOMIS VENICE INLET
398	8725916	CASEY KEY
399	8725943	BLACKBURN POINT
400	8725985	SIESTA KEY LITTLE SARASO
401	8726045	HAYDEN ROBERTS BAY
402	8726083	SARASOTA SARASOTA BAY

No.	Station ID	Station Name
403	8726089	LONGBOAT KEY
404	8726159	WHITFIELD ESTATES SARASO
405	8726217	CORTEZ SARASOTA BAY
406	8726232	PERICO ISLAND
407	8726233	PALMA SOLA BAY SOUTH
408	8726247	BRADENTON MANATEE RIVER
409	8726249	PALMA SOLA BAY NORTH
410	8726254	PERICO BAYOU
411	8726273	DESOTO POINT
412	8726278	REDFISH POINT MANATEE RI
413	8726282	ANNA MARIA CITY PIER
414	8726347	EGMONT KEY TAMPA BAY
415	8726353	BISHOP HARBOR
416	8726364	MULLET KEY TAMPA BAY
417	8726384	PORT MANATEE TAMPA BAY
418	8726428	TIERRA VERDE
419	8726520	ST. PETERSBURG TAMPA BAY
420	8726533	JOHNS PASS
421	8726537	APOLLO BEACH HILLSBOROUG
422	8726573	GADSDEN POINT TAMPA BAY
423	8726574	BOCA CIEGA BAY
424	8726601	INDIAN ROCKS BEACH
425	8726604	LONG SHOAL MACDILL AFB
426	8726607	PORT TAMPA OLD TAMPA BAY
427	8726632	ARCHIE CREEK
428	8726639	TAMPA BALLAST POINT
429	8726641	GANDY BRIDGE OLD TAMPA
430	8726651	PENDOLA POINT HILLSBOROU
431	8726657	DAVIS ISLAND HILLSBOROUG
432	8726667	CSX ROCKPORT MCKAY BAY E
433	8726668	TAMPA HOOKER POINT HILL
434	8726685	TWENTY-SECOND ST. CAUSEWA
435	8726689	BAY ARISTOCRAT VILLAGE O
436	8726693	HILLSBOROUGH RIVER ENTRAN
437	8726696	PALM RIVER ENTRANCE
438	8726699	PALM RIVER
439	8726706	CLEARWATER CLEARWATER HA
440	8726724	CLEARWATER BEACH GULF OF
441	8726738	SAFETY HARBOR OLD TAMPA
442	8726761	DUNEDIN CITY DOCK
443	8726774	CALADESI ISLAND INSIDE
444	8726808	HONEYMOON ISLAND SOUTH
445	8726809	HONNEYMOON ISLAND INSIDE
446	8726819	OZONA
447	8726833	SUTHERLAND BAYOU PALM HA
448	8726853	INDIAN BLUFF ISLAND
449	8726904	HOWARD PARK
450	8726917	ANCLOTE LIGHTHOUSE ANCLO
451	8726924	ANCLOTE RIVER
452	8726942	NORTH ANCLOTE KEY
453	8726976	BAILEYS BLUFF INSIDE
454	8726978	BAILEYS BLUFF GULFSIDE
455	8726988	FILLMANS CREEK NEW PORT
456	8727061	HUDSON HUDSON CREEK
457	8727086	FILLMANS BAYOU
458	8727097	ARIPEKA
459	8727151	BAYPORT
460	8727235	JOHNS ISLAND CHASSAHOWIT

No.	Station ID	Station Name
461	8727274	MASON CREEK HOMOSASSA BA
462	8727277	TUCKERS ISLAND HOMOSASSA
463	8727328	OZELLO NORTH
464	8727333	MSNGROVE POINT CRYSTAL B
465	8727336	DIXIE BAY
466	8727343	CRYSTAL RIVER KINGS BAY
467	8727348	TWIN RIVERS MARINA CRYST
468	8727359	SHELL ISLAND CRYSTAL RIV
469	8727395	PORT INGLIS WITHLACOOCHE
470	8727411	YANKEETOWN WITHLACOOCHEE
471	8727471	WACCASASSA RIVER
472	8727520	CEDAR KEY GULF OF MEXICO
473	8727577	SUWANNEE
474	8727604	SHIRED ISLAND
475	8727648	HORSESHOE POINT
476	8727695	STEINHATCHEE
477	8727843	SPRING WARRIOR CREEK
478	8727892	FENHOLLOWAY RIVER
479	8727956	ECONFINA RIVER INSIDE
480	8728130	ST. MARKS LHTSE. APALACH
481	8728229	SHELL POINT WALKER CREEK
482	8728255	ALLIGATOR HARBOR
483	8728258	FIDDLERS POINT
484	8728261	ALLIGATOR POINT SW CAPE
485	8728288	ALLIGATOR POINT
486	8728311	ST. TERESA BEACH
487	8728360	TURKEY POINT
488	8728408	DOG ISLAND EAST END
489	8728412	LANARK ST. GEORGES SOUND
490	8728464	CARRABELLE RIVER ST. GEO
491	8728486	NE END ST. GEORGE ISLAND
492	8728488	SOUTH CARRABELLE BEACH
493	8728619	CAT POINT APALACHICOLA B
494	8728626	ST. GEORGE ISLAND BAYSID
495	8728669	SIKES CUT ST. GEORGE ISL
496	8728690	APALACHICOLA APALACHICOL
497	8728694	WHITE BEACH EAST BAY
498	8728711	APALACHICOLA RIVER
499	8728757	HUCKLEBERRY LANDING JACK
500	8728786	ELEVEN MILE ST. VINCENT
501	8728912	PORT ST. JOE
502	8728942	CAPE SAN BLAS
503	8728949	RICHARDSON HAMMOCK ST. J
504	8728958	ST. JOSEPH POINT ST. JOS
505	8728995	MEXICO BEACH
506	8729149	ST. ANDREW STATE PARK
507	8729189	PANAMA CITY BEACH
508	8729210	PANAMA CITY BEACH GULF O
509	8666433	TOOGOODOO CREEK
510	8665763	CHURCH FLATS STONO RIVER
511	8666101	JOHNS ISLAND CHURCH CREE
512	8666799	DAWHOO BRIDGE DAWHOO RIV
513	8666918	HO-NON-WAH BOYSCOUT CAMP
514	8667062	KIAWAH BRIDGE KIAWAH RIV
515	8667425	PETERS POINT ST. PIERRE
516	8662953	WINDSOR PLANTATION BLACK

Table B.2. Tidal datums (meters) relative to mean sea level. The 'N/A's in the table denote missing values.

Note : stations with * means the control station used for datum determination used an accepted datum based on the 5-year Modified Tidal Epoch procedure in order to take into account rapid vertical land movement.

No.	Station ID	Longitude (degree)	Latitude (degree)	MHHW (m)	MHW (m)	MLW (m)	MLLW (m)	NAVD88 (m)
1	8657419	-77.495	34.4517	0.735	0.637	-0.642	-0.69	N/A
2	8658120	-77.9533	34.2267	0.684	0.608	-0.696	-0.743	-0.01
3	8658163	-77.795	34.21	0.739	0.631	-0.629	-0.676	N/A
4	8658501	-77.94	34.0567	0.708	0.618	-0.652	-0.699	N/A
5	8658559	-77.8933	34.0317	0.747	0.643	-0.639	-0.686	0.216
6	8658579	-77.9467	34.0233	0.712	0.616	-0.649	-0.697	0.113
7	8658622	-77.955	34.0033	0.708	0.611	-0.637	-0.685	0.275
8	8658654	-77.9567	33.99	0.698	0.603	-0.633	-0.676	0.113
9	8658715	-77.94	33.9617	0.673	0.571	-0.659	-0.701	N/A
10	8658741	-77.9517	33.95	0.714	0.616	-0.63	-0.678	0.142
11	8658901	-78.0017	33.88	0.751	0.64	-0.728	-0.779	N/A
12	8659084	-78.0183	33.915	0.736	0.634	-0.659	-0.706	0.141
13	8659182	-78.0817	33.9017	0.829	0.715	-0.726	-0.776	0.17
14	8659897	-78.5067	33.865	0.847	0.731	-0.737	-0.801	N/A
15	8659898	-78.51	33.8817	0.823	0.704	-0.735	-0.785	N/A
16	8660098	-78.5733	33.87	0.817	0.7	-0.711	-0.76	0.103
17	8660166	-78.6483	33.855	0.731	0.632	-0.617	-0.656	0.017
18	8660642	-78.815	33.7667	0.355	0.289	-0.253	-0.302	-0.198
19	8660854	-78.9217	33.7133	0.308	0.261	-0.26	-0.312	-0.235
20	8660983	-79.005	33.6867	0.315	0.273	-0.36	-0.402	-0.186
21	8661000	-78.885	33.6833	0.825	0.751	-0.768	-0.868	N/A
22	8661070	-78.9183	33.655	0.881	0.762	-0.769	-0.826	0.136
23	8661139	-79.095	33.6467	0.313	0.277	-0.381	-0.433	-0.282
24	8661437	-78.9967	33.575	0.88	0.759	-0.769	-0.827	N/A
25	8661703	-79.145	33.5067	0.508	0.456	-0.562	-0.614	N/A
26	8661991	-79.1817	33.435	0.565	0.497	-0.56	-0.605	-0.075
27	8662006	-79.1167	33.4317	0.864	0.745	-0.754	-0.81	N/A
28	8662549	-79.2683	33.2517	0.643	0.555	-0.569	-0.613	0.049
29	8662746	-79.2033	33.235	0.681	0.588	-0.574	-0.624	0.051
30	8662796	-79.275	33.195	0.698	0.596	-0.619	-0.674	0.008
31	8662931	-79.255	33.3667	0.603	0.524	-0.574	-0.606	-0.054
32	8663461	-79.3933	33.1083	0.792	0.685	-0.702	-0.748	N/A
33	8663539	-79.9533	33.095	0.323	0.254	-0.259	-0.31	-0.556
34	8663618	-79.46	33.0783	0.858	0.74	-0.74	-0.792	0.094
35	8663665	-79.855	33.0767	0.432	0.371	-0.442	-0.52	-0.356
36	8664022	-79.9233	33.0083	0.685	0.598	-0.729	-0.792	-0.127
37	8664515	-79.9317	32.9483	0.824	0.72	-0.897	-0.959	N/A
38	8664545	-79.83	32.9267	0.919	0.814	-1.02	-1.079	N/A
39	8664561	-79.8367	32.9233	0.951	0.854	-0.93	-0.995	N/A
40	8664662	-79.9517	32.91	0.852	0.75	-0.898	-0.957	0.014
41	8664688	-79.935	32.9067	0.839	0.736	-0.921	-0.979	N/A
42	8664782	-79.845	32.885	0.932	0.831	-0.907	-0.97	N/A
43	8664941	-79.7067	32.8567	0.843	0.727	-0.764	-0.818	N/A
44	8664945	-79.9383	32.86	0.856	0.753	-0.877	-0.936	N/A
45	8664992	-79.7033	32.85	0.813	0.709	-0.741	-0.797	N/A
46	8665002	-80.0517	32.8483	0.883	0.786	-0.949	-1.009	0.018
47	8665099	-80.0217	32.8367	0.896	0.793	-0.939	-1.003	N/A
48	8665101	-79.9867	32.835	0.891	0.786	-0.913	-0.973	0.07
49	8665111	-79.7267	32.8333	0.848	0.732	-0.771	-0.823	N/A
50	8665167	-79.7867	32.8267	0.87	0.753	-0.828	-0.885	0.089

51	8665192	-79.9	32.8217	0.888	0.779	-0.862	-0.918	0.053
52	8665387	-79.7917	32.7867	0.858	0.741	-0.795	-0.854	0.103
53	8665424	-79.9517	32.675	0.903	0.786	-0.864	-0.921	0.097
54	8665475	-80.105	32.7867	0.784	0.688	-1.014	-1.089	-0.036
55	8665494	-79.785	32.7833	0.864	0.745	-0.763	-0.816	N/A
56	8665495	-79.9567	32.7833	0.872	0.763	-0.849	-0.908	N/A
57	8665530	-79.925	32.7817	0.867	0.758	-0.834	-0.89	0.067
58	8665552	-79.8117	32.7767	0.853	0.738	-0.767	-0.827	0.12
59	8665567	-79.8417	32.7733	0.857	0.743	-0.796	-0.853	0.11
60	8665589	-80.0633	32.77	0.742	0.658	-0.946	-1.03	-0.012
61	8665599	-80.07	32.7683	0.774	0.676	-0.945	-1.021	N/A
62	8665637	-79.8567	32.7633	0.858	0.747	-0.8	-0.856	0.094
63	8665641	-80.0017	32.7633	0.795	0.697	-0.871	-0.938	0.019
64	8666017	-80.4367	32.715	0.695	0.621	-0.894	-0.974	-0.27
65	8666217	-80.2233	32.695	0.929	0.82	-1.159	-1.226	0.012
66	8666367	-80.4167	32.6817	0.828	0.741	-0.987	-1.054	-0.155
67	8666467	-79.9167	32.67	0.894	0.777	-0.863	-0.919	0.086
68	8666616	-80.3917	32.6567	0.888	0.803	-1.071	-1.136	N/A
69	8666652	-79.945	32.6617	0.877	0.761	-0.845	-0.901	0.085
70	8666699	-80.2567	32.6467	0.924	0.816	-1.052	-1.117	0.046
71	8666767	-80.015	32.64	0.895	0.781	-0.826	-0.885	N/A
72	8666775	-80.2017	32.6367	0.912	0.801	-1.026	-1.09	N/A
73	8667075	-80.2867	32.6033	0.925	0.815	-1.02	-1.084	0.041
74	8667178	-80.2283	32.585	0.901	0.791	-0.934	-0.996	0.071
75	8667309	-80.4183	32.56	0.963	0.858	-1.03	-1.097	N/A
76	8667630	-80.2967	32.5017	0.971	0.852	-0.899	-0.963	0.096
77	8667733	-80.6	32.4833	1.001	0.891	-1.138	-1.204	0.017
78	8667783	-80.42	32.4767	0.981	0.872	-0.959	-1.023	N/A
79	8667972	-80.5333	32.4467	1.008	0.897	-1.057	-1.121	0.058
80	8667999	-80.675	32.43	1.115	0.998	-1.252	-1.317	0.033
81	8668146	-80.4533	32.4033	0.999	0.881	-0.975	-1.039	0.094
82	8668223	-80.7767	32.3867	1.111	0.998	-1.24	-1.302	0.035
83	8668227	-80.4383	32.3917	0.976	0.857	-0.935	-0.994	0.097
84	8668482	-80.89	32.3467	1.224	1.097	-1.368	-1.439	0.022
85	8668498	-80.465	32.34	1.012	0.896	-0.963	-1.024	0.09
86	8668918	-80.7367	32.2667	1.065	0.955	-1.126	-1.187	N/A
87	8669133	-80.7717	32.2233	1.138	1.017	-1.201	-1.27	0.074
88	8669167	-80.6683	32.22	1.047	0.904	-0.953	-1.02	0.083
89	8669801	-80.8783	32.0817	1.103	0.991	-1.073	-1.135	0.105
90	8670870	-80.9017	32.0333	1.123	1.009	-1.099	-1.164	0.071
91	8675622	-81.2883	31.39	1.146	1.025	-1.054	-1.118	N/A
92	8676329	-81.385	31.285	1.065	0.968	-1.126	-1.199	N/A
93	8677344	-81.3967	31.1317	1.109	0.996	-1.016	-1.077	0.2
94	8679511	-81.515	30.7967	1.05	0.939	-1.022	-1.084	N/A
95	8679758	-81.4717	30.7633	1.023	0.915	-0.984	-1.044	0.637
96	8679945	-81.4767	30.7267	0.994	0.882	-0.922	-0.978	N/A
97	8679964	-81.5483	30.72	0.943	0.841	-0.945	-1.005	N/A
98	8720030	-81.465	30.6717	0.995	0.888	-0.947	-1.004	0.161
99	8720051	-81.5233	30.6433	1.043	0.929	-0.999	-1.059	0.153
100	8720086	-81.4633	30.5867	0.917	0.812	-0.83	-0.881	0.122
101	8720098	-81.515	30.5683	0.785	0.694	-0.754	-0.811	0.073
102	8720135	-81.4533	30.5183	0.911	0.807	-0.765	-0.823	0.15
103	8720137	-81.4567	30.5133	0.881	0.774	-0.765	-0.822	0.158
104	8720143	-81.4717	30.5033	0.868	0.764	-0.784	-0.828	N/A
105	8720186	-81.4383	30.44	0.792	0.701	-0.756	-0.799	0.107
106	8720194	-81.405	30.43	0.979	0.854	-0.808	-0.865	0.136
107	8720196	-81.4533	30.4167	0.696	0.622	-0.686	-0.724	N/A
108	8720198	-81.51	30.4067	0.609	0.548	-0.547	-0.579	N/A
109	8720203	-81.545	30.4133	0.552	0.493	-0.565	-0.593	0.104

110	8720211	-81.4133	30.4	0.801	0.71	-0.725	-0.772	N/A
111	8720214	-81.395	30.3967	0.831	0.731	-0.733	-0.782	N/A
112	8720215	-81.6267	30.4	0.434	0.394	-0.397	-0.42	0.098
113	8720217	-81.6617	30.3917	0.426	0.387	-0.378	-0.403	0.109
114	8720218	-81.43	30.3967	0.771	0.688	-0.705	-0.752	N/A
115	8720219	-81.5583	30.3867	0.559	0.518	-0.536	-0.573	0.112
116	8720220	-81.4317	30.3933	0.747	0.666	-0.692	-0.736	0.181
117	8720221	-81.5067	30.39	0.605	0.543	-0.558	-0.588	0.131
118	8720224	-81.4317	30.395	0.761	0.678	-0.707	-0.752	N/A
119	8720225	-81.6367	30.3833	0.425	0.385	-0.379	-0.403	0.093
120	8720226	-81.6583	30.32	0.278	0.263	-0.296	-0.329	N/A
121	8720232	-81.4483	30.3767	0.64	0.56	-0.61	-0.64	0.123
122	8720242	-81.62	30.36	0.407	0.377	-0.381	-0.414	N/A
123	8720267	-81.4383	30.3233	0.585	0.523	-0.626	-0.67	0.131
124	8720291	-81.3867	30.2833	0.935	0.82	-0.726	-0.776	0.181
125	8720296	-81.705	30.2783	0.209	0.18	-0.153	-0.171	-0.001
126	8720305	-81.43	30.2533	0.572	0.506	-0.746	-0.792	0.064
127	8720333	-81.6633	30.2283	0.161	0.14	-0.125	-0.142	N/A
128	8720357	-81.6917	30.1917	0.159	0.148	-0.128	-0.156	N/A
129	8720374	-81.695	30.1683	0.143	0.123	-0.109	-0.121	N/A
130	8720398	-81.3867	30.1333	0.642	0.566	-0.854	-0.91	N/A
131	8720406	-81.7583	30.12	0.148	0.127	-0.116	-0.13	-0.013
132	8720496	-81.6633	29.99	0.142	0.12	-0.119	-0.131	-0.007
133	8720503	-81.6283	29.9783	0.151	0.136	-0.131	-0.155	N/A
134	8720554	-81.3	29.9167	0.757	0.653	-0.65	-0.706	N/A
135	8720576	-81.31	29.8917	0.779	0.676	-0.689	-0.74	0.153
136	8720582	-81.3067	29.8667	0.752	0.65	-0.662	-0.718	N/A
137	8720587	-81.2633	29.8567	0.827	0.712	-0.693	-0.742	0.212
138	8720596	-81.5533	29.8583	0.168	0.145	-0.144	-0.157	-0.015
139	8720623	-81.2717	29.7933	0.77	0.672	-0.71	-0.764	0.111
140	8720625	-81.5483	29.8017	0.192	0.179	-0.17	-0.191	N/A
141	8720651	-81.2583	29.7683	0.702	0.605	-0.646	-0.701	N/A
142	8720653	-81.5617	29.7633	0.192	0.165	-0.155	-0.17	0.019
143	8720686	-81.2383	29.715	0.659	0.564	-0.611	-0.667	0.14
144	8720692	-81.22	29.7067	0.676	0.579	-0.542	-0.591	N/A
145	8720757	-81.205	29.615	0.262	0.217	-0.227	-0.267	N/A
146	8720767	-81.6817	29.595	0.176	0.17	-0.147	-0.17	N/A
147	8720774	-81.6317	29.6433	0.212	0.204	-0.186	-0.212	N/A
148	8720832	-81.675	29.4767	0.081	0.076	-0.053	-0.066	N/A
149	8720833	-81.1367	29.4783	0.169	0.128	-0.139	-0.16	0.078
150	8720954	-81.0533	29.285	0.118	0.095	-0.085	-0.11	0.116
151	8721120	-80.9633	29.1467	0.719	0.606	-0.584	-0.631	0.242
152	8721138	-80.9367	29.0817	0.507	0.425	-0.414	-0.458	0.226
153	8721147	-80.915	29.0633	0.516	0.43	-0.412	-0.45	0.188
154	8721191	-80.9	28.9883	0.376	0.314	-0.292	-0.31	0.15
155	8721222	-80.87	28.94	0.214	0.164	-0.16	-0.167	N/A
156	8721604	-80.5933	28.415	0.63	0.526	-0.531	-0.579	N/A
157	8721649	-80.6	28.3683	0.636	0.528	-0.527	-0.575	N/A
158	8721804	-80.5783	28.1383	0.634	0.507	-0.518	-0.58	N/A
159	8721832	-80.6117	28.1	0.036	0.028	-0.022	-0.042	N/A
160	8721994	-80.4967	27.8733	0.057	0.041	-0.041	-0.063	0.255
161	8722004	-80.4483	27.86	0.367	0.309	-0.333	-0.374	0.367
162	8722029	-80.4633	27.8117	0.068	0.046	-0.047	-0.068	0.27
163	8722059	-80.425	27.755	0.078	0.06	-0.053	-0.068	0.277
164	8722105	-80.36	27.67	0.617	0.516	-0.516	-0.573	0.348
165	8722125	-80.3717	27.6317	0.141	0.116	-0.112	-0.131	N/A
166	8722212	-80.2883	27.47	0.443	0.377	-0.404	-0.465	0.338
167	8722334	-80.3133	27.2433	0.175	0.143	-0.155	-0.192	0.274
168	8722357	-80.2583	27.2	0.161	0.128	-0.134	-0.168	0.25

169	8722371	-80.1883	27.175	0.17	0.138	-0.145	-0.183	0.308
170	8722381	-80.1717	27.155	0.197	0.162	-0.161	-0.202	0.276
171	8722404	-80.145	27.1133	0.222	0.187	-0.198	-0.238	0.276
172	8722414	-80.1367	27.0933	0.23	0.192	-0.204	-0.246	0.283
173	8722429	-80.1233	27.065	0.263	0.226	-0.231	-0.271	N/A
174	8722445	-80.1067	27.0367	0.297	0.254	-0.26	-0.302	0.29
175	8722478	-80.1133	26.975	0.339	0.291	-0.29	-0.337	0.294
176	8722481	-80.1267	26.97	0.34	0.295	-0.293	-0.34	0.295
177	8722487	-80.1017	26.9517	0.315	0.269	-0.267	-0.305	0.278
178	8722491	-80.08	26.9517	0.345	0.294	-0.299	-0.354	0.287
179	8722492	-80.09	26.9467	0.353	0.307	-0.292	-0.337	0.343
180	8722495	-80.0733	26.9433	0.415	0.363	-0.365	-0.423	N/A
181	8722557	-80.055	26.8267	0.482	0.422	-0.434	-0.49	0.314
182	8722607	-80.0417	26.7333	0.466	0.406	-0.414	-0.47	0.335
183	8722621	-80.045	26.705	0.456	0.399	-0.384	-0.431	0.309
184	8722654	-80.045	26.645	0.439	0.386	-0.365	-0.415	0.322
185	8722670	-80.0333	26.6117	0.457	0.414	-0.419	-0.46	0.279
186	8722706	-80.0533	26.5483	0.439	0.388	-0.365	-0.41	0.293
187	8722718	-80.0533	26.5267	0.446	0.398	-0.355	-0.403	N/A
188	8722746	-80.0617	26.4733	0.436	0.389	-0.364	-0.413	0.278
189	8722761	-80.065	26.4467	0.429	0.389	-0.353	-0.405	0.28
190	8722784	-80.07	26.4033	0.413	0.376	-0.34	-0.389	0.267
191	8722802	-80.07	26.37	0.389	0.351	-0.321	-0.37	0.268
192	8722816	-80.0767	26.3433	0.367	0.328	-0.339	-0.385	N/A
193	8722859	-80.085	26.26	0.409	0.37	-0.362	-0.407	0.275
194	8722861	-80.0817	26.2583	0.423	0.381	-0.378	-0.426	0.289
195	8722862	-80.08	26.2567	0.425	0.385	-0.382	-0.434	0.309
196	8722899	-80.0933	26.1883	0.427	0.39	-0.395	-0.446	0.255
197	8722939	-80.1083	26.1133	0.397	0.362	-0.362	-0.411	0.286
198	8722951	-80.1233	26.0917	0.419	0.384	-0.388	-0.437	0.267
199	8722956	-80.1167	26.0817	0.41	0.376	-0.38	-0.436	0.259
200	8722957	-80.1117	26.08	0.412	0.376	-0.377	-0.43	0.264
201	8722971	-80.1133	26.055	0.369	0.342	-0.332	-0.381	0.242
202	8722979	-80.115	26.04	0.343	0.312	-0.308	-0.355	N/A
203	8723044	-80.125	25.9417	0.331	0.31	-0.306	-0.349	0.227
204	8723050	-80.12	25.93	0.406	0.374	-0.384	-0.435	0.292
205	8723073	-80.125	25.9033	0.34	0.32	-0.293	-0.331	0.259
206	8723080	-80.12	25.9033	0.395	0.374	-0.381	-0.423	0.264
207	8723089	-80.1633	25.88	0.352	0.331	-0.325	-0.366	0.278
208	8723165	-80.185	25.7783	0.352	0.332	-0.331	-0.371	0.272
209	8723170	-80.1317	25.7683	0.395	0.37	-0.379	-0.428	0.293
210	8723178	-80.13	25.7633	0.366	0.353	-0.353	-0.396	N/A
211	8723214	-80.1617	25.7317	0.343	0.321	-0.305	-0.341	0.267
212	8723232	-80.17	25.6983	0.314	0.302	-0.299	-0.34	N/A
213	8723289	-80.305	25.615	0.315	0.297	-0.294	-0.334	0.258
214	8723350	-80.1717	25.5333	0.279	0.256	-0.247	-0.288	N/A
215	8723355	-80.175	25.5233	0.239	0.238	-0.228	-0.272	N/A
216	8723372	-80.1883	25.5067	0.254	0.234	-0.21	-0.244	N/A
217	8723391	-80.1883	25.48	0.252	0.232	-0.21	-0.242	N/A
218	8723393	-80.18	25.4767	0.36	0.347	-0.339	-0.41	N/A
219	8723409	-80.1967	25.4533	0.259	0.234	-0.216	-0.247	N/A
220	8723423	-80.33	25.4367	0.272	0.254	-0.238	-0.271	0.265
221	8723439	-80.21	25.415	0.258	0.233	-0.211	-0.242	N/A
222	8723453	-80.2333	25.3967	0.22	0.219	-0.233	-0.282	N/A
223	8723457	-80.23	25.3917	0.295	0.271	-0.285	-0.335	N/A
224	8723465	-80.29	25.3733	0.155	0.14	-0.131	-0.155	N/A
225	8723467	-80.2567	25.3783	0.225	0.202	-0.18	-0.209	N/A
226	8723506	-80.2933	25.325	0.117	0.115	-0.083	-0.111	N/A
227	8723518	-80.2983	25.31	0.133	0.122	-0.106	-0.13	0.252

228	8723519	-80.2767	25.3083	0.35	0.341	-0.358	-0.422	0.266
229	8723534	-80.37	25.2883	0.094	0.081	-0.081	-0.099	0.226
230	8723583	-80.2117	25.2217	0.372	0.35	-0.348	-0.404	N/A
231	8723693	-80.455	25.0767	0.33	0.3	-0.302	-0.342	0.246
232	8723746	-80.6183	25.005	0.09	0.066	-0.054	-0.062	N/A
233	8723747	-80.5167	25.005	0.34	0.305	-0.318	-0.376	0.262
234	8723752	-80.61	24.9967	0.107	0.081	-0.075	-0.079	N/A
235	8723769	-80.55	24.9733	0.361	0.32	-0.332	-0.391	0.27
236	8723786	-80.5867	24.9533	0.151	0.122	-0.122	-0.141	0.253
237	8723795	-80.6083	24.94	0.285	0.251	-0.217	-0.229	0.234
238	8723797	-80.61	24.9383	0.243	0.215	-0.191	-0.219	0.274
239	8723807	-80.6717	24.9233	0.129	0.093	-0.089	-0.093	N/A
240	8723808	-80.6317	24.925	0.102	0.077	-0.071	-0.086	0.229
241	8723812	-80.66	24.9133	0.175	0.145	-0.161	-0.177	N/A
242	8723814	-80.6317	24.915	0.335	0.294	-0.308	-0.361	0.255
243	8723824	-80.695	24.9033	0.135	0.103	-0.099	-0.105	N/A
244	8723851	-80.7033	24.8683	0.324	0.28	-0.294	-0.359	0.276
245	8723852	-80.7167	24.865	0.16	0.118	-0.112	-0.139	0.257
246	8723861	-80.6183	24.85	0.327	0.284	-0.292	-0.352	N/A
247	8723906	-80.8833	24.7917	0.194	0.138	-0.21	-0.252	N/A
248	8723912	-80.9067	24.7833	0.132	0.067	-0.075	-0.098	N/A
249	8723918	-80.9233	24.7767	0.111	0.072	-0.076	-0.133	0.255
250	8723921	-80.94	24.7717	0.203	0.152	-0.109	-0.185	0.237
251	8723927	-80.9133	24.765	0.26	0.201	-0.207	-0.247	0.274
252	8723933	-80.9583	24.755	0.304	0.244	-0.27	-0.324	0.274
253	8723949	-81.0167	24.7333	0.251	0.193	-0.147	-0.221	0.245
254	8723950	-81.03	24.73	0.253	0.192	-0.209	-0.266	0.304
255	8723962	-81.0167	24.7183	0.312	0.246	-0.26	-0.32	0.304
256	8723970	-81.105	24.7117	0.141	0.109	-0.109	-0.156	0.251
257	8723971	-81.105	24.7033	0.299	0.229	-0.24	-0.293	0.272
258	8723999	-81.1117	24.6267	0.317	0.241	-0.248	-0.308	N/A
259	8724008	-81.125	24.7067	0.177	0.105	-0.113	-0.145	0.304
260	8724032	-81.155	24.7033	0.239	0.162	-0.174	-0.213	0.281
261	8724033	-81.1567	24.705	0.155	0.076	-0.102	-0.143	0.251
262	8724062	-81.1917	24.6833	0.234	0.159	-0.165	-0.202	N/A
263	8724093	-81.2283	24.6817	0.202	0.131	-0.129	-0.176	0.279
264	8724094	-81.2267	24.775	0.214	0.154	-0.116	-0.208	N/A
265	8724098	-81.2367	24.745	0.171	0.113	-0.099	-0.189	N/A
266	8724099	-81.235	24.68	0.185	0.123	-0.165	-0.199	0.222
267	8724107	-81.2433	24.6733	0.224	0.152	-0.164	-0.204	0.269
268	8724112	-81.2517	24.67	0.234	0.163	-0.165	-0.21	0.303
269	8724129	-81.2717	24.78	0.281	0.216	-0.162	-0.237	N/A
270	8724138	-81.2817	24.655	0.242	0.17	-0.182	-0.228	0.284
271	8724139	-81.2833	24.7667	0.246	0.182	-0.142	-0.216	N/A
272	8724153	-81.3	24.7433	0.193	0.125	-0.135	-0.205	N/A
273	8724154	-81.3033	24.7133	0.157	0.074	-0.126	-0.181	N/A
274	8724168	-81.3183	24.6983	0.16	0.081	-0.127	-0.185	0.233
275	8724172	-81.3233	24.7667	0.341	0.276	-0.23	-0.329	N/A
276	8724177	-81.3283	24.75	0.288	0.221	-0.175	-0.263	N/A
277	8724178	-81.33	24.6483	0.232	0.155	-0.163	-0.194	0.248
278	8724189	-81.3417	24.74	0.222	0.15	-0.148	-0.222	N/A
279	8724192	-81.35	24.6517	0.259	0.178	-0.186	-0.223	N/A
280	8724193	-81.3483	24.6967	0.171	0.103	-0.138	-0.195	0.208
281	8724196	-81.3517	24.7183	0.195	0.119	-0.141	-0.213	N/A
282	8724199	-81.3583	24.7567	0.352	0.285	-0.233	-0.328	N/A
283	8724201	-81.3567	24.69	0.18	0.102	-0.136	-0.184	0.201
284	8724205	-81.3617	24.7333	0.256	0.188	-0.162	-0.24	N/A
285	8724209	-81.3683	24.7733	0.43	0.357	-0.329	-0.448	N/A
286	8724211	-81.3683	24.67	0.186	0.116	-0.125	-0.148	0.229

287	8724215	-81.375	24.6517	0.243	0.171	-0.169	-0.205	0.272
288	8724224	-81.3867	24.665	0.219	0.148	-0.146	-0.167	N/A
289	8724226	-81.3867	24.7283	0.217	0.162	-0.162	-0.241	N/A
290	8724227	-81.3833	24.69	0.155	0.09	-0.123	-0.15	0.219
291	8724229	-81.39	24.7583	0.388	0.318	-0.254	-0.346	N/A
292	8724231	-81.395	24.745	0.299	0.241	-0.158	-0.221	0.258
293	8724238	-81.4033	24.6233	0.276	0.2	-0.205	-0.252	N/A
294	8724239	-81.4033	24.65	0.272	0.194	-0.19	-0.224	N/A
295	8724246	-81.4117	24.7883	0.498	0.419	-0.379	-0.482	N/A
296	8724255	-81.4233	24.66	0.213	0.138	-0.14	-0.172	0.258
297	8724257	-81.4283	24.7583	0.391	0.337	-0.345	-0.441	N/A
298	8724264	-81.4333	24.705	0.175	0.093	-0.135	-0.185	0.204
299	8724266	-81.435	24.6517	0.245	0.17	-0.172	-0.221	0.239
300	8724273	-81.45	24.7467	0.419	0.339	-0.29	-0.362	N/A
301	8724276	-81.4467	24.65	0.263	0.173	-0.161	-0.201	0.247
302	8724292	-81.4683	24.6617	0.16	0.101	-0.135	-0.168	0.232
303	8724302	-81.4783	24.715	0.39	0.307	-0.229	-0.316	N/A
304	8724306	-81.485	24.6417	0.269	0.186	-0.178	-0.227	N/A
305	8724307	-81.4833	24.79	0.495	0.422	-0.429	-0.564	0.286
306	8724311	-81.4833	24.7417	0.398	0.308	-0.3	-0.388	N/A
307	8724313	-81.4917	24.66	0.261	0.18	-0.172	-0.221	0.239
308	8724327	-81.51	24.6283	0.265	0.183	-0.183	-0.227	N/A
309	8724328	-81.505	24.7	0.41	0.339	-0.302	-0.409	0.204
310	8724332	-81.515	24.6617	0.237	0.167	-0.133	-0.19	0.18
311	8724334	-81.5167	24.63	0.099	0.071	-0.067	-0.091	0.211
312	8724347	-81.5333	24.6717	0.297	0.214	-0.206	-0.257	N/A
313	8724353	-81.54	24.655	0.091	0.053	-0.05	-0.068	0.126
314	8724368	-81.555	24.6933	0.396	0.307	-0.235	-0.291	N/A
315	8724369	-81.5617	24.7583	0.429	0.347	-0.279	-0.315	N/A
316	8724373	-81.5617	24.7167	0.424	0.335	-0.302	-0.389	N/A
317	8724378	-81.57	24.6483	0.117	0.07	-0.055	-0.061	N/A
318	8724397	-81.5933	24.71	0.36	0.269	-0.206	-0.244	N/A
319	8724405	-81.6033	24.6233	0.191	0.111	-0.073	-0.087	0.133
320	8724409	-81.6083	24.6583	0.368	0.295	-0.234	-0.296	N/A
321	8724417	-81.6167	24.615	0.218	0.14	-0.086	-0.108	0.15
322	8724422	-81.6217	24.6	0.139	0.07	-0.084	-0.098	N/A
323	8724423	-81.6233	24.6117	0.191	0.109	-0.117	-0.197	0.095
324	8724427	-81.63	24.6667	0.289	0.207	-0.215	-0.262	N/A
325	8724436	-81.6383	24.5883	0.187	0.118	-0.123	-0.151	N/A
326	8724438	-81.645	24.6033	0.152	0.084	-0.123	-0.155	N/A
327	8724441	-81.645	24.6167	0.308	0.229	-0.187	-0.246	N/A
328	8724448	-81.6533	24.6467	0.287	0.2	-0.208	-0.273	N/A
329	8724463	-81.6733	24.6917	0.439	0.358	-0.33	-0.425	N/A
330	8724474	-81.685	24.6233	0.337	0.259	-0.22	-0.289	N/A
331	8724485	-81.6983	24.6033	0.295	0.214	-0.169	-0.221	N/A
332	8724489	-81.655	24.6017	0.315	0.223	-0.143	-0.166	0.188
333	8724493	-81.7083	24.575	0.181	0.105	-0.148	-0.2	0.238
334	8724503	-81.7217	24.5767	0.196	0.111	-0.101	-0.148	0.246
335	8724507	-81.725	24.6033	0.227	0.135	-0.135	-0.184	N/A
336	8724517	-81.7383	24.58	0.218	0.136	-0.144	-0.2	0.185
337	8724527	-81.75	24.57	0.207	0.122	-0.128	-0.181	0.214
338	8724529	-81.7517	24.565	0.206	0.119	-0.137	-0.182	0.238
339	8724542	-81.775	24.585	0.233	0.15	-0.158	-0.221	0.219
340	8724557	-81.7833	24.545	0.3	0.208	-0.222	-0.288	0.264
341	8724571	-81.795	24.5917	0.227	0.148	-0.159	-0.216	N/A
342	8724580	-81.8083	24.5533	0.279	0.191	-0.199	-0.272	0.266
343	8724635	-81.8783	24.4533	0.269	0.181	-0.196	-0.261	N/A
344	8724697	-82.8717	24.6267	0.268	0.171	-0.171	-0.266	N/A
345	8724698	-82.92	24.6317	0.257	0.171	-0.169	-0.252	N/A

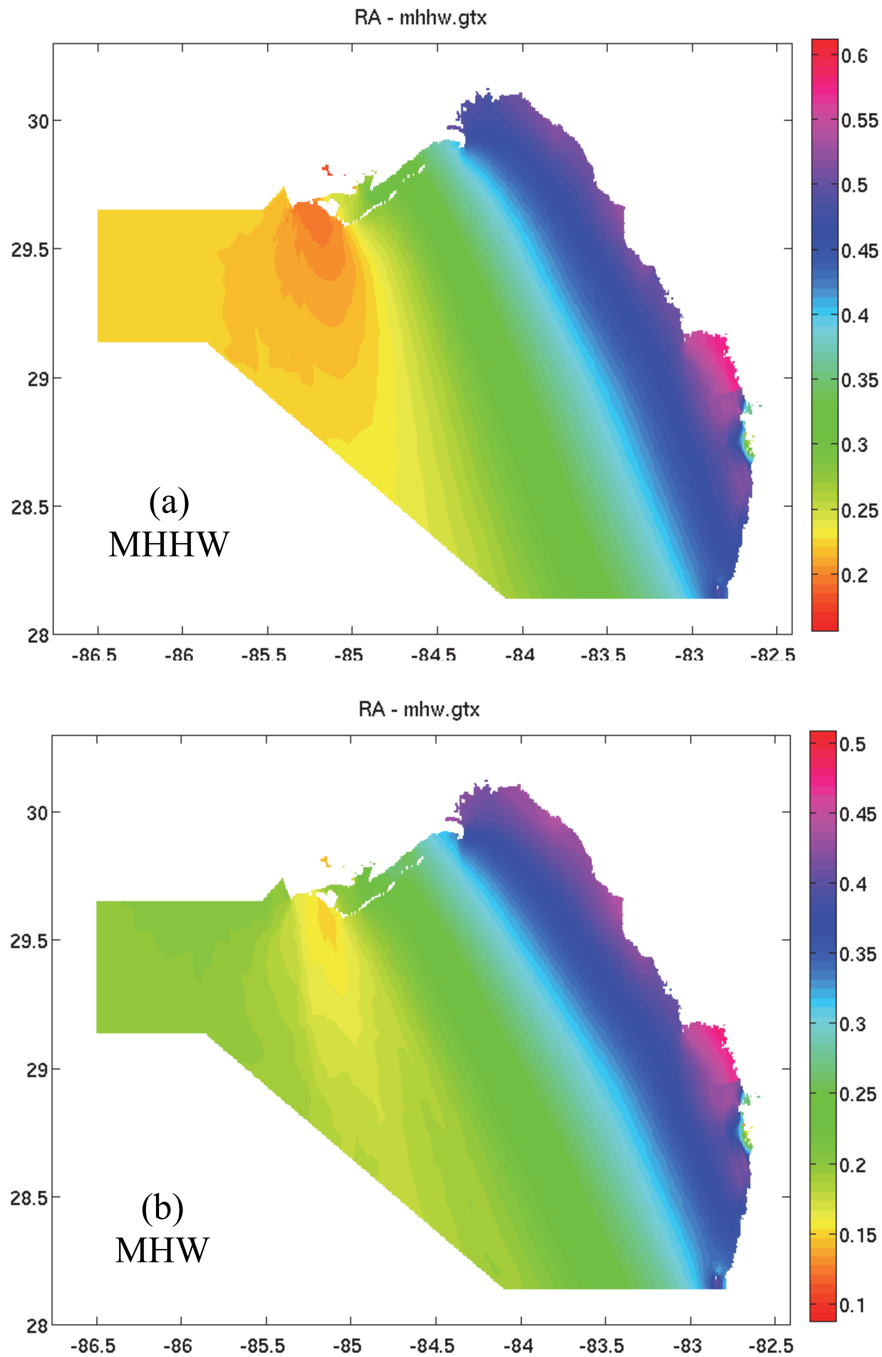
346	8724919	-81.3633	25.8133	0.497	0.413	-0.359	-0.471	0.207
347	8724932	-81.465	25.81	0.564	0.485	-0.512	-0.712	N/A
348	8724947	-81.675	25.8533	0.49	0.416	-0.376	-0.559	N/A
349	8724948	-81.3867	25.8583	0.437	0.364	-0.325	-0.427	0.205
350	8724951	-81.5383	25.8583	0.585	0.505	-0.505	-0.701	N/A
351	8724962	-81.4767	25.89	0.484	0.395	-0.34	-0.46	N/A
352	8724964	-81.6367	25.8967	0.518	0.44	-0.432	-0.622	N/A
353	8724967	-81.7283	25.9083	0.419	0.343	-0.332	-0.513	0.208
354	8724970	-81.5133	25.9033	0.435	0.357	-0.313	-0.418	N/A
355	8724971	-81.6867	25.9167	0.449	0.371	-0.358	-0.52	N/A
356	8724975	-81.5967	25.9317	0.488	0.401	-0.362	-0.497	N/A
357	8724979	-81.655	25.9333	0.47	0.392	-0.386	-0.551	0.189
358	8724991	-81.7283	25.9717	0.389	0.322	-0.302	-0.457	0.192
359	8724992	-81.665	25.9633	0.384	0.315	-0.341	-0.5	N/A
360	8724996	-81.7017	25.985	0.358	0.285	-0.299	-0.437	0.181
361	8725019	-81.7683	26.025	0.354	0.28	-0.298	-0.441	0.169
362	8725079	-81.785	26.0833	0.335	0.264	-0.302	-0.458	N/A
363	8725110	-81.8067	26.13	0.372	0.295	-0.318	-0.502	0.194
364	8725114	-81.7883	26.1367	0.362	0.287	-0.315	-0.478	0.152
365	8725171	-81.8133	26.2117	0.207	0.14	-0.116	-0.16	N/A
366	8725222	-81.825	26.2767	0.314	0.245	-0.24	-0.366	0.161
367	8725228	-81.8017	26.2817	0.302	0.229	-0.241	-0.361	0.149
368	8725235	-81.8183	26.29	0.303	0.233	-0.251	-0.385	0.147
369	8725319	-81.8433	26.4	0.337	0.256	-0.278	-0.419	0.115
370	8725331	-81.8983	26.4133	0.341	0.258	-0.276	-0.417	N/A
371	8725346	-81.8567	26.43	0.352	0.265	-0.266	-0.394	N/A
372	8725351	-81.9183	26.4383	0.344	0.261	-0.277	-0.426	0.217
373	8725362	-82.0817	26.4433	0.308	0.229	-0.248	-0.385	N/A
374	8725366	-81.9533	26.4567	0.35	0.27	-0.28	-0.444	0.221
375	8725368	-81.94	26.46	0.353	0.265	-0.287	-0.441	N/A
376	8725391	-82.0133	26.4883	0.302	0.227	-0.242	-0.387	N/A
377	8725488	-82.2183	26.605	0.296	0.235	-0.236	-0.319	N/A
378	8725520	-81.8717	26.6467	0.208	0.142	-0.146	-0.193	0.125
379	8725541	-82.1633	26.7067	0.245	0.2	-0.209	-0.281	0.214
380	8725577	-82.2583	26.72	0.211	0.14	-0.144	-0.264	N/A
381	8725649	-82.1833	26.7967	0.21	0.154	-0.155	-0.264	N/A
382	8725665	-82.285	26.8267	0.206	0.131	-0.145	-0.258	N/A
383	8725667	-82.265	26.8333	0.19	0.119	-0.13	-0.239	0.152
384	8725685	-82.3033	26.855	0.213	0.136	-0.142	-0.241	N/A
385	8725691	-82.3133	26.8717	0.214	0.137	-0.151	-0.268	N/A
386	8725744	-82.065	26.9283	0.272	0.193	-0.189	-0.326	0.176
387	8725745	-82.1367	26.93	0.287	0.191	-0.18	-0.307	N/A
388	8725747	-82.3533	26.9333	0.234	0.154	-0.151	-0.244	0.195
389	8725769	-82.21	26.9617	0.277	0.198	-0.198	-0.332	0.159
390	8725781	-81.96	26.98	0.316	0.218	-0.227	-0.352	0.12
391	8725782	-81.975	26.9783	0.291	0.205	-0.201	-0.333	N/A
392	8725791	-81.9933	26.9883	0.279	0.201	-0.201	-0.336	0.129
393	8725809	-82.41	27.0117	0.246	0.158	-0.163	-0.266	0.146
394	8725835	-81.9867	27.0433	0.297	0.208	-0.225	-0.361	0.116
395	8725837	-82.2933	27.045	0.268	0.187	-0.2	-0.312	0.108
396	8725858	-82.4533	27.0717	0.314	0.232	-0.244	-0.357	0.137
397	8725899	-82.47	27.1233	0.256	0.194	-0.204	-0.278	N/A
398	8725916	-82.4833	27.1533	0.278	0.186	-0.199	-0.282	0.123
399	8725943	-82.495	27.1783	0.244	0.166	-0.15	-0.274	N/A
400	8725985	-82.515	27.2217	0.255	0.179	-0.163	-0.285	0.139
401	8726045	-82.5417	27.2917	0.302	0.221	-0.228	-0.319	0.126
402	8726083	-82.545	27.3317	0.27	0.197	-0.183	-0.325	0.15
403	8726089	-82.59	27.34	0.307	0.193	-0.195	-0.323	0.133
404	8726159	-82.58	27.4083	0.279	0.194	-0.202	-0.363	0.152

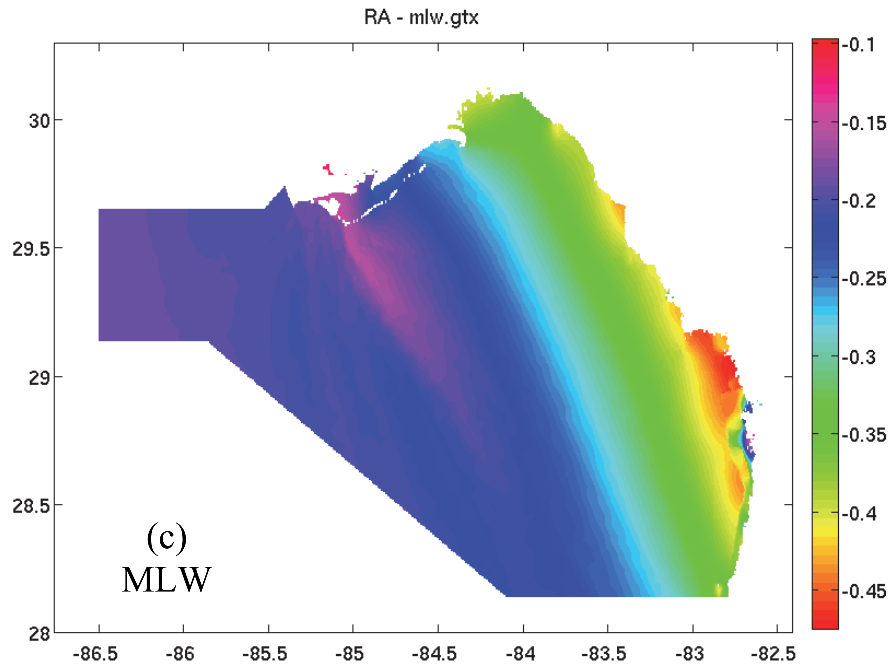
405	8726217	-82.6867	27.4667	0.304	0.215	-0.229	-0.333	0.145
406	8726232	-82.6867	27.4867	0.314	0.232	-0.235	-0.325	N/A
407	8726233	-82.645	27.485	0.315	0.236	-0.258	-0.355	0.101
408	8726247	-82.5733	27.5	0.32	0.24	-0.262	-0.364	N/A
409	8726249	-82.6483	27.5033	0.325	0.244	-0.251	-0.344	0.105
410	8726254	-82.6683	27.4983	0.317	0.228	-0.238	-0.323	N/A
411	8726273	-82.65	27.5233	0.311	0.226	-0.24	-0.349	0.144
412	8726278	-82.4817	27.5267	0.325	0.252	-0.268	-0.371	0.078
413	8726282	-82.73	27.5333	0.305	0.227	-0.243	-0.355	0.139
414	8726347	-82.76	27.6017	0.302	0.225	-0.239	-0.355	0.131
415	8726353	-82.5533	27.6017	0.321	0.234	-0.255	-0.362	0.761
416	8726364	-82.7267	27.615	0.296	0.218	-0.232	-0.338	0.126
417	8726384	-82.5633	27.6367	0.312	0.23	-0.245	-0.356	0.119
418	8726428	-82.7183	27.6883	0.312	0.23	-0.243	-0.347	0.126
419	8726520	-82.6267	27.76	0.322	0.236	-0.249	-0.366	N/A
420	8726533	-82.7817	27.785	0.331	0.223	-0.217	-0.353	0.083
421	8726537	-82.4267	27.7867	0.346	0.257	-0.268	-0.404	0.106
422	8726573	-82.485	27.8217	0.335	0.259	-0.295	-0.415	0.078
423	8726574	-82.795	27.8083	0.34	0.252	-0.26	-0.396	0.102
424	8726601	-82.8517	27.8733	0.37	0.252	-0.252	-0.406	N/A
425	8726604	-82.48	27.855	0.35	0.284	-0.32	-0.436	0.056
426	8726607	-82.5533	27.8583	0.362	0.267	-0.259	-0.395	N/A
427	8726632	-82.3967	27.8817	0.334	0.273	-0.246	-0.306	0.034
428	8726639	-82.48	27.89	0.384	0.291	-0.313	-0.446	0.092
429	8726641	-82.5383	27.8933	0.369	0.268	-0.265	-0.409	0.086
430	8726651	-82.4267	27.8983	0.369	0.264	-0.288	-0.425	0.081
431	8726657	-82.4517	27.9083	0.369	0.268	-0.288	-0.431	0.092
432	8726667	-82.425	27.9133	0.377	0.278	-0.297	-0.444	0.027
433	8726668	-82.445	27.9183	0.376	0.293	-0.309	-0.442	0.062
434	8726685	-82.4317	27.9383	0.38	0.297	-0.316	-0.442	0.077
435	8726689	-82.72	27.9417	0.402	0.297	-0.296	-0.453	0.085
436	8726693	-82.4617	27.9467	0.371	0.295	-0.3	-0.401	0.048
437	8726696	-82.4017	27.9467	0.383	0.312	-0.31	-0.443	N/A
438	8726699	-82.385	27.9483	0.406	0.295	-0.311	-0.465	-0.212
439	8726706	-82.8067	27.955	0.391	0.285	-0.291	-0.445	0.09
440	8726724	-82.8317	27.9783	0.383	0.279	-0.291	-0.451	0.094
441	8726738	-82.685	27.9883	0.398	0.292	-0.291	-0.452	0.085
442	8726761	-82.7933	28.0133	0.401	0.295	-0.318	-0.475	0.058
443	8726774	-82.82	28.0317	0.412	0.305	-0.311	-0.468	N/A
444	8726808	-82.81	28.0583	0.398	0.292	-0.315	-0.474	N/A
445	8726809	-82.8133	28.0617	0.409	0.302	-0.326	-0.489	0.057
446	8726819	-82.7817	28.07	0.425	0.321	-0.333	-0.497	0.089
447	8726833	-82.7717	28.085	0.435	0.321	-0.327	-0.493	0.1
448	8726853	-82.7783	28.1033	0.425	0.319	-0.337	-0.505	0.078
449	8726904	-82.8017	28.1533	0.431	0.32	-0.326	-0.493	0.077
450	8726917	-82.8433	28.165	0.49	0.404	-0.404	-0.52	N/A
451	8726924	-82.785	28.1717	0.43	0.32	-0.338	-0.506	0.1
452	8726942	-82.84	28.21	0.431	0.322	-0.344	-0.505	N/A
453	8726976	-82.78	28.2017	0.444	0.331	-0.335	-0.49	0.098
454	8726978	-82.7833	28.205	0.446	0.333	-0.357	-0.522	0.118
455	8726988	-82.7533	28.23	0.483	0.356	-0.374	-0.541	0.119
456	8727061	-82.71	28.3617	0.473	0.364	-0.392	-0.546	0.124
457	8727086	-82.6767	28.4133	0.418	0.308	-0.244	-0.3	0.063
458	8727097	-82.6683	28.4333	0.511	0.395	-0.339	-0.456	N/A
459	8727151	-82.65	28.5333	0.483	0.366	-0.343	-0.48	0.081
460	8727235	-82.6383	28.6917	0.39	0.288	-0.259	-0.333	N/A
461	8727274	-82.6383	28.7617	0.231	0.16	-0.133	-0.181	0.01
462	8727277	-82.695	28.7717	0.332	0.234	-0.181	-0.252	N/A
463	8727328	-82.6667	28.8633	0.36	0.259	-0.201	-0.256	0.02

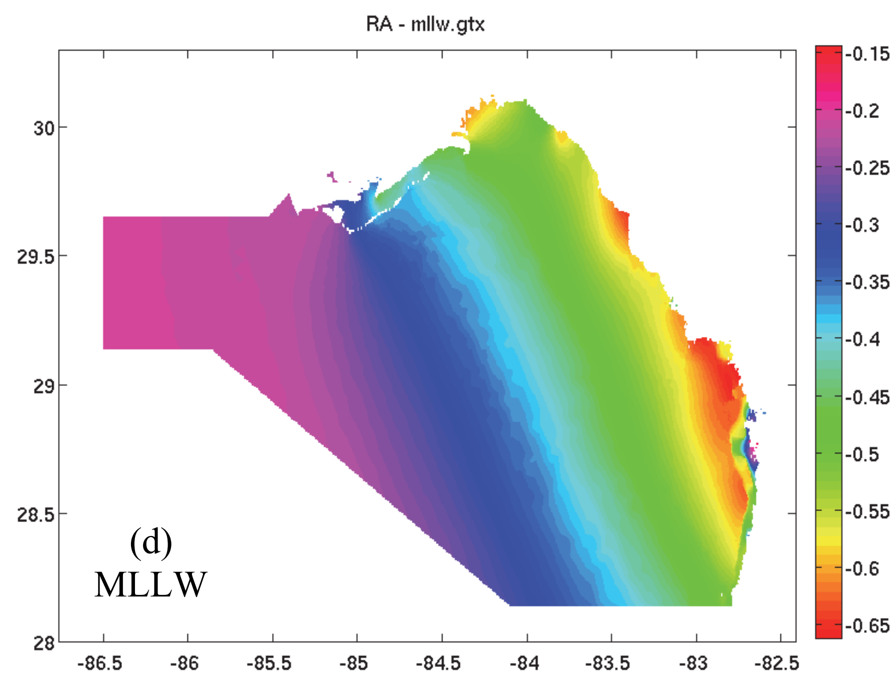
464	8727333	-82.7233	28.87	0.542	0.435	-0.424	-0.57	N/A
465	8727336	-82.635	28.8817	0.348	0.266	-0.248	-0.313	0.06
466	8727343	-82.5983	28.8983	0.356	0.272	-0.276	-0.356	0.003
467	8727348	-82.6383	28.905	0.396	0.296	-0.284	-0.377	0.027
468	8727359	-82.6917	28.9233	0.463	0.371	-0.348	-0.461	N/A
469	8727395	-82.7583	29.0017	0.586	0.474	-0.468	-0.648	0.132
470	8727411	-82.7133	29.03	0.562	0.459	-0.468	-0.633	0.044
471	8727471	-82.8083	29.165	0.566	0.465	-0.423	-0.569	N/A
472	8727520	-83.0317	29.135	0.537	0.434	-0.428	-0.621	0.066
473	8727577	-83.1517	29.3283	0.509	0.415	-0.391	-0.548	0.021
474	8727604	-83.2067	29.3983	0.494	0.409	-0.404	-0.565	0.036
475	8727648	-83.2933	29.4367	0.514	0.424	-0.397	-0.577	0.046
476	8727695	-83.39	29.6717	0.526	0.442	-0.432	-0.64	0.024
477	8727843	-83.6717	29.92	0.507	0.428	-0.388	-0.546	-0.028
478	8727892	-83.7833	29.98	0.519	0.441	-0.404	-0.588	N/A
479	8727956	-83.91	30.0533	0.507	0.43	-0.327	-0.465	-0.075
480	8728130	-84.1783	30.0783	0.479	0.407	-0.396	-0.584	-0.022
481	8728229	-84.29	30.06	0.49	0.417	-0.39	-0.595	-0.006
482	8728255	-84.365	29.9117	0.404	0.334	-0.305	-0.486	0.037
483	8728258	-84.3683	30.015	0.488	0.42	-0.392	-0.608	0.002
484	8728261	-84.3883	29.895	0.392	0.325	-0.276	-0.454	0.003
485	8728288	-84.4133	29.9033	0.398	0.325	-0.266	-0.452	0.015
486	8728311	-84.4467	29.9283	0.377	0.313	-0.282	-0.46	0.034
487	8728360	-84.5117	29.915	0.371	0.307	-0.278	-0.463	0.043
488	8728408	-84.585	29.81	0.327	0.271	-0.249	-0.419	0.057
489	8728412	-84.595	29.8783	0.345	0.285	-0.267	-0.452	0.049
490	8728464	-84.665	29.85	0.312	0.255	-0.23	-0.402	0.012
491	8728486	-84.7	29.7667	0.304	0.261	-0.215	-0.366	0.017
492	8728488	-84.7367	29.8017	0.324	0.267	-0.239	-0.425	N/A
493	8728619	-84.8867	29.7233	0.34	0.247	-0.237	-0.462	0.05
494	8728626	-84.8967	29.6533	0.281	0.225	-0.227	-0.381	N/A
495	8728669	-84.9583	29.6133	0.257	0.188	-0.184	-0.343	0.067
496	8728690	-84.9817	29.7267	0.215	0.183	-0.155	-0.277	-0.045
497	8728694	-84.8983	29.785	0.26	0.216	-0.171	-0.341	N/A
498	8728711	-85.0333	29.7633	0.18	0.155	-0.138	-0.232	-0.105
499	8728757	-85.085	29.77	0.156	0.122	-0.096	-0.213	-0.056
500	8728786	-85.1533	29.7067	0.235	0.194	-0.148	-0.274	0.006
501	8728912	-85.3133	29.815	0.254	0.163	-0.188	-0.25	N/A
502	8728942	-85.36	29.6683	0.211	0.195	-0.198	-0.227	0.006
503	8728949	-85.3633	29.69	0.269	0.183	-0.207	-0.253	-0.114
504	8728958	-85.39	29.8733	0.242	0.149	-0.205	-0.232	0.007
505	8728995	-85.425	29.9483	0.262	0.231	-0.217	-0.25	N/A
506	8729149	-85.7433	30.13	0.237	0.213	-0.223	-0.229	-0.043
507	8729189	-85.8333	30.1867	0.225	0.206	-0.185	-0.196	N/A
508	8729210	-85.8783	30.2133	0.219	0.193	-0.179	-0.199	N/A
509	8666433	-80.2933	32.6683	0.952	0.833	-1.105	-1.165	0.033
510	8665763	-80.165	32.7467	0.886	0.784	-1.158	-1.226	-0.02
511	8666101	-80.1567	32.7067	0.928	0.821	-1.266	-1.332	-0.007
512	8666799	-80.3417	32.6367	0.936	0.83	-1.049	-1.113	0.005
513	8666918	-80.1667	32.625	0.91	0.801	-1.005	-1.069	0.054
514	8667062	-80.1317	32.6033	0.938	0.819	-0.887	-0.939	0.059
515	8667425	-80.34	32.54	0.954	0.842	-1.013	-1.078	0.035
516	8662953	-79.25	33.415	0.563	0.496	-0.553	-0.596	0

APPENDIX C. TIDAL DATUM FIELDS DEFINED ON VDATUM MARINE GRID

Figure C.1. Tidal datums on the VDatum marine grid in Region A (Table 3), (a) MHHW, (b) MHW, (c) MLW, (d) MLLW, (e) MTL, and (f) DTL.




RA - mlw.gtx
(c)
MLW
30
29.5
29
28.5
28
-86.5
-86
-85.5
-85
-84.5
-84
-83.5
-83
-82.5
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.4
-0.45


RA - mllw.gtx
(d)
MLLW
30
29.5
29
28.5
28
-86.5
-86
-85.5
-85
-84.5
-84
-83.5
-83
-82.5
-0.15
-0.2
-0.25
-0.3
-0.35
-0.4
-0.45
-0.5
-0.55
-0.6
-0.65

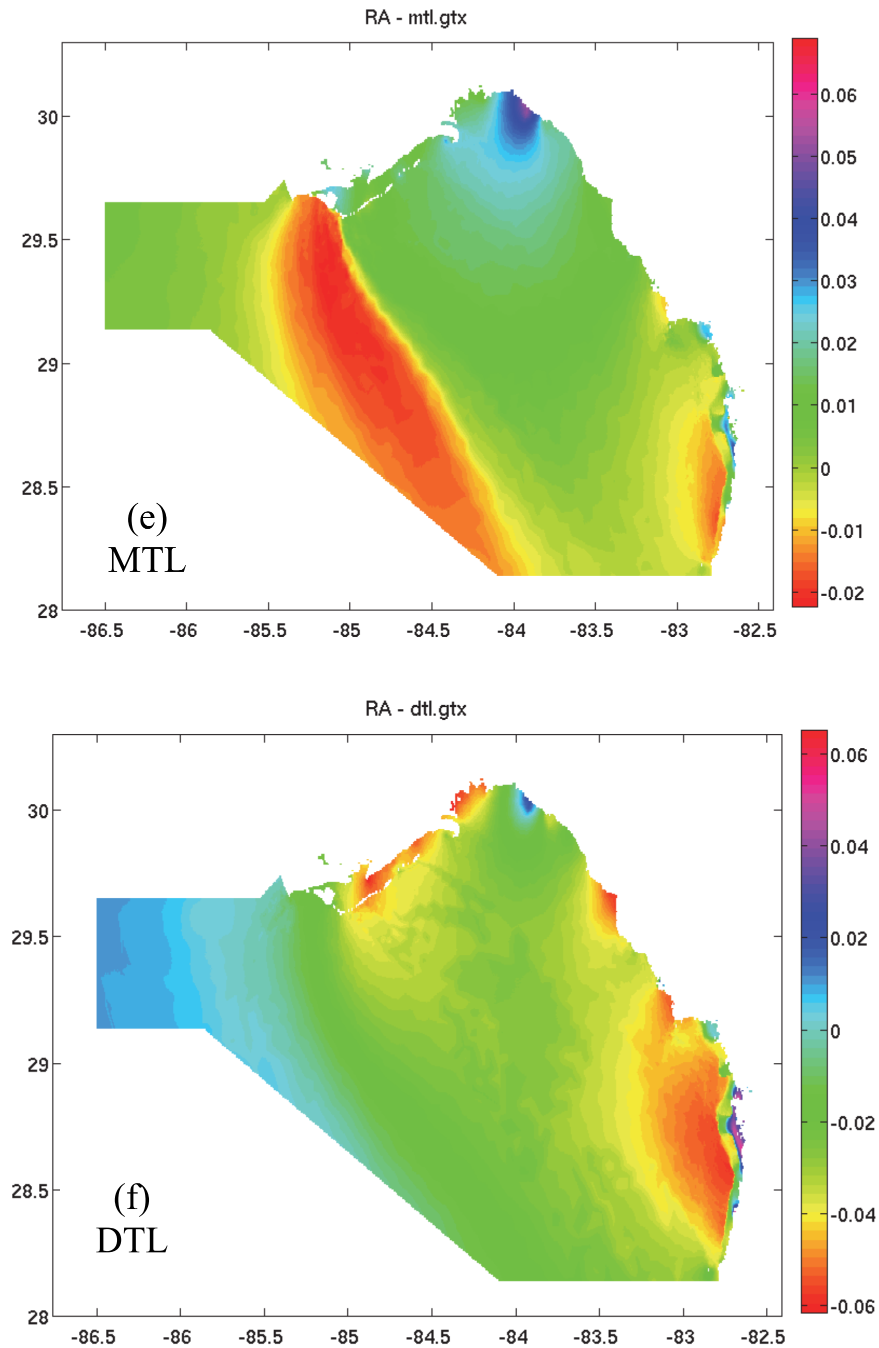
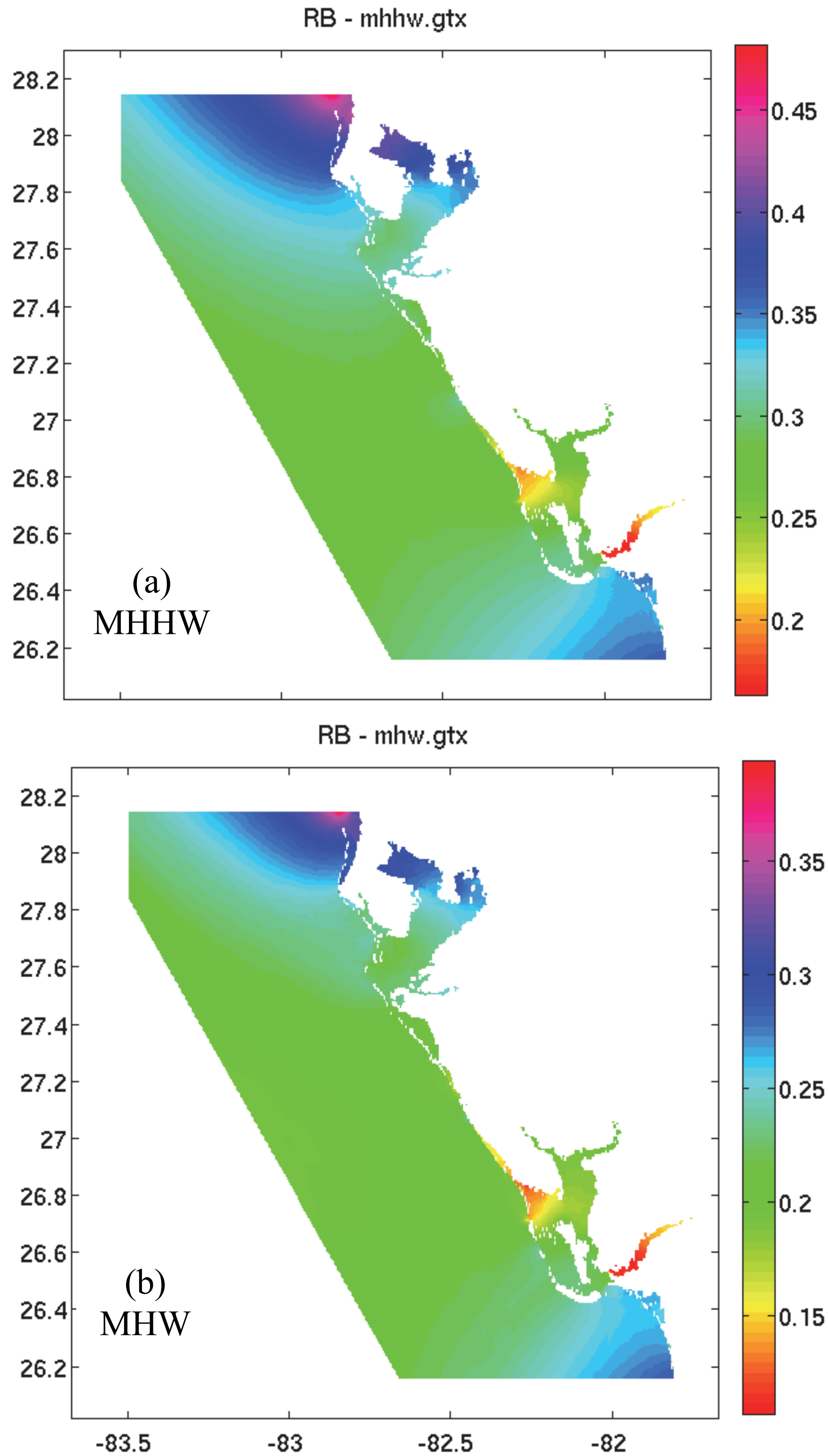
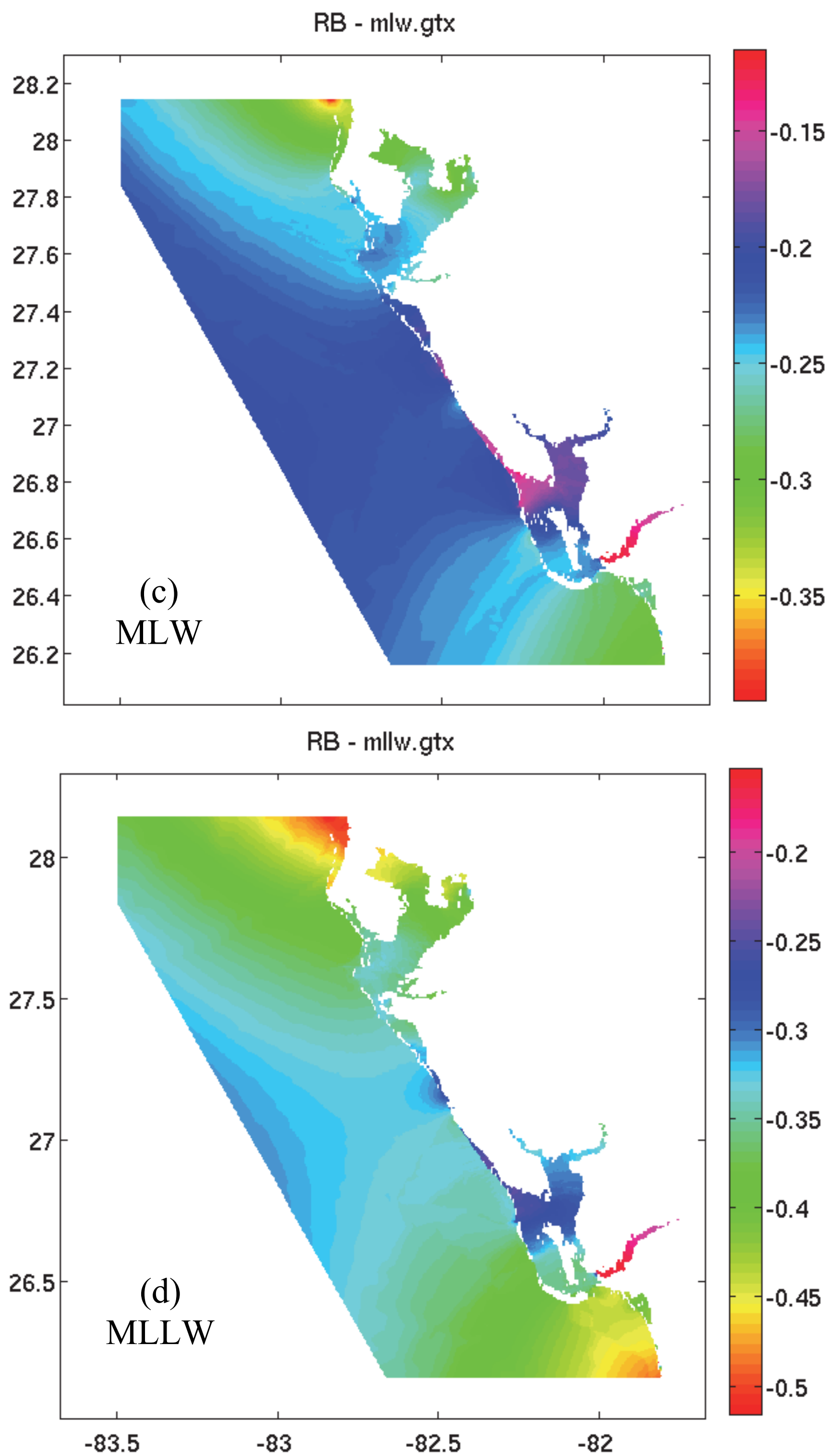
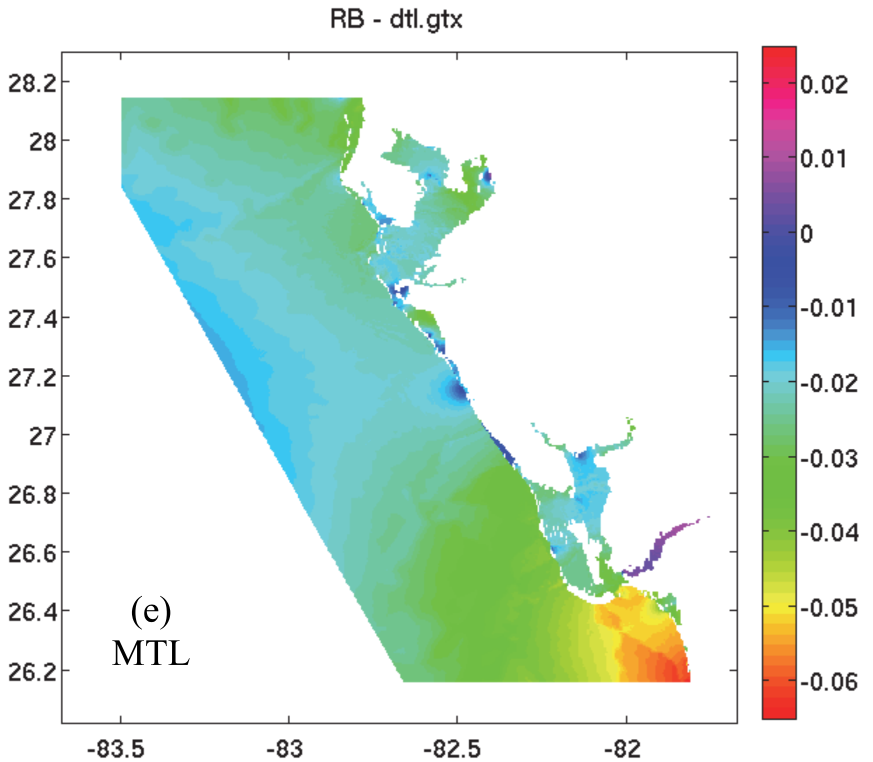

RA - mtl.gtx
30
29.5
29
28.5
28
-86.5
-86
-85.5
-85
-84.5
-84
-83.5
-83
-82.5
0.06
0.05
0.04
0.03
0.02
0.01
0
-0.01
-0.02
(e)
MTL
RA - dtl.gtx
30
29.5
29
28.5
28
-86.5
-86
-85.5
-85
-84.5
-84
-83.5
-83
-82.5
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
(f)
DTL

Figure C.2. Tidal datums on the VDatum marine grid in Region B (Table 3), (a) MHHW, (b) MHW, (c) MLW, (d) MLLW, (e) MTL, and (f) DTL.




RB - mlw.gtx
28.2
28
27.8
27.6
27.4
27.2
27
26.8
26.6
26.4
26.2
-0.15
-0.2
-0.25
-0.3
-0.35
(c)
MLW
RB - mllw.gtx
28
27.5
27
26.5
-0.2
-0.25
-0.3
-0.35
-0.4
-0.45
-0.5
(d)
MLLW
-83.5
-83
-82.5
-82


RB - dtl.gtx
28.2
28
27.8
27.6
27.4
27.2
27
26.8
26.6
26.4
26.2
-83.5
-83
-82.5
-82
0.02
0.01
0
-0.01
-0.02
-0.03
-0.04
-0.05
-0.06
(e)
MTL

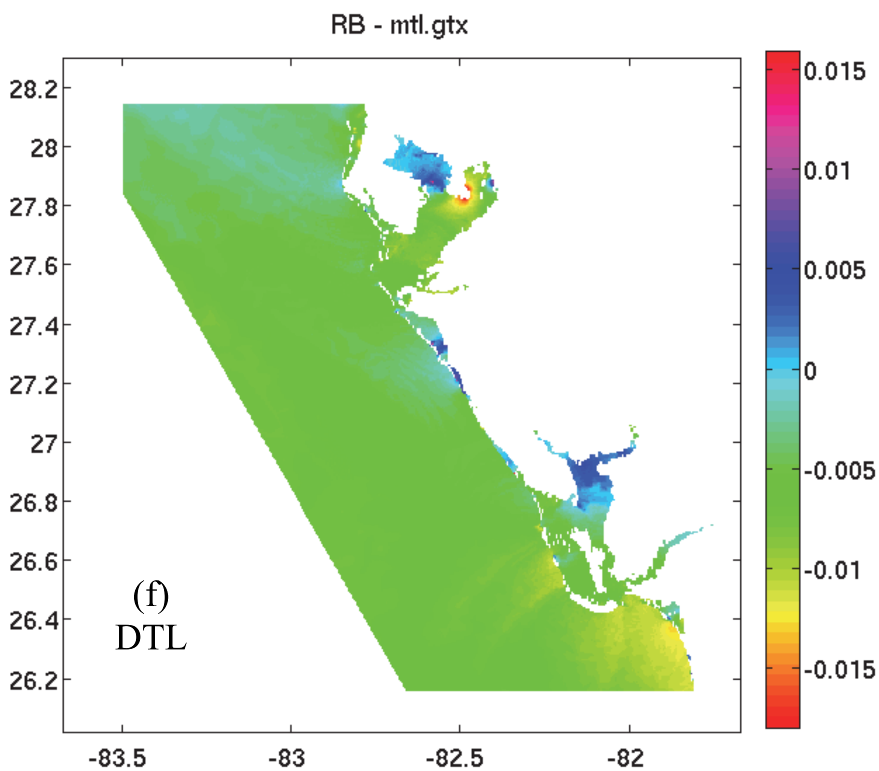
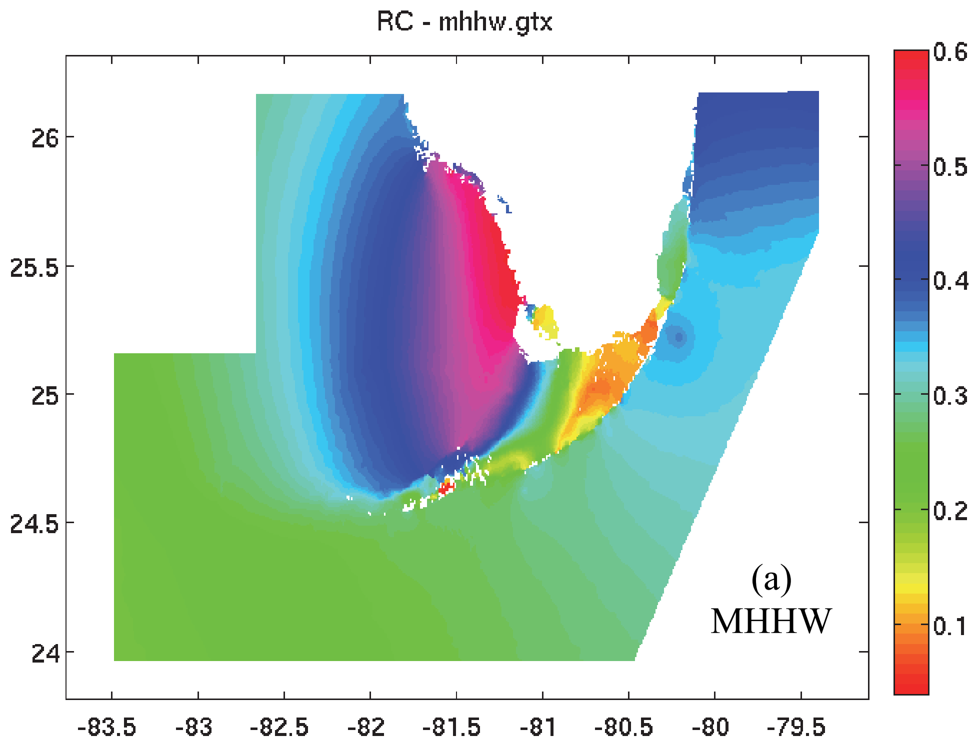
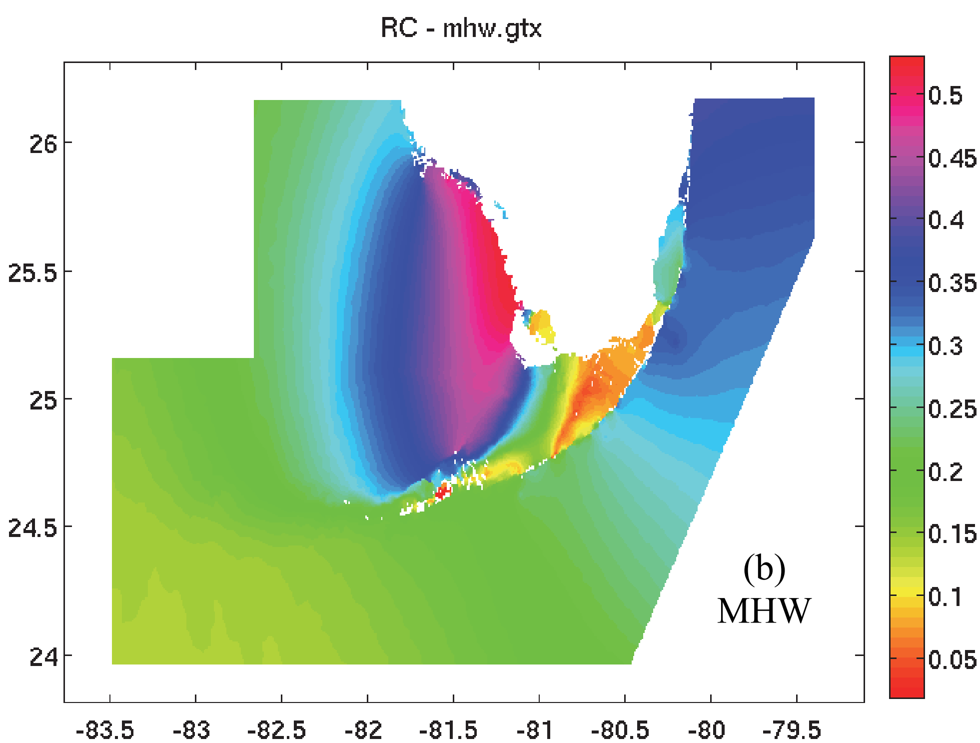
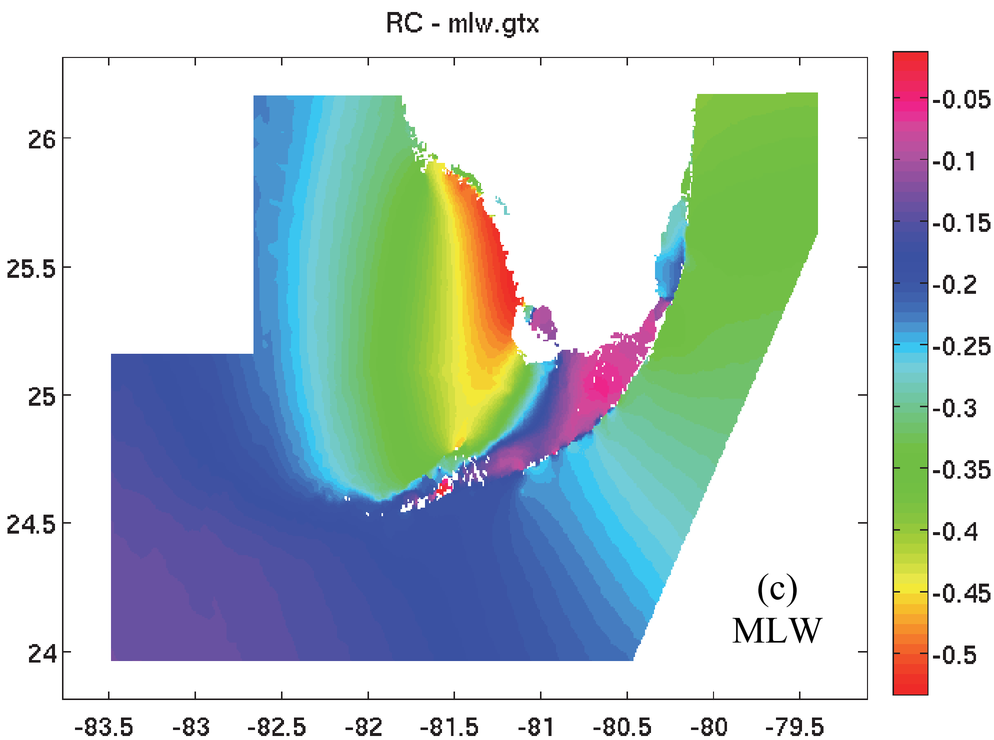
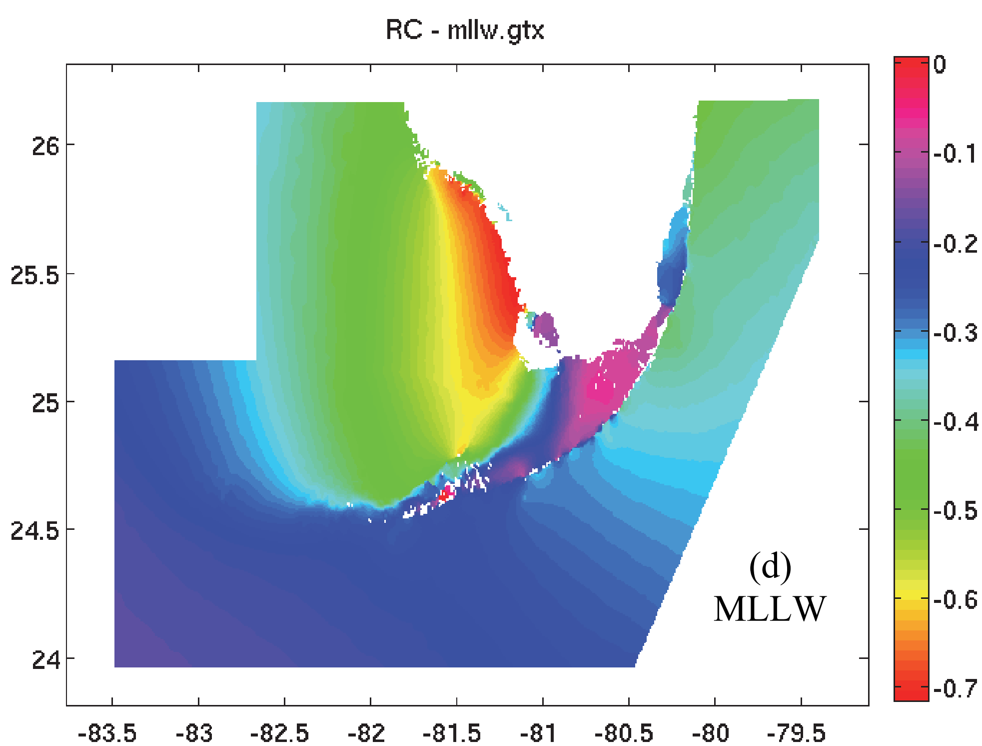

RB - mtl.gtx
28.2
28
27.8
27.6
27.4
27.2
27
26.8
26.6
26.4
26.2
-83.5
-83
-82.5
-82
0.015
0.01
0.005
0
-0.005
-0.01
-0.015
(f)
DTL

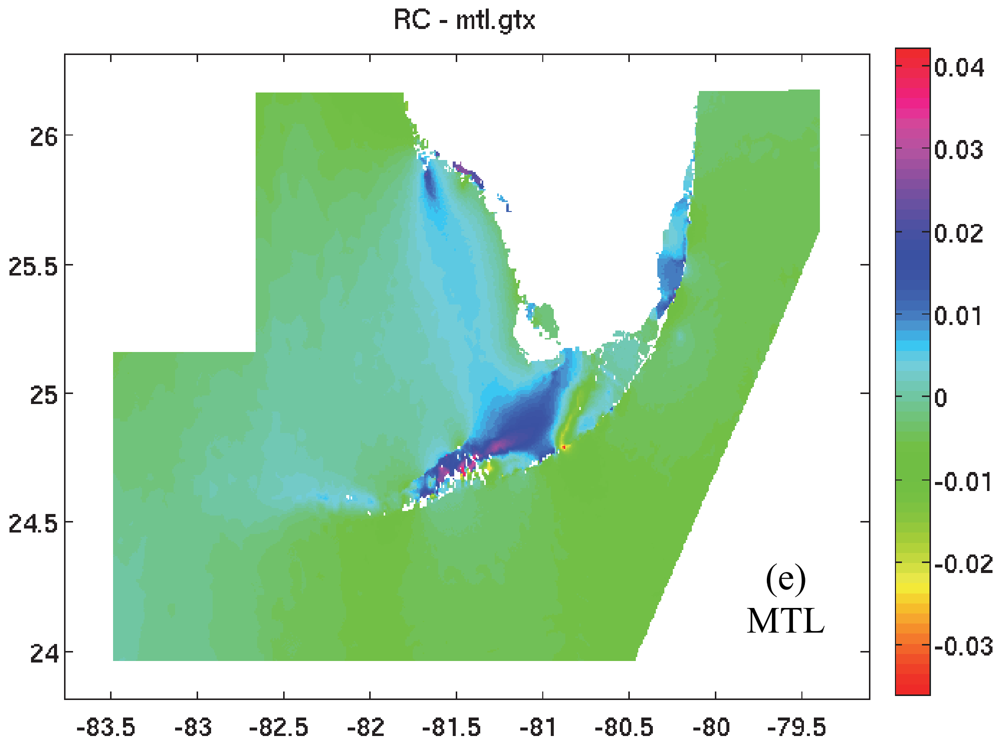
Figure C.3. Tidal datums on the VDatum marine grid in Region C (Table 3), (a) MHHW, (b) MHW, (c) MLW, (d) MLLW, (e) MTL, and (f) DTL.






RC - mlw.gtx
26
25.5
25
24.5
24
-83.5
-83
-82.5
-82
-81.5
-81
-80.5
-80
-79.5
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.4
-0.45
-0.5
(c)
MLW


RC - mllw.gtx
26
25.5
25
24.5
24
-83.5
-83
-82.5
-82
-81.5
-81
-80.5
-80
-79.5
0
-0.1
-0.2
-0.3
-0.4
-0.5
-0.6
-0.7
(d)
MLLW


RC - mtl.gtx
26
25.5
25
24.5
24
-83.5
-83
-82.5
-82
-81.5
-81
-80.5
-80
-79.5
0.04
0.03
0.02
0.01
0
-0.01
-0.02
-0.03
(e)
MTL

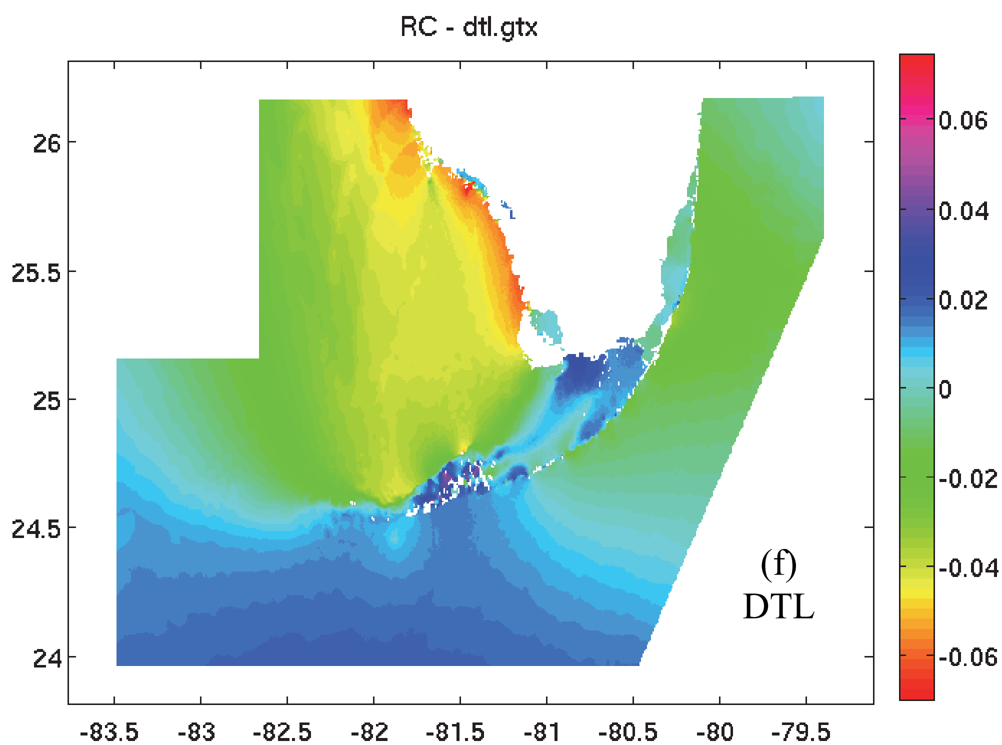
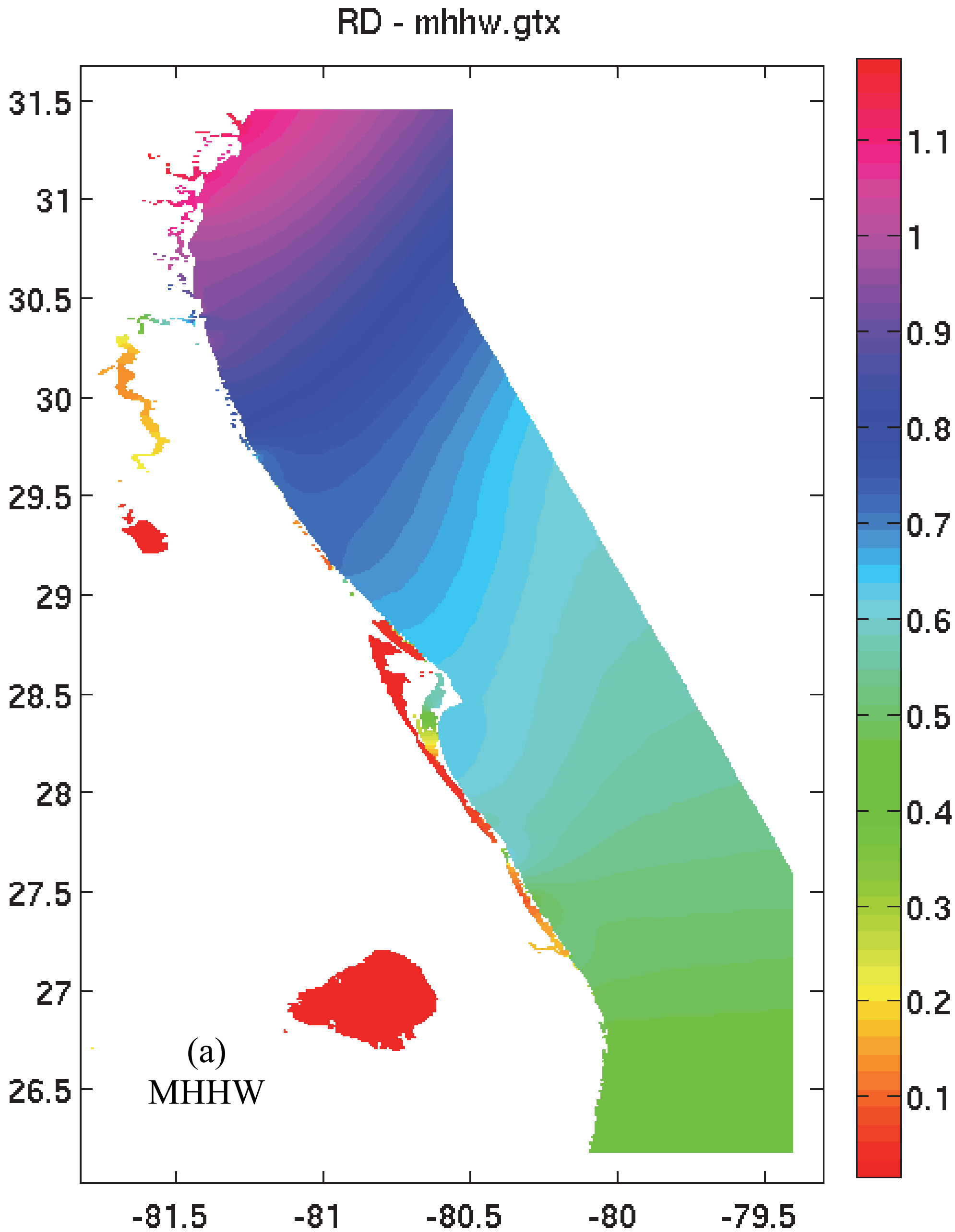
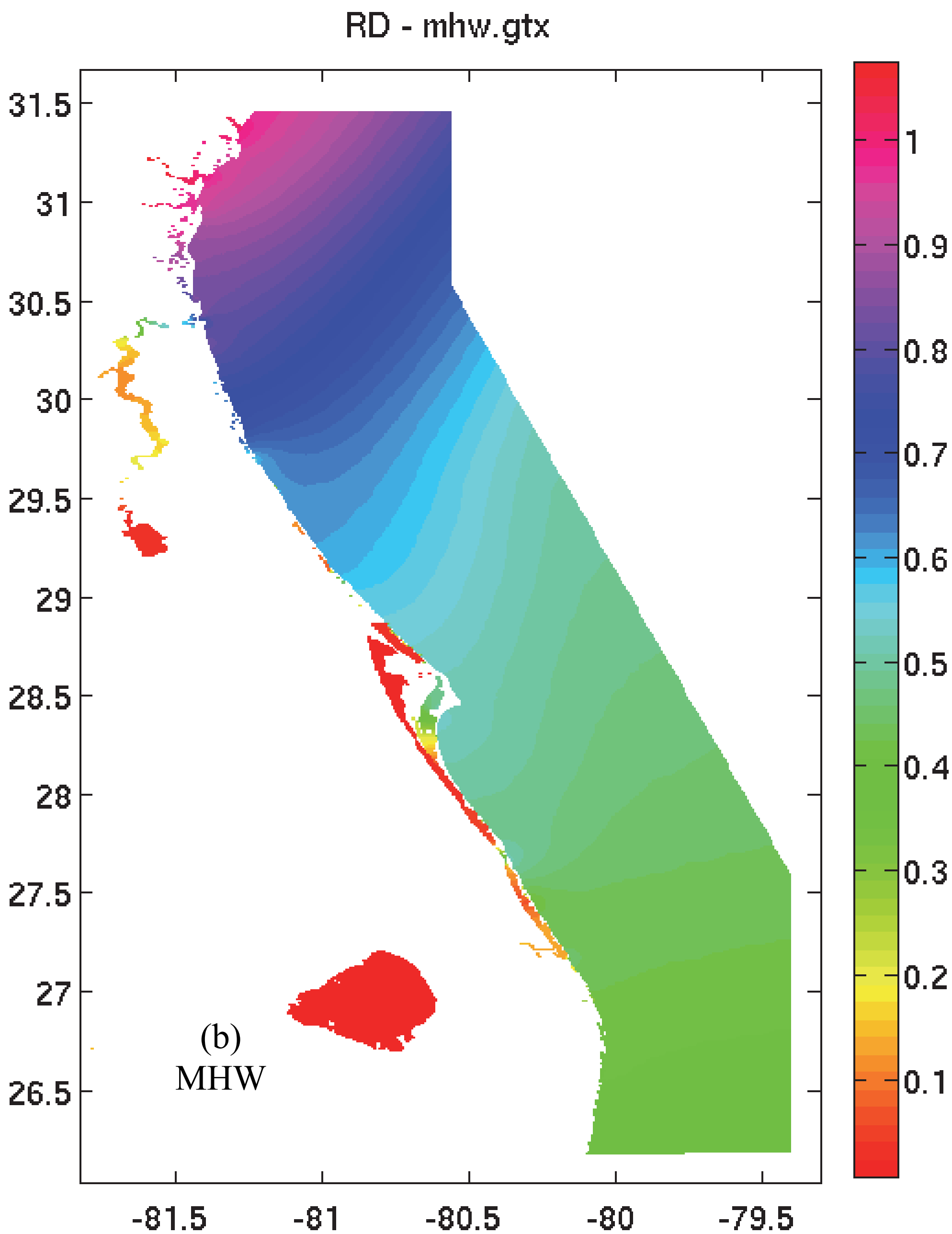
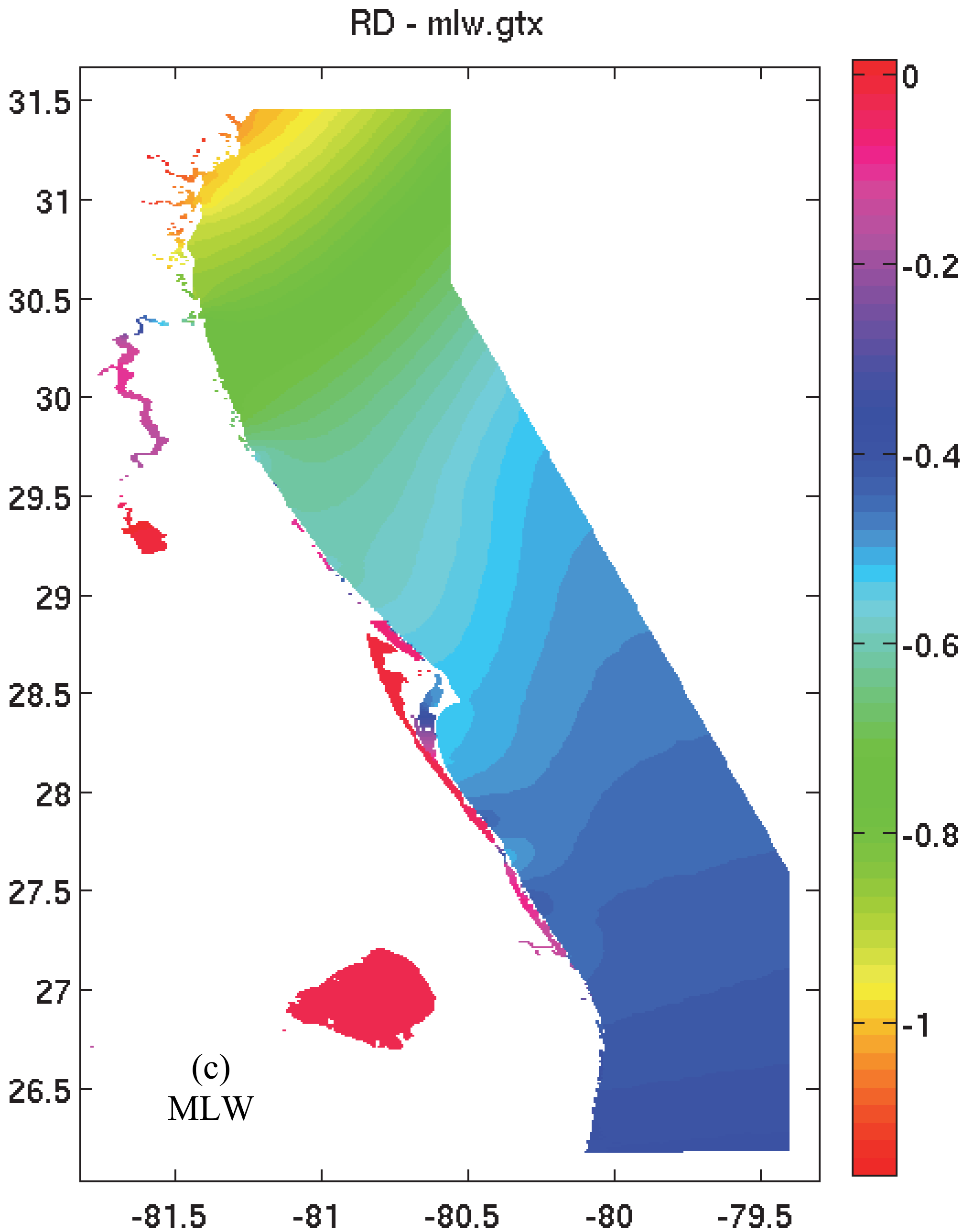
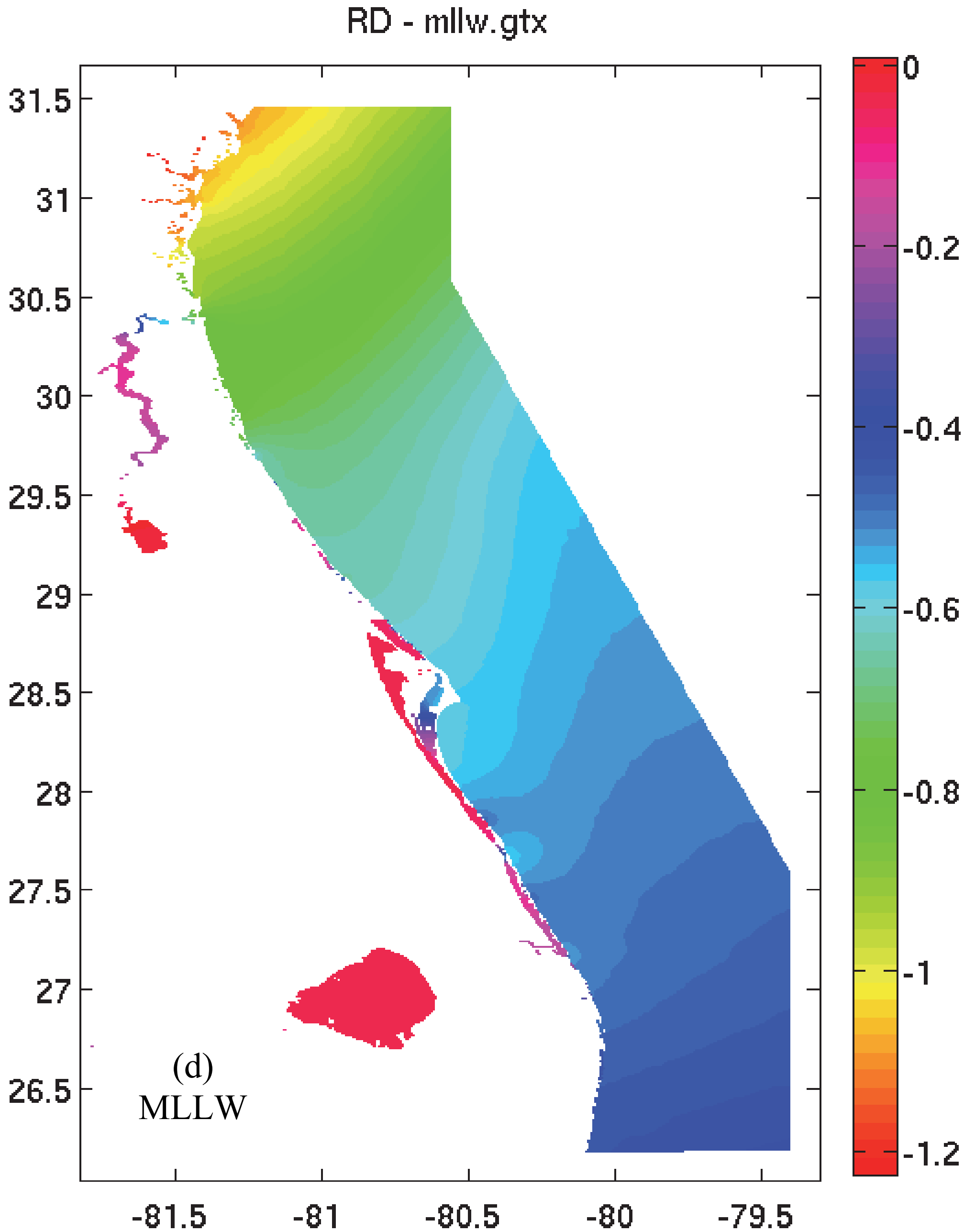

RC - dtl.gtx
26
25.5
25
24.5
24
-83.5
-83
-82.5
-82
-81.5
-81
-80.5
-80
-79.5
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
(f)
DTL

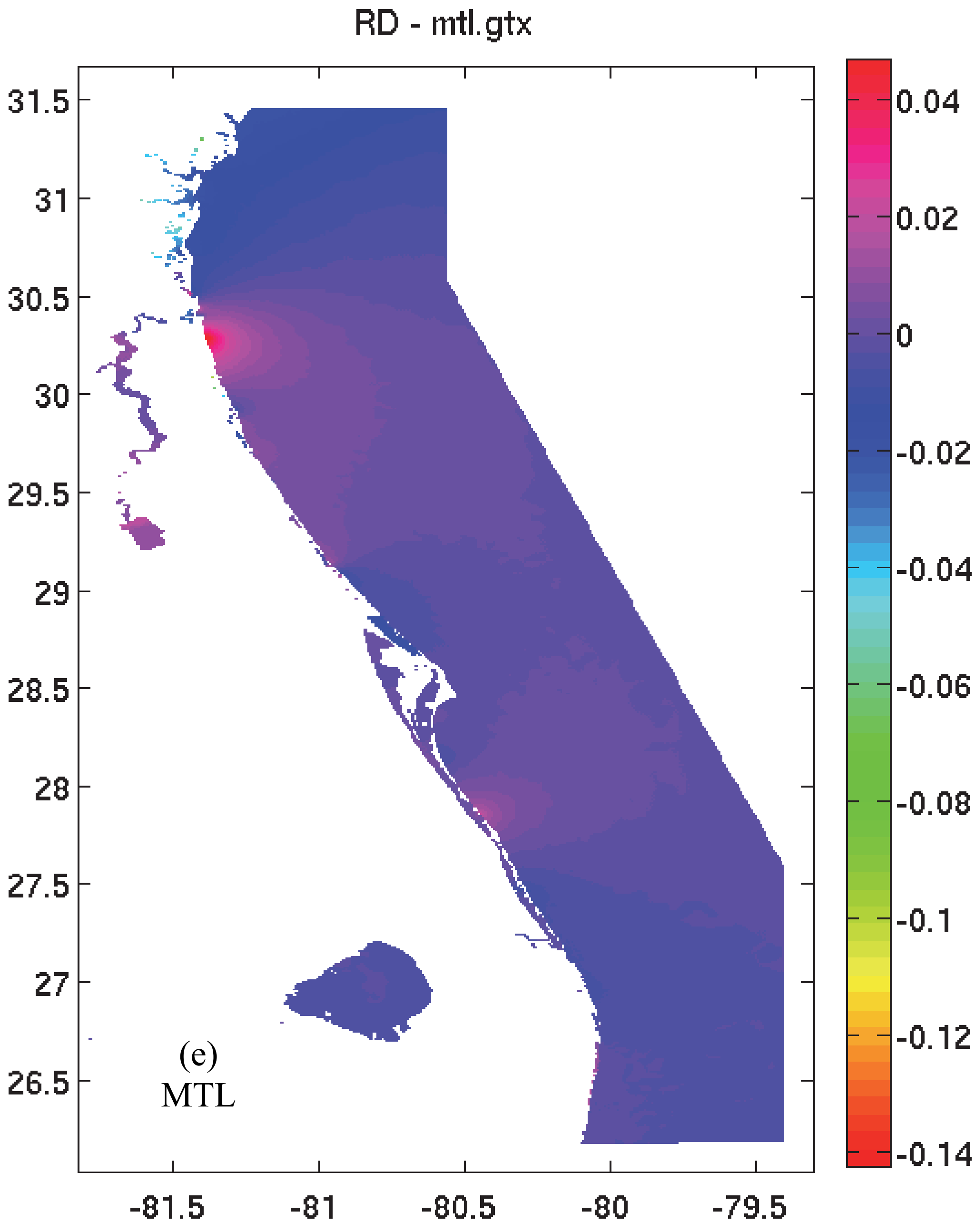
Figure C.4. Tidal datums on the VDatum marine grid in Region D (Table 3), (a) MHHW, (b) MHW, (c) MLW, (d) MLLW, (e) MTL, and (f) DTL.




RD - mhw.gtx
31.5
31
30.5
30
29.5
29
28.5
28
27.5
27
26.5
-81.5
-81
-80.5
-80
-79.5
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
(b)
MHW


RD - mlw.gtx
31.5
31
30.5
30
29.5
29
28.5
28
27.5
27
26.5
-81.5
-81
-80.5
-80
-79.5
0
-0.2
-0.4
-0.6
-0.8
-1
(c)
MLW


RD - mllw.gtx
31.5
31
30.5
30
29.5
29
28.5
28
27.5
27
26.5
-81.5
-81
-80.5
-80
-79.5
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
(d)
MLLW


RD - mtl.gtx
31.5
31
30.5
30
29.5
29
28.5
28
27.5
27
26.5
-81.5
-81
-80.5
-80
-79.5
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
-0.14
(e)
MTL

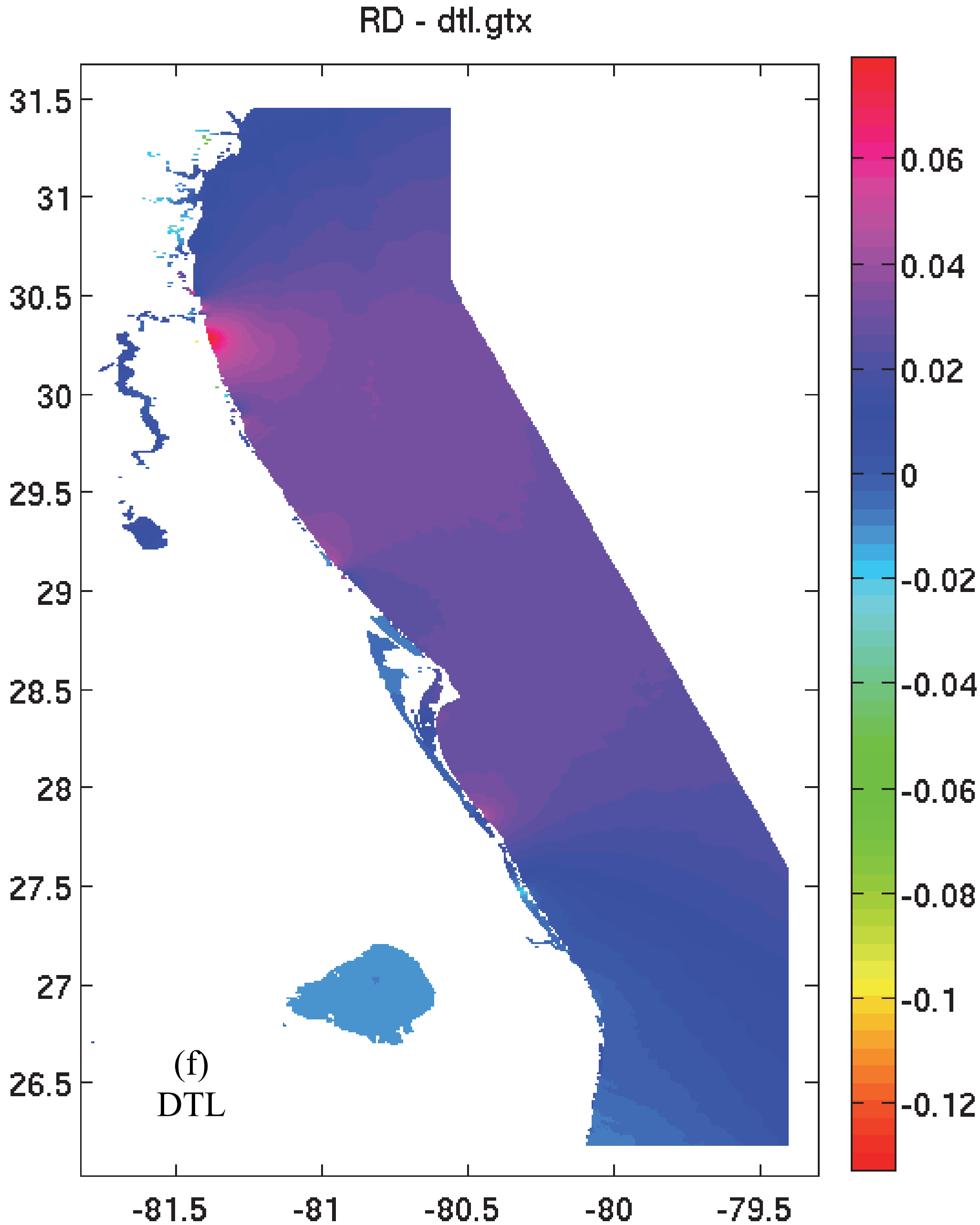
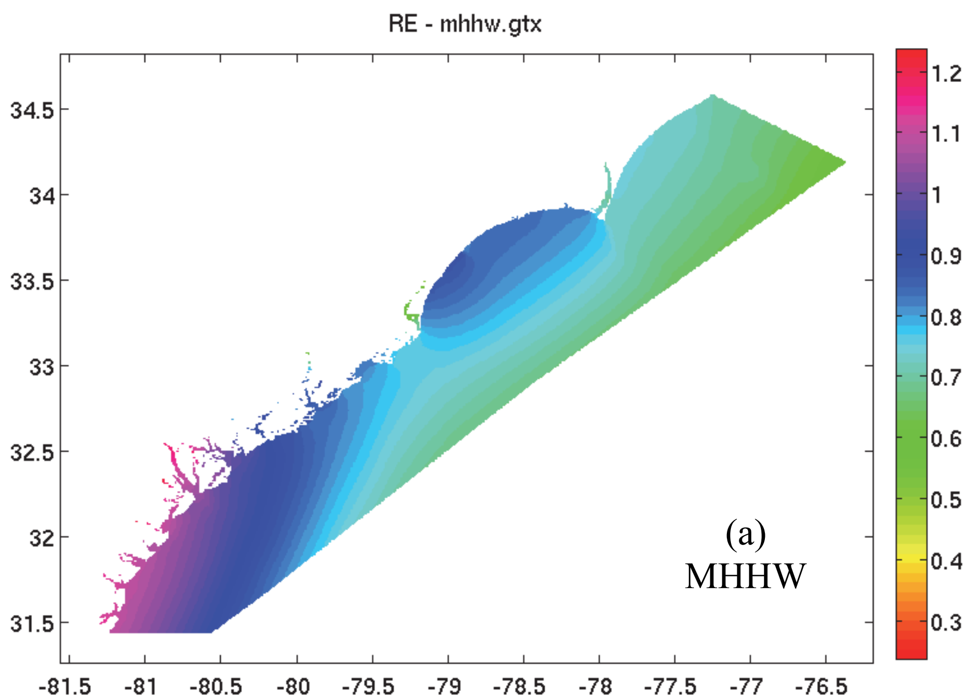
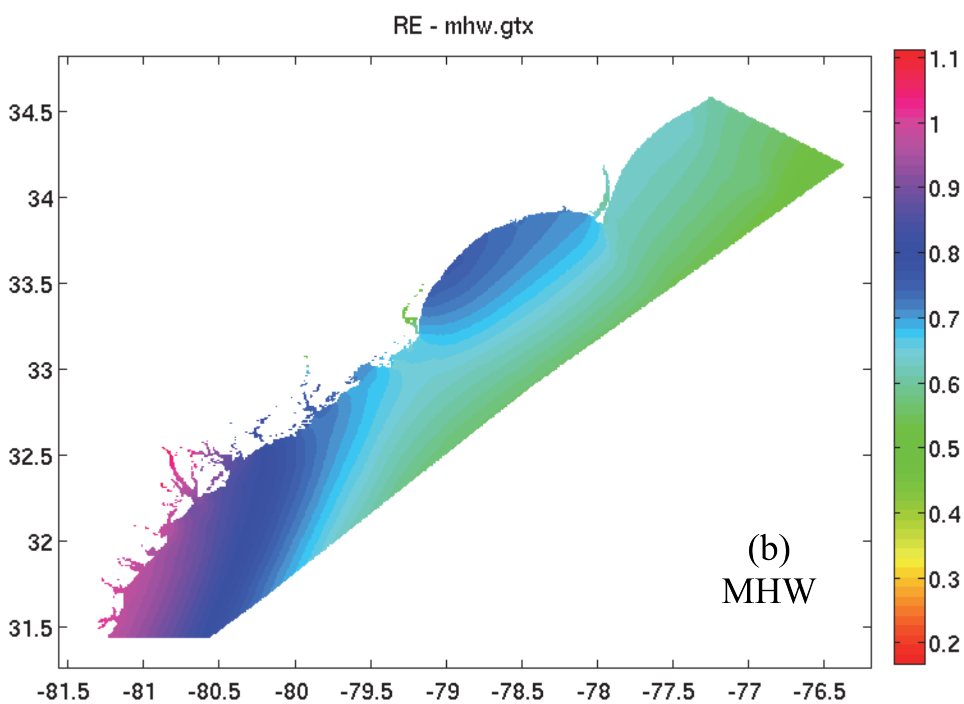
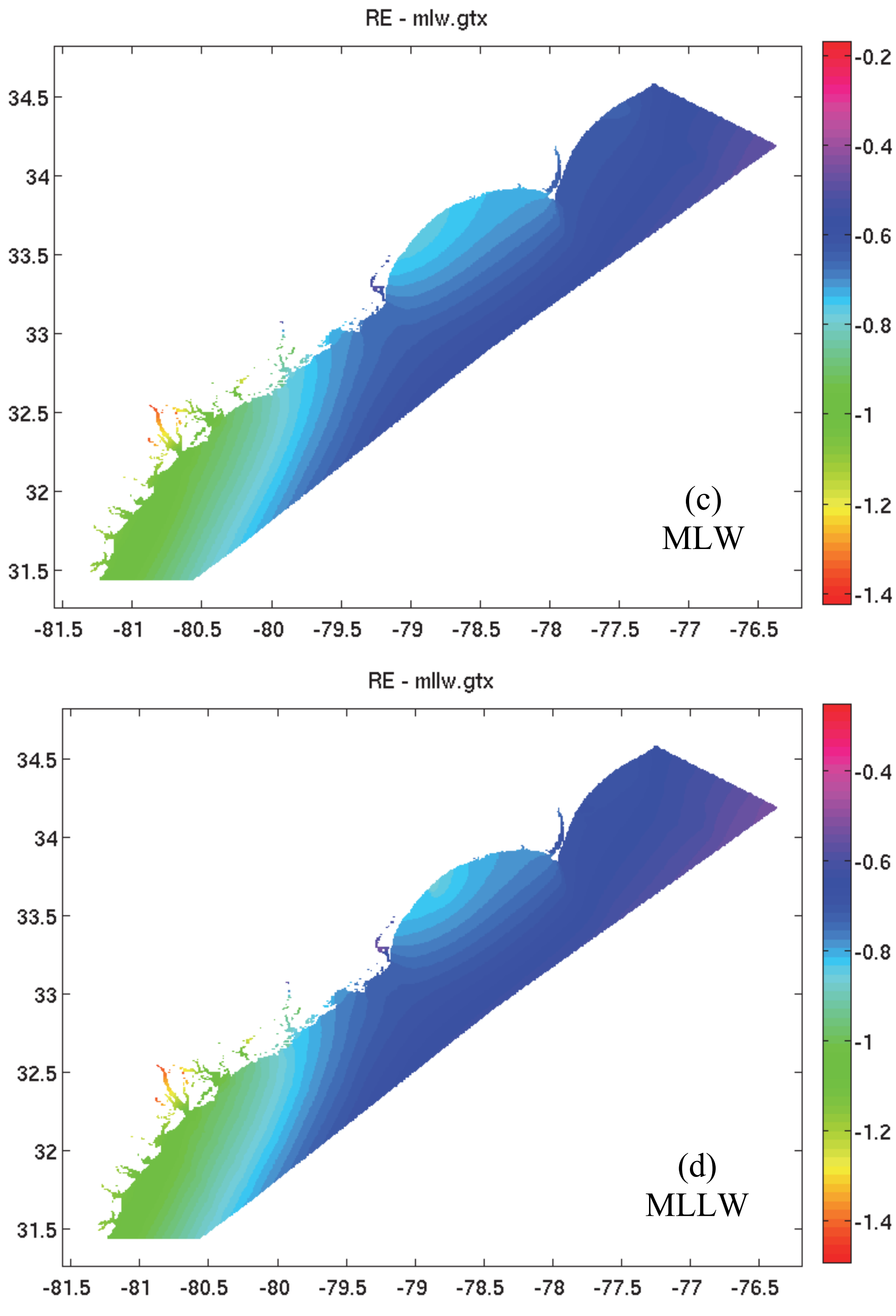
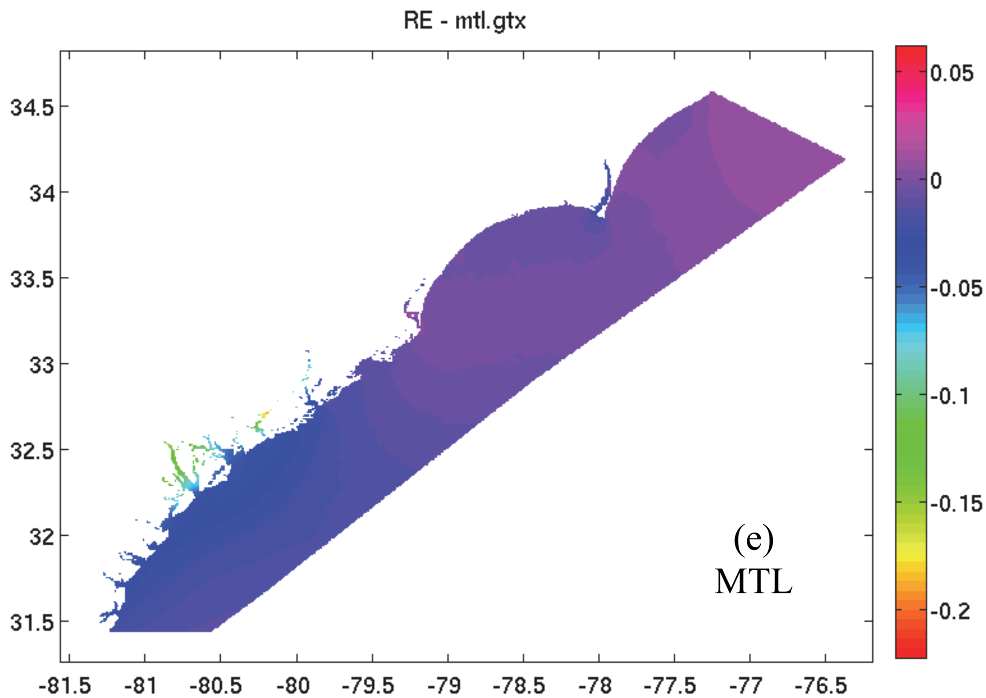

RD - dtl.gtx
31.5
31
30.5
30
29.5
29
28.5
28
27.5
27
26.5
-81.5
-81
-80.5
-80
-79.5
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
(f)
DTL

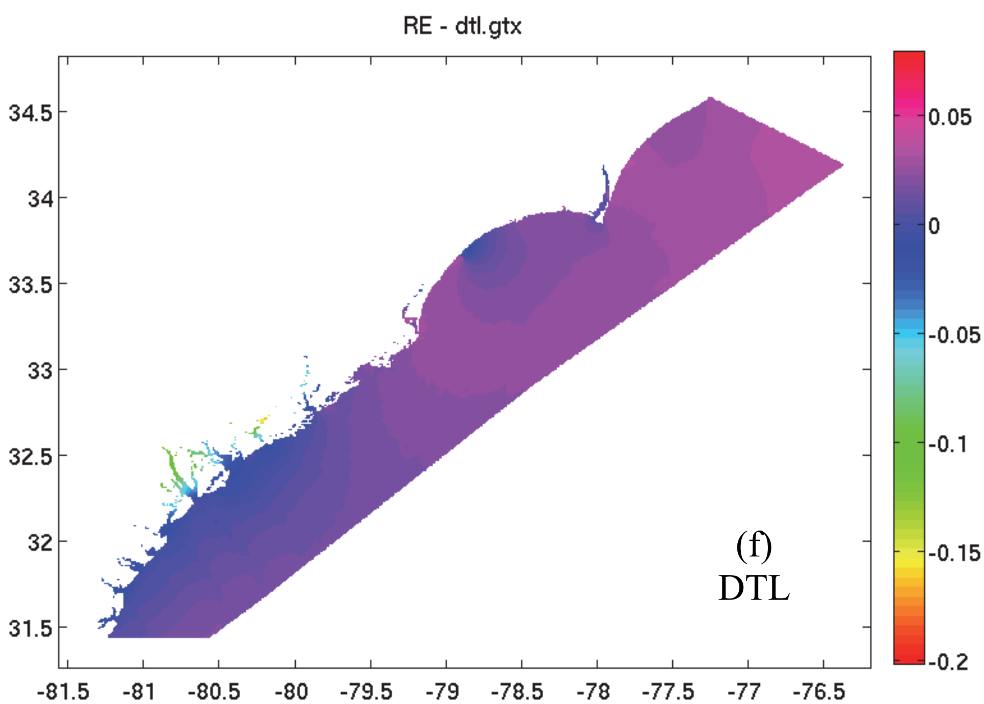
Figure C.5. Tidal datums on the VDatum marine grid in Region E (Table 3), (a) MHHW, (b) MHW, (c) MLW, (d) MLLW, (e) MTL, and (f) DTL.






RE - mlw.gtx
34.5
34
33.5
33
32.5
32
31.5
-81.5
-81
-80.5
-80
-79.5
-79
-78.5
-78
-77.5
-77
-76.5
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
(c)
MLW
RE - mllw.gtx
34.5
34
33.5
33
32.5
32
31.5
-81.5
-81
-80.5
-80
-79.5
-79
-78.5
-78
-77.5
-77
-76.5
-0.4
-0.6
-0.8
-1
-1.2
-1.4
(d)
MLLW


RE - mtl.gtx
34.5
34
33.5
33
32.5
32
31.5
-81.5
-81
-80.5
-80
-79.5
-79
-78.5
-78
-77.5
-77
-76.5
0.05
0
-0.05
-0.1
-0.15
-0.2
(e)
MTL


RE - dtl.gtx
34.5
34
33.5
33
32.5
32
31.5
-81.5
-81
-80.5
-80
-79.5
-79
-78.5
-78
-77.5
-77
-76.5
0.05
0
-0.05
-0.1
-0.15
-0.2
(f)
DTL

APPENDIX D. Creation and Validation of the Modeled TSS field

Table D.1. Tide station data utilized for TSS creation and model data differences. NA denotes a station where a NAVD88-to-LMSL value cannot be computed with the TSS grid. Delta is the difference between the observed and the TSS-grid derived values.

ID	Latitude (deg)	Longitude (deg)	NAVD 88 to MSL (m)	TSS Derived Value (m)	Delta (m)
8654400	35.22330	-75.63500	0.135	NA	NA
8656394	34.74500	-77.43670	0.020	NA	NA
8656590	34.69330	-76.71170	0.147	NA	NA
8658120	34.22670	-77.95330	-0.010	-0.010	0.000
8658163	34.21330	-77.78670	0.141	0.141	0.000
8658559	34.03170	-77.89330	0.216	0.215	0.001
8658579	34.02330	-77.94670	0.113	0.118	-0.005
8658622	34.00330	-77.95500	0.275	0.269	0.006
8658654	33.99000	-77.95670	0.113	0.119	-0.006
8658741	33.95000	-77.95170	0.142	0.142	0.000
8659084	33.91500	-78.01830	0.141	0.141	0.000
8659182	33.90170	-78.08170	0.170	0.169	0.001
8660098	33.87000	-78.57330	0.103	0.102	0.001
8660147	33.86000	-78.58000	0.098	0.099	-0.001
8660166	33.85500	-78.64830	0.017	0.014	0.003
8660265	33.83500	-78.63330	0.096	0.096	0.000
8660642	33.76670	-78.81500	-0.198	-0.196	-0.002
8660854	33.71330	-78.92170	-0.235	-0.234	-0.001
8660983	33.68670	-79.00500	-0.186	-0.186	0.000
8661070	33.65500	-78.91830	0.136	0.135	0.001
8661139	33.64670	-79.09500	-0.282	-0.282	0.000
8661299	33.60830	-79.15170	-0.729	NA	NA
8661419	33.57830	-79.00330	0.107	0.107	0.000
8661529	33.55170	-79.03670	0.119	NA	NA
8661559	33.54500	-79.04500	0.098	NA	NA
8661582	33.54170	-79.02830	0.122	0.121	0.001
8661684	33.51170	-79.06830	0.066	NA	NA
8661989	33.43500	-79.12670	-0.037	-0.034	-0.003
8661991	33.43500	-79.18170	-0.075	-0.077	0.002
8662071	33.41170	-79.13500	-0.062	-0.059	-0.003
8662245	33.35170	-79.18670	0.006	NA	NA
8662299	33.33330	-79.19330	0.109	NA	NA
8662549	33.25170	-79.26830	0.049	0.049	0.000
8662746	33.23500	-79.20330	0.051	0.051	0.000
8662796	33.19500	-79.27500	0.008	0.009	-0.001
8662799	33.18500	-79.40670	0.000	NA	NA
8662931	33.36670	-79.25500	-0.054	-0.052	-0.002
8662953	33.41500	-79.25000	0.000	-0.003	0.003
8663539	33.09500	-79.95330	-0.556	NA	NA
8663618	33.07830	-79.46000	0.094	0.093	0.001
8663781	33.05500	-79.88000	-0.335	NA	NA

8664022	33.00830	-79.92330	-0.127	-0.133	0.006
8664541	32.92500	-79.98670	-0.130	NA	NA
8664589	32.91830	-80.01170	-0.148	NA	NA
8664611	32.91500	-79.74670	-0.016	NA	NA
8664662	32.91000	-79.95170	0.014	0.012	0.002
8664701	32.90000	-79.90000	0.024	NA	NA
8665002	32.84830	-80.05170	0.018	0.019	-0.001
8665101	32.83500	-79.98670	0.070	0.069	0.001
8665167	32.82670	-79.78670	0.089	0.089	0.000
8665192	32.82170	-79.90000	0.053	0.053	0.000
8665387	32.78670	-79.79170	0.103	0.101	0.002
8665424	32.67500	-79.95170	0.097	0.097	0.001
8665475	32.78670	-80.10500	-0.036	-0.035	-0.001
8665530	32.78170	-79.92500	0.067	0.067	0.000
8665552	32.77670	-79.81170	0.120	0.119	0.001
8665567	32.77330	-79.84170	0.110	0.110	0.000
8665589	32.77000	-80.06330	-0.012	-0.011	-0.001
8665637	32.76330	-79.85670	0.094	0.095	-0.001
8665641	32.76330	-80.00170	0.019	0.020	-0.001
8665737	32.75330	-80.45000	-0.352	NA	NA
8665763	32.74670	-80.16500	-0.020	-0.020	0.000
8666017	32.71500	-80.43670	-0.270	-0.269	-0.001
8666101	32.70670	-80.15670	-0.007	-0.007	0.000
8666131	32.70330	-80.27830	-0.006	NA	NA
8666217	32.69500	-80.22330	0.012	0.011	0.001
8666367	32.68170	-80.41670	-0.155	-0.155	0.000
8666433	32.66830	-80.29330	0.033	0.033	0.000
8666467	32.67000	-79.91670	0.086	0.086	0.000
8666652	32.66170	-79.94500	0.085	0.085	0.000
8666699	32.64670	-80.25670	0.046	0.046	0.000
8666749	32.63170	-80.47170	-0.098	NA	NA
8666799	32.63670	-80.34170	0.005	0.005	0.000
8666918	32.62500	-80.16670	0.054	0.054	0.000
8667062	32.60330	-80.13170	0.059	0.059	0.000
8667074	32.60170	-80.54170	-0.110	NA	NA
8667075	32.60330	-80.28670	0.041	0.042	-0.001
8667172	32.58330	-80.78330	-0.051	NA	NA
8667178	32.58500	-80.22830	0.071	0.071	0.000
8667199	32.57830	-80.67000	-0.023	NA	NA
8667209	32.57830	-80.44830	-0.012	NA	NA
8667411	32.57330	-80.74500	-0.001	NA	NA
8667425	32.54000	-80.34000	0.035	0.036	-0.001
8667630	32.50170	-80.29670	0.096	0.096	0.000
8667676	32.49330	-80.34000	0.098	0.097	0.001
8667679	32.49330	-80.32670	0.081	0.093	-0.012
8667733	32.48330	-80.60000	0.017	0.096	-0.079
8667972	32.44670	-80.53330	0.058	0.058	0.000
8667982	32.44000	-80.55330	0.059	NA	NA
8667999	32.43000	-80.67500	0.033	0.033	0.000
8668092	32.41330	-80.70000	0.031	NA	NA

8668146	32.40330	-80.45330	0.094	0.094	0.000
8668155	32.40170	-80.65330	0.005	NA	NA
8668223	32.38670	-80.77670	0.035	0.035	0.000
8668227	32.39170	-80.43830	0.097	NA	NA
8668482	32.34670	-80.89000	0.022	0.022	0.000
8668498	32.34000	-80.46500	0.089	0.089	0.000
8668601	32.32500	-80.60170	0.080	NA	NA
8669133	32.22330	-80.77170	0.074	0.074	0.000
8669167	32.22000	-80.66830	0.083	0.083	0.000
8669338	32.18500	-80.75330	0.087	NA	NA
8669691	32.10330	-80.89500	0.062	NA	NA
8669801	32.08170	-80.87830	0.105	0.105	0.000
8670424	32.14330	-81.14170	-0.027	NA	NA
8670870	32.03330	-80.90170	0.071	0.072	-0.001
8677344	31.13170	-81.39670	0.200	0.199	0.001
8720004	30.72170	-81.62170	0.004	NA	NA
8720007	30.70330	-81.57670	0.130	NA	NA
8720023	30.68330	-81.53330	0.113	0.115	-0.002
8720030	30.67170	-81.46500	0.161	0.161	0.001
8720051	30.64330	-81.52330	0.153	0.152	0.001
8720058	30.63170	-81.47670	0.147	NA	NA
8720084	30.58830	-81.66330	-0.106	NA	NA
8720086	30.58670	-81.46330	0.122	0.122	0.000
8720093	30.57670	-81.60830	0.016	NA	NA
8720097	30.57667	-81.57167	0.002	NA	NA
8720098	30.56830	-81.51500	0.073	0.075	-0.002
8720135	30.51830	-81.45330	0.150	0.150	0.000
8720137	30.51330	-81.45670	0.158	0.157	0.001
8720168	30.46500	-81.43170	0.139	NA	NA
8720186	30.44000	-81.43830	0.107	0.110	-0.003
8720189	30.43670	-81.64170	0.089	NA	NA
8720194	30.43000	-81.40500	0.136	0.137	-0.001
8720203	30.41330	-81.54500	0.104	0.105	-0.001
8720213	30.42000	-81.72830	0.068	NA	NA
8720215	30.40000	-81.62670	0.098	0.098	0.000
8720216	30.39830	-81.69830	0.051	-NA	NA
8720217	30.39170	-81.66170	0.109	0.108	0.001
8720219	30.38670	-81.55830	0.112	0.111	0.001
8720220	30.39330	-81.43170	0.181	0.179	0.003
8720221	30.39000	-81.50670	0.131	0.131	0.001
8720225	30.38330	-81.63670	0.093	0.093	0.000
8720232	30.37670	-81.44830	0.123	0.126	-0.003
8720267	30.32330	-81.43830	0.131	0.130	0.001
8720291	30.28330	-81.38670	0.181	0.181	0.000
8720296	30.27830	-81.70500	-0.001	0.000	-0.001
8720305	30.25330	-81.43000	0.064	0.065	-0.001
8720406	30.12000	-81.75830	-0.013	-0.013	0.000
8720434	30.08000	-81.76170	-0.014	NA	NA
8720496	29.99000	-81.66330	-0.007	-0.007	0.000
8720576	29.89170	-81.31000	0.153	0.153	0.000

8720587	29.85670	-81.26330	0.212	0.211	0.001
8720596	29.85830	-81.55330	-0.015	-0.014	-0.001
8720623	29.79330	-81.27170	0.111	0.112	-0.001
8720653	29.76330	-81.56170	0.019	0.019	0.001
8720686	29.71500	-81.23830	0.140	0.141	-0.001
8720833	29.47830	-81.13670	0.078	0.079	-0.001
8720954	29.28500	-81.05330	0.116	0.117	-0.001
8721120	29.14670	-80.96330	0.242	0.241	0.001
8721136	29.08330	-80.96670	0.166	NA	NA
8721138	29.08170	-80.93670	0.226	0.226	0.000
8721147	29.06330	-80.91500	0.279	0.266	0.013
8721191	28.98830	-80.90000	0.150	0.151	-0.001
8721223	28.92670	-80.82500	0.121	0.242	-0.121
8721374	28.73330	-80.75670	0.173	0.174	-0.001
8721415	28.67670	-80.65000	0.214	0.218	-0.004
8721456	28.62000	-80.80000	0.214	0.214	0.001
8721533	28.51330	-80.61170	0.210	0.210	0.000
8721749	28.21170	-80.66330	0.224	0.224	0.000
8721994	27.87330	-80.49670	0.255	0.258	-0.003
8722004	27.86000	-80.44830	0.367	0.362	0.005
8722029	27.81170	-80.46330	0.270	0.272	-0.002
8722059	27.75500	-80.42500	0.277	0.277	0.000
8722105	27.67000	-80.36000	0.348	0.342	0.006
8722212	27.47000	-80.28830	0.338	0.338	0.000
8722334	27.24330	-80.31330	0.274	0.273	0.001
8722357	27.20000	-80.25830	0.250	0.252	-0.002
8722371	27.17500	-80.18830	0.336	0.335	0.001
8722381	27.15500	-80.17170	0.276	0.277	-0.001
8722383	27.15170	-80.19500	0.309	NA	NA
8722404	27.11330	-80.14500	0.307	0.306	0.001
8722414	27.09330	-80.13670	0.283	0.289	-0.006
8722429	27.06500	-80.12330	0.373	0.369	0.005
8722445	27.03670	-80.10670	0.293	0.297	-0.004
8722478	26.97500	-80.11330	0.296	0.296	0.000
8722481	26.97000	-80.12670	0.372	0.369	0.003
8722486	26.96000	-80.10500	0.291	0.289	0.002
8722487	26.95170	-80.10170	0.274	0.278	-0.004
8722492	26.94670	-80.09000	0.343	0.343	0.000
8722495	26.94330	-80.07330	0.353	0.348	0.006
8722496	26.93500	-80.14330	0.299	NA	NA
8722512	26.91170	-80.08000	0.311	NA	NA
8722557	26.82670	-80.05500	0.314	0.314	0.000
8722607	26.73330	-80.04170	0.335	0.332	0.003
8722621	26.70500	-80.04500	0.304	0.305	-0.001
8722654	26.64500	-80.04500	0.322	0.320	0.002
8722670	26.61170	-80.03330	0.288	0.287	0.001
8722706	26.54830	-80.05330	0.222	0.225	-0.003
8722746	26.47330	-80.06170	0.278	0.277	0.001
8722761	26.44670	-80.06500	0.280	0.278	0.002
8722784	26.40330	-80.07000	0.267	0.268	-0.001

8722859	26.26000	-80.08500	0.275	0.278	-0.003
8722861	26.25830	-80.08170	0.289	0.299	-0.010
8722862	26.25670	-80.08000	0.309	0.307	0.002
8722899	26.18830	-80.09330	0.255	0.257	-0.002
8722939	26.11330	-80.10830	0.286	0.281	0.005
8722951	26.09170	-80.12330	0.267	0.267	0.000
8722956	26.08170	-80.11670	0.259	0.260	-0.001
8722957	26.08000	-80.11170	0.264	0.267	-0.003
8722971	26.05500	-80.11330	0.242	0.265	-0.023
8722982	26.03330	-80.12330	0.281	0.280	0.001
8723044	25.94170	-80.12500	0.227	0.230	-0.003
8723050	25.93000	-80.12000	0.292	0.289	0.003
8723073	25.90330	-80.12500	0.259	0.260	-0.001
8723080	25.90330	-80.12000	0.264	0.265	-0.001
8723089	25.88000	-80.16330	0.278	0.277	0.001
8723165	25.77830	-80.18500	0.272	0.272	0.000
8723170	25.76830	-80.13170	0.293	0.292	0.001
8723214	25.73170	-80.16170	0.267	0.267	0.000
8723289	25.61500	-80.30500	0.258	0.258	0.000
8723423	25.43670	-80.33000	0.265	0.265	0.000
8723518	25.31000	-80.29830	0.252	0.252	0.000
8723519	25.30830	-80.27670	0.266	0.266	0.000
8723534	25.28830	-80.37000	0.226	0.227	-0.001
8723574	25.23500	-80.43500	0.296	0.295	0.001
8723688	25.08170	-80.44500	0.285	NA	NA
8723689	25.08170	-80.44670	0.265	NA	NA
8723691	25.08170	-80.45000	0.249	NA	NA
8723693	25.07670	-80.45500	0.246	0.249	-0.003
8723747	25.00500	-80.51670	0.262	0.262	0.000
8723769	24.97330	-80.55000	0.270	0.270	0.000
8723786	24.95330	-80.58670	0.253	0.254	-0.001
8723795	24.94000	-80.60830	0.234	0.236	-0.002
8723797	24.93830	-80.61000	0.274	0.256	0.018
8723808	24.92500	-80.63170	0.229	0.232	-0.003
8723814	24.91500	-80.63170	0.255	0.255	0.000
8723851	24.86830	-80.70330	0.276	0.275	0.001
8723852	24.86500	-80.71670	0.257	0.258	-0.001
8723918	24.77670	-80.92330	0.255	0.256	-0.001
8723921	24.77170	-80.94000	0.237	0.249	-0.012
8723927	24.76500	-80.91330	0.274	0.273	0.001
8723933	24.75500	-80.95830	0.274	0.274	0.000
8723949	24.73330	-81.01670	0.245	0.250	-0.005
8723950	24.73000	-81.03000	0.304	0.299	0.005
8723962	24.71830	-81.01670	0.304	0.303	0.001
8723970	24.71170	-81.10500	0.251	0.254	-0.003
8723971	24.70330	-81.10500	0.272	0.273	-0.001
8724008	24.70670	-81.12500	0.304	0.301	0.003
8724032	24.70330	-81.15500	0.281	0.282	-0.001
8724033	24.70500	-81.15670	0.251	0.268	-0.017
8724093	24.68170	-81.22830	0.279	0.282	-0.003

8724099	24.68000	-81.23500	0.222	0.235	-0.013
8724107	24.67330	-81.24330	0.269	0.264	0.005
8724112	24.67000	-81.25170	0.303	0.297	0.007
8724138	24.65500	-81.28170	0.284	0.284	0.001
8724168	24.69830	-81.31830	0.233	0.235	-0.002
8724178	24.64830	-81.33000	0.248	0.249	-0.001
8724193	24.69670	-81.34830	0.208	0.210	-0.002
8724201	24.69000	-81.35670	0.201	0.202	-0.001
8724211	24.67000	-81.36830	0.229	0.231	-0.002
8724215	24.65170	-81.37500	0.272	0.271	0.001
8724227	24.69000	-81.38330	0.219	0.220	-0.001
8724231	24.74500	-81.39500	0.258	0.257	0.001
8724255	24.66000	-81.42330	0.258	0.256	0.002
8724264	24.70500	-81.43330	0.204	0.210	-0.006
8724266	24.65170	-81.43500	0.239	0.241	-0.002
8724276	24.65000	-81.44670	0.247	0.247	0.000
8724292	24.66170	-81.46830	0.232	0.233	-0.001
8724307	24.79000	-81.48330	0.286	0.285	0.001
8724313	24.66000	-81.49170	0.239	0.239	0.000
8724328	24.70000	-81.50500	0.204	0.206	-0.002
8724332	24.66170	-81.51500	0.180	0.186	-0.006
8724334	24.63000	-81.51670	0.211	0.210	0.001
8724353	24.65500	-81.54000	0.126	0.128	-0.002
8724405	24.62330	-81.60330	0.133	0.135	-0.002
8724417	24.61500	-81.61670	0.150	0.149	0.001
8724423	24.61170	-81.62330	0.095	0.107	-0.012
8724489	24.60170	-81.65500	0.188	0.185	0.003
8724493	24.57500	-81.70830	0.238	0.236	0.002
8724499	24.56330	-81.71330	0.254	0.251	0.003
8724503	24.57670	-81.72170	0.246	0.245	0.001
8724517	24.58000	-81.73830	0.185	0.191	-0.006
8724527	24.57000	-81.75000	0.214	0.217	-0.003
8724529	24.56500	-81.75170	0.238	0.235	0.003
8724542	24.58500	-81.77500	0.219	0.218	0.001
8724557	24.54500	-81.78330	0.264	0.263	0.001
8724580	24.55330	-81.80830	0.266	0.264	0.002
8724919	25.81330	-81.36330	0.207	0.207	0.000
8724948	25.85830	-81.38670	0.205	0.205	0.000
8724967	25.90830	-81.72830	0.208	0.206	0.002
8724979	25.93330	-81.65500	0.189	0.189	0.000
8724991	25.97170	-81.72830	0.192	0.191	0.001
8724996	25.98500	-81.70170	0.181	0.181	0.000
8725019	26.02500	-81.76830	0.169	0.175	-0.006
8725110	26.13000	-81.80670	0.194	0.194	0.000
8725114	26.13670	-81.78830	0.152	0.153	-0.001
8725222	26.27670	-81.82500	0.161	0.160	0.001
8725228	26.28170	-81.80170	0.149	0.149	0.000
8725235	26.29000	-81.81830	0.147	0.147	0.000
8725259	26.33000	-81.83830	0.096	0.095	0.001
8725269	26.33670	-81.83000	0.081	NA	NA

8725271	26.34330	-81.78000	0.082	NA	NA
8725272	26.33670	-81.84500	0.104	0.103	0.001
8725319	26.40000	-81.84330	0.115	0.116	-0.001
8725351	26.43830	-81.91830	0.217	0.213	0.005
8725366	26.45670	-81.95330	0.221	0.219	0.002
8725520	26.64670	-81.87170	0.125	0.126	-0.001
8725528	26.66000	-82.15500	0.193	0.193	0.000
8725541	26.70670	-82.16330	0.214	0.213	0.001
8725667	26.83330	-82.26500	0.152	0.153	-0.001
8725744	26.92830	-82.06500	0.176	0.176	0.000
8725747	26.93330	-82.35330	0.195	0.194	0.001
8725769	26.96170	-82.21000	0.159	0.159	0.000
8725781	26.98000	-81.96000	0.120	0.121	-0.001
8725791	26.98830	-81.99330	0.129	0.130	-0.001
8725809	27.01170	-82.41000	0.146	0.147	-0.001
8725835	27.04330	-81.98670	0.116	0.116	0.000
8725837	27.04500	-82.29330	0.108	NA	NA
8725858	27.07170	-82.45330	0.137	0.137	0.000
8725902	27.12670	-82.44670	0.120	NA	NA
8725916	27.15330	-82.48330	0.123	0.126	-0.003
8725943	27.17830	-82.49500	0.218	0.212	0.006
8725985	27.22170	-82.51500	0.139	0.140	-0.001
8726045	27.29170	-82.54170	0.126	0.126	0.000
8726083	27.33170	-82.54500	0.150	0.149	0.001
8726089	27.34000	-82.59000	0.133	0.134	-0.001
8726159	27.40830	-82.58000	0.152	0.152	0.000
8726217	27.46670	-82.68670	0.145	0.145	0.000
8726233	27.48500	-82.64500	0.101	0.102	-0.001
8726247	27.50000	-82.57330	0.097	0.098	-0.001
8726249	27.50330	-82.64830	0.105	0.105	0.000
8726273	27.52330	-82.65000	0.144	0.145	-0.001
8726278	27.52670	-82.48170	0.078	0.078	0.000
8726282	27.53330	-82.73000	0.139	0.139	0.000
8726347	27.60170	-82.76000	0.131	0.132	-0.001
8726353	27.60170	-82.55330	0.761	0.739	0.022
8726364	27.61500	-82.72670	0.126	0.129	-0.003
8726384	27.63667	-82.56556	0.119	0.139	-0.020
8726425	27.67830	-82.50330	0.084	NA	NA
8726428	27.68830	-82.71830	0.126	0.127	-0.001
8726436	27.70500	-82.44830	0.076	NA	NA
8726467	27.71830	-82.45330	0.075	NA	NA
8726533	27.78500	-82.78170	0.083	0.088	-0.005
8726537	27.78670	-82.42670	0.106	0.104	0.002
8726539	27.78330	-82.40670	0.086	0.087	-0.001
8726572	27.82000	-82.38670	0.084	0.084	0.000
8726573	27.82170	-82.48500	0.078	0.078	0.000
8726574	27.80830	-82.79500	0.102	0.102	0.000
8726604	27.85500	-82.48000	0.056	0.057	-0.001
8726632	27.88170	-82.39670	0.034	0.036	-0.002
8726639	27.89000	-82.48000	0.092	0.091	0.002

8726641	27.89330	-82.53830	0.086	0.086	0.000
8726651	27.89830	-82.42670	0.081	0.080	0.001
8726657	27.90830	-82.45170	0.092	0.091	0.001
8726667	27.91333	-82.42500	0.027	0.031	-0.004
8726668	27.91830	-82.44500	0.062	0.066	-0.004
8726685	27.93830	-82.43170	0.077	0.074	0.003
8726689	27.94170	-82.72000	0.085	0.085	0.000
8726693	27.94670	-82.46170	0.048	0.050	-0.002
8726699	27.94830	-82.38500	-0.212	-0.202	-0.011
8726706	27.95500	-82.80670	0.090	0.090	0.000
8726711	27.96000	-82.46830	0.085	NA	NA
8726724	27.97830	-82.83170	0.094	0.094	0.000
8726738	27.98830	-82.68500	0.085	0.084	0.001
8726761	28.01330	-82.79330	0.058	0.059	-0.001
8726769	28.02170	-82.65500	-0.003	0.000	-0.003
8726809	28.06170	-82.81330	0.057	0.059	-0.002
8726819	28.07000	-82.78170	0.089	0.088	0.001
8726833	28.08500	-82.77170	0.100	0.099	0.001
8726853	28.10330	-82.77830	0.078	0.079	-0.001
8726899	28.15000	-82.77170	0.059	NA	NA
8726904	28.15330	-82.80170	0.077	0.077	0.000
8726905	28.16000	-82.76830	0.053	NA	NA
8726924	28.17170	-82.78500	0.100	0.097	0.003
8726976	28.20170	-82.78000	0.098	0.098	0.000
8726978	28.20500	-82.78330	0.118	0.113	0.005
8726988	28.23000	-82.75330	0.119	0.118	0.001
8727001	28.24830	-82.72330	0.085	NA	NA
8727061	28.36170	-82.71000	0.124	0.123	0.001
8727086	28.41330	-82.67670	0.063	0.065	-0.002
8727151	28.53330	-82.65000	0.081	0.080	0.001
8727246	28.71500	-82.57670	-0.168	NA	NA
8727274	28.76170	-82.63830	0.010	0.008	0.002
8727293	28.80000	-82.60330	0.042	NA	NA
8727306	28.82500	-82.65830	0.035	NA	NA
8727328	28.86330	-82.66670	0.020	0.021	-0.001
8727336	28.88170	-82.63500	0.060	0.058	0.002
8727343	28.89830	-82.59830	0.003	0.000	0.003
8727348	28.90500	-82.63830	0.027	0.029	-0.002
8727395	29.00170	-82.75830	0.132	0.130	0.003
8727411	29.03000	-82.71330	0.044	0.047	-0.003
8727520	29.13500	-83.03170	0.066	0.066	0.000
8727577	29.32830	-83.15170	0.021	0.022	-0.001
8727604	29.39830	-83.20670	0.036	0.036	0.000
8727648	29.43670	-83.29330	0.046	0.046	0.000
8727695	29.67170	-83.39000	0.024	0.024	0.000
8727843	29.92000	-83.67170	-0.028	-0.028	0.000
8727956	30.05330	-83.91000	-0.075	-0.075	0.000
8727989	30.12670	-83.97500	-0.196	NA	NA
8728130	30.07830	-84.17830	-0.022	-0.022	0.000
8728229	30.06000	-84.29000	-0.006	-0.006	0.000

8728255	29.91170	-84.36500	0.037	0.037	0.000
8728258	30.01500	-84.36830	0.002	0.000	0.002
8728261	29.89500	-84.38830	0.003	0.001	0.002
8728288	29.90330	-84.41330	0.015	0.019	-0.004
8728311	29.92830	-84.44670	0.034	0.034	0.000
8728351	30.00500	-84.47170	-0.035	NA	NA
8728360	29.91500	-84.51170	0.043	0.043	0.000
8728408	29.81000	-84.58500	0.057	0.054	0.003
8728412	29.87830	-84.59500	0.049	0.048	0.001
8728464	29.85000	-84.66500	0.012	0.012	0.000
8728486	29.76670	-84.70000	0.017	0.018	-0.001
8728488	29.80170	-84.73670	0.024	0.024	0.000
8728619	29.72330	-84.88670	0.050	0.048	0.002
8728669	29.61330	-84.95830	0.067	0.065	0.002
8728690	29.72670	-84.98170	-0.045	-0.044	-0.002
8728711	29.76330	-85.03330	-0.105	-0.102	-0.003
8728757	29.77000	-85.08500	-0.056	-0.057	0.001
8728786	29.70670	-85.15330	0.006	0.006	0.000
8728853	29.88069	-85.22144	-0.109	NA	NA
8728942	29.66830	-85.36000	0.006	0.006	0.000
8728949	29.69000	-85.36330	-0.114	NA	NA
8728958	29.87330	-85.39000	0.007	NA	NA
8729149	30.13000	-85.74330	-0.043	NA	NA
8665494	32.78330	-79.78500	0.146	0.145	0.001

Table D.2: Mean and standard deviations of delta values (see Table D.1) for the five VDatum regions (see Table 3).

	Mean Delta Value (m)	**Standard Deviation (m)**
Region A	0.00035	0.00176
Region B	-0.00031	0.00418
Region C	-0.00088	0.00475
Region D	-0.00158	0.01420
Region E	-0.00011	0.00222