

Digital Elevation Models of Ouzinkie and Chiniak, Alaska: Procedures, Data Sources, and Analysis

Prepared for the National Tsunami Hazard Mitigation Program (NTHMP) by the NOAA National Centers for Environmental Information (NCEI)

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Summary

In December of 2015, NOAA’s National Centers for Environmental Information (NCEI) developed integrated bathymetric–topographic digital elevation models (DEMs) of Ouzinkie and Chiniak, Alaska for the National Tsunami Hazard Mitigation Program (NTHMP) and University of Alaska, Fairbanks (UAF). The 8/15 arc-second DEMs will be used to support modeling tsunami generation, propagation, and inundation. The DEMs cover the northeastern corner of Kodiak Island immediately surrounding the communities of Ouzinkie and Chiniak. The extents of these DEMs, procedures, data sources, and analysis are described below. The methodologies used by NCEI in developing DEMs are described in the NGDC Technical Report of Kodiak, Alaska (Carignan et al., 2013).

DEM Specifications

The Ouzinkie and Chiniak DEMs were built to the specifications listed in Table 1. Figure 1 shows the previously developed 1/3 arc-second Kodiak DEM boundary in green and the 8/15 arc-second DEM boundaries in red.

Table 1. Specifications for the 8/15 Ouzinkie and Chiniak, Alaska DEMs.

Grid Area	Ouzinkie, Alaska	Chiniak, Alaska
Coverage Area	152.47° to 152.54° W, 57.89° to 57.94° N	152.18° to 152.38° W, 57.60° to 57.65° N
Coordinate System	Geographic decimal degrees	Geographic decimal degrees
Horizontal Datum	World Geodetic System 1984 (WGS 84)	World Geodetic System 1984 (WGS 84)
Vertical Datum	Mean Higher High Water (MHHW)	Mean Higher High Water (MHHW)
Vertical Units	Meters	Meters
Cell Size	8/15 arc-second	8/15 arc-second
Grid Format	ASCII raster grid	ASCII raster grid

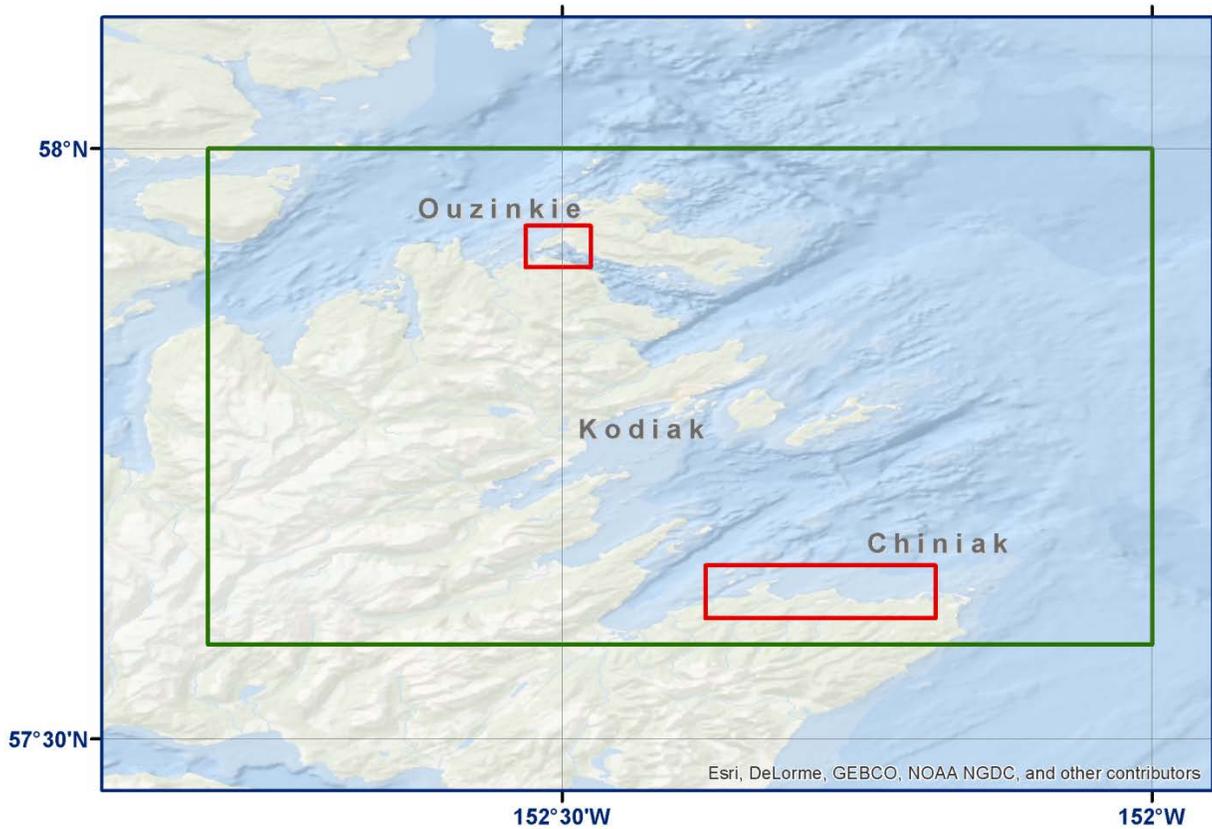


Figure 1. Map image of the boundaries for the 1/3 arc-second Kodiak DEM in green and the 8/15 arc-second DEMs in red.

Data Sources and Processing

Data for the DEMs were provided by UAF, the Kodiak Island Borough, the City of Kodiak, or available online through the USACE, NOAA/OCS, and USGS. Figures 2 and 3 show the source and data coverage for the Ouzinkie and Chiniak DEMs.

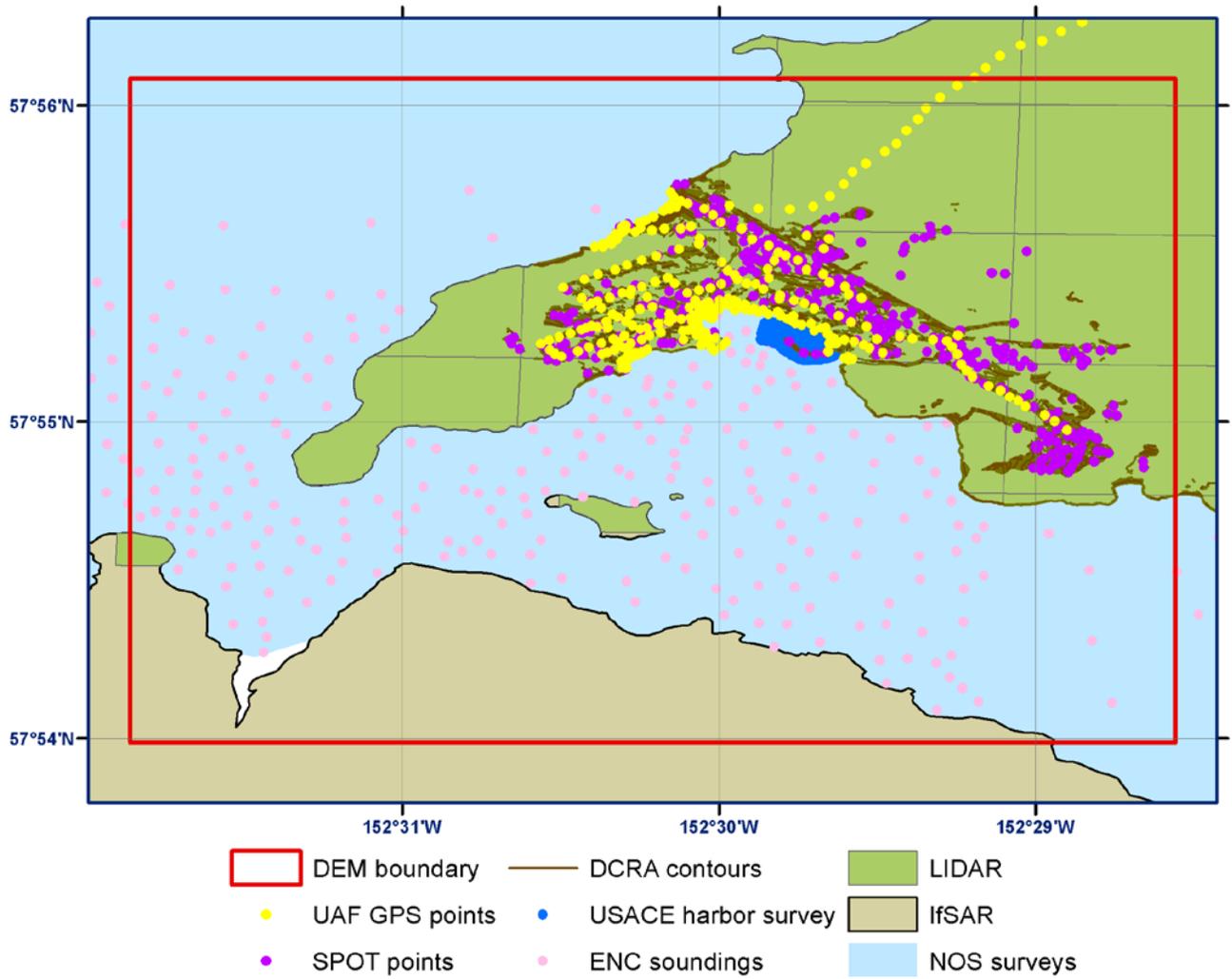


Figure 2. Source and coverage of the datasets used in compiling the Ouzinkie DEM.

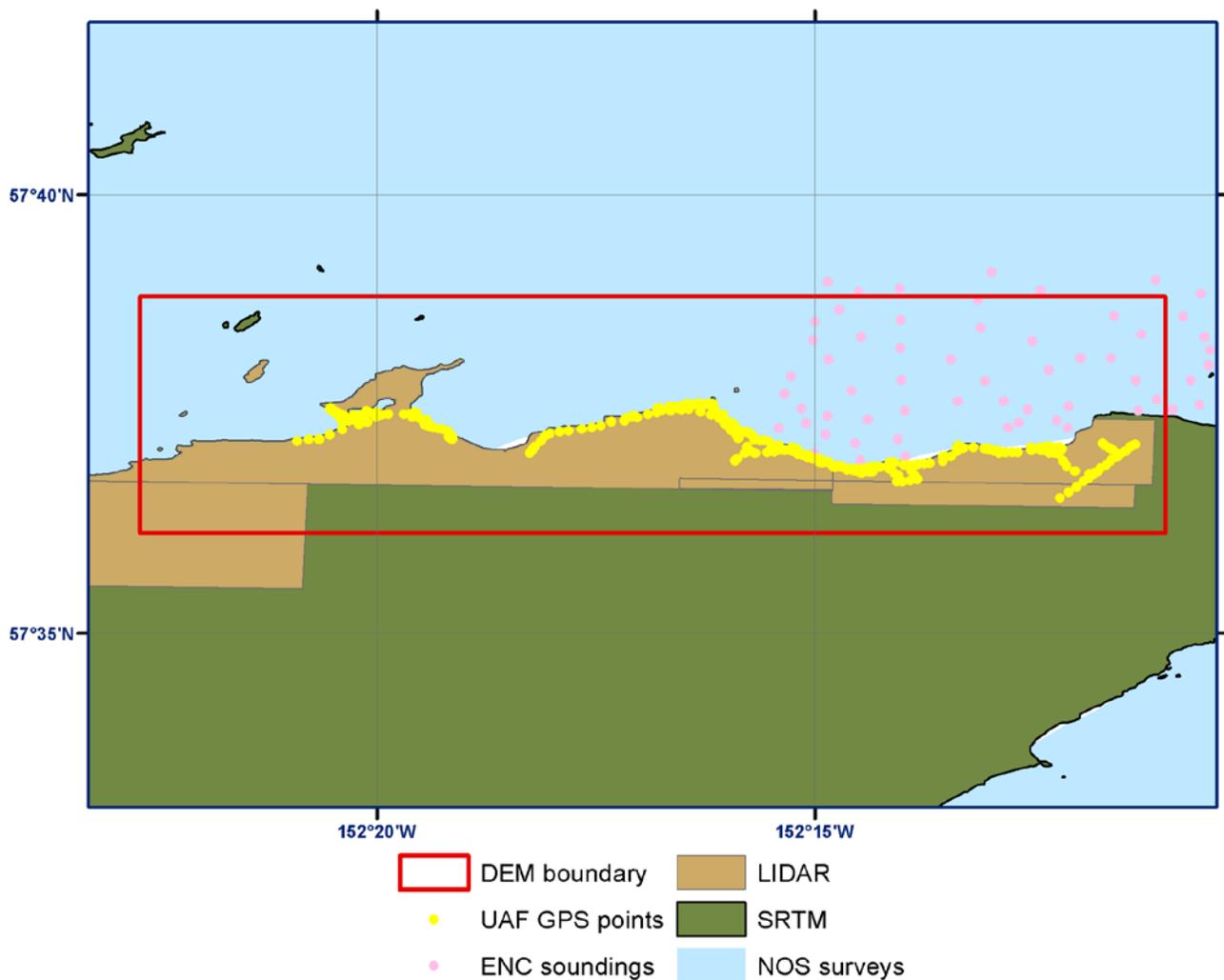


Figure 3. Source and coverage of the datasets used in compiling the Chiniak DEM.

Table 2 lists the bathymetric data source used in both the Kodiak DEM and the additional data for the Ouzinkie and Chiniak DEMs. As no new NOS hydrographic surveys were available for DEM regions, the bathymetric surface generated for the 2013 Kodiak DEM was reused. Table 3 lists the NOS surveys used in the surface that are located within the new DEM boundaries. The surface was transformed to MHHW for the final gridding. ENC chart soundings were extracted, converted to MHHW and xyz format and used in the final gridding process. A USACE Alaska District hydrographic condition survey for Ouzinkie Harbor was downloaded in pdf format, georeferenced, and soundings were hand digitized. Bathymetric data were transformed to WGS 84 and MHHW as needed and where recent, higher resolution data exists, older data were deleted. Vertical datum transformations were based on the NOAA tide stations (Table 4). Elevation differences in vertical datums at the two stations were averaged and used as conversion values.

Table 2: Bathymetric data sources used in compiling the Kodiak DEM.

<i>Source</i>	<i>Date</i>	<i>Data Type</i>	<i>Spatial Resolution</i>	<i>Horizontal Datum</i>	<i>Vertical Datum</i>
NOAA NOS	1907 to 2011	Hydrographic survey soundings	1 meter to several kilometers	Unknown, Early Alaska Datums, NAD 83 geographic, or NAD 83 UTM Zone 5	Mean Lower Low Water (MLLW)
NOAA OCS	1981 to 2012	Extracted chart soundings	20 meters to hundreds of meters	WGS 84 geographic	MLLW
USACE	2015	Project survey map digitized bathymetric survey points	~25 feet point spacing	NAD 83 AK (CORS96) State Plane Zone 5 (feet)	MLLW

Table 3: NOS hydrographic surveys

<i>Survey ID</i>	<i>Date</i>	<i>Scale</i>	<i>Original Horizontal Datum</i>	<i>Original Vertical Datum</i>
F00238	1981	10000	Early Alaska Datums	Mean Lower Low Water
H02922	1907	20000	UNKNOWN	Mean Lower Low Water
H05251	1932	20000	Early Alaska Datums	Mean Lower Low Water
H05438	1933	20000	Early Alaska Datums	Mean Lower Low Water
H05439	1933	20000	Early Alaska Datums	Mean Lower Low Water
H05440	1933	20000	Early Alaska Datums	Mean Lower Low Water
H12317	2011	10000	North American Datum 1983	Mean Lower Low Water
H12320	2011	40000	North American Datum 1983	Mean Lower Low Water

Table 4: Relationship between MHW and other vertical datums in the Kodiak region.

<i>Vertical Datum</i>	<i>Ouzinkie</i>	<i>Kodiak, St. Pauls Harbor</i>	<i>Kodiak, Womens Bay</i>
	#9457287	#9457283	#9457292
MHHW	2.714	2.652	2.675
MHW	2.454	2.37	2.4
MSL	1.404	1.356	1.369
MTL	1.399	1.357	1.367
MLW	0.343	0.343	0.335
NAVD 88	0.296*	0.008*	
MLLW	0	0	0

*values from Alaska Tidal Datum Portal

Topographic data used in developing the Kodiak DEM are listed in Table 5. The City of Kodiak and the Kodiak Island Borough provided NCEI with IfSAR and LIDAR data. The IfSAR DEM is not bare-earth and was filtered using LIDAR classification software to remove some vegetation. LIDAR data provided to NCEI was unclassified LAS files and was minimally processed to classify some of the vegetation returns. Returns or elevation values over water were removed by both filtering by elevation value and by clipping the data files to the coastline. Topographic contours provided by DCRA were transformed to point format. The USACE harbor

survey also provided additional topographic points for the breakwater located in Ouzinkie Harbor. Conversions to MHHW were done using values based on the tide station information and the Alaska Tidal Datum Portal. The SRTM data were used only in Chiniak replacing the non-bare earth IfSAR data minimizing an elevation offset artifact in the grid.

Table 5: Topographic data sources used in compiling the Kodiak DEM.

<i>Source</i>	<i>Date</i>	<i>Data Type</i>	<i>Spatial Resolution</i>	<i>Horizontal Datum</i>	<i>Vertical Datum</i>
Kodiak Island Borough	2014-2015	Unclassified LAS LIDAR	5 meter	NAD 83 AK State Plane Zone 5 (feet)	NAVD 88
City of Kodiak	2003	Non-bare earth IfSAR DEM	3 meter	NAD 83 UTM Zone 5 (meters)	MSL
SRTM	2001	Topographic DEM	1 arc second	WGS 84 geographic	WGS84/EGM96 Geoid
UAF		GPS points		WGS 84 geographic	MHHW
DCRA	2012	Extracted CAD contours and SPOT elevations	2 foot contour interval	NAD 83 AK State Plane Zone 5 FIPS 5005 (feet)	NAVD 88

DEM Development

Development of the Ouzinkie and Chiniak DEM followed procedures documented in NGDC Technical Report of Kodiak, Alaska (Carignan et al., 2013). Gridding weight was modified to Table 7.

Table 6: Data hierarchy used to assign gridding weight in MB-System.

<i>Dataset</i>	<i>Relative Gridding Weight - Ouzinkie</i>	<i>Relative Gridding Weight - Chiniak</i>
LIDAR LAS	100	100
DCRA topographic points and SPOT elevations	1000	n/a
USACE hydrographic survey	10	n/a
UAF GPS	1000	1000
IfSAR DEM	.1	n/a
Bathymetric pre-surface	1	1
Extracted ENC approach and harbor soundings	1	1
SRTM	n/a	1

DEM Analysis

The completed 8/15 arc-second Ouzinkie and Chiniak DEMs were compared to nautical charts, topographic maps, and high resolution imagery. Inconsistencies were evaluated and resolved based on most reliable data available.

Acknowledgement

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Reference

Carignan, K.S., S.J. McLean, B.W. Eakins, M.R. Love, and M. Sutherland (2013) Digital Elevation Model of Kodiak, Alaska: Procedures, Data Sources and Analysis, NGDC Technical Report, pp. 7.

Alaska Division of Geological & Geophysical Surveys, Alaska Tidal Datum

Portal. <http://dggs.alaska.gov/sections/engineering/ak-tidal-datum-portal/calculator.php> [accessed Oct. 2015].