

Digital Elevation Model of Larsen Bay, Alaska: Procedures, Data Sources, and Analysis

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

September 29, 2016

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Summary

In September of 2016, NOAA’s National Centers for Environmental Information (NCEI) developed an integrated bathymetric–topographic digital elevation model (DEM) of Larsen Bay, Alaska for the National Tsunami Hazard Mitigation Program (NTHMP) and University of Alaska, Fairbanks (UAF). The 8/15 arc-second DEM will be used to support modeling tsunami generation, propagation, and inundation. The DEM covers a portion of Uyak Bay on the southwestern side of Kodiak Island, Larsen Bay, and the community of Larsen Bay. The extents of these DEM, 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 Larsen Bay DEM were built to the specifications listed in Table 1. Figure 1 shows the location on Kodiak Island and the 8/15 arc-second Larsen Bay DEM boundary in red.

Table 1. Specifications for the 8/15 arc-second Larsen Bay, Alaska DEM.

Grid Area	Larsen Bay, Alaska
Coverage Area	153.90° to 154.15° W, 57.51° to 57.59° N
Coordinate System	Geographic decimal degrees
Horizontal Datum	World Geodetic System 1984 (WGS 84)
Vertical Datum	Mean Higher High Water (MHHW)
Vertical Units	Meters
Cell Size	8/15 arc-second
Grid Format	ASCII raster grid

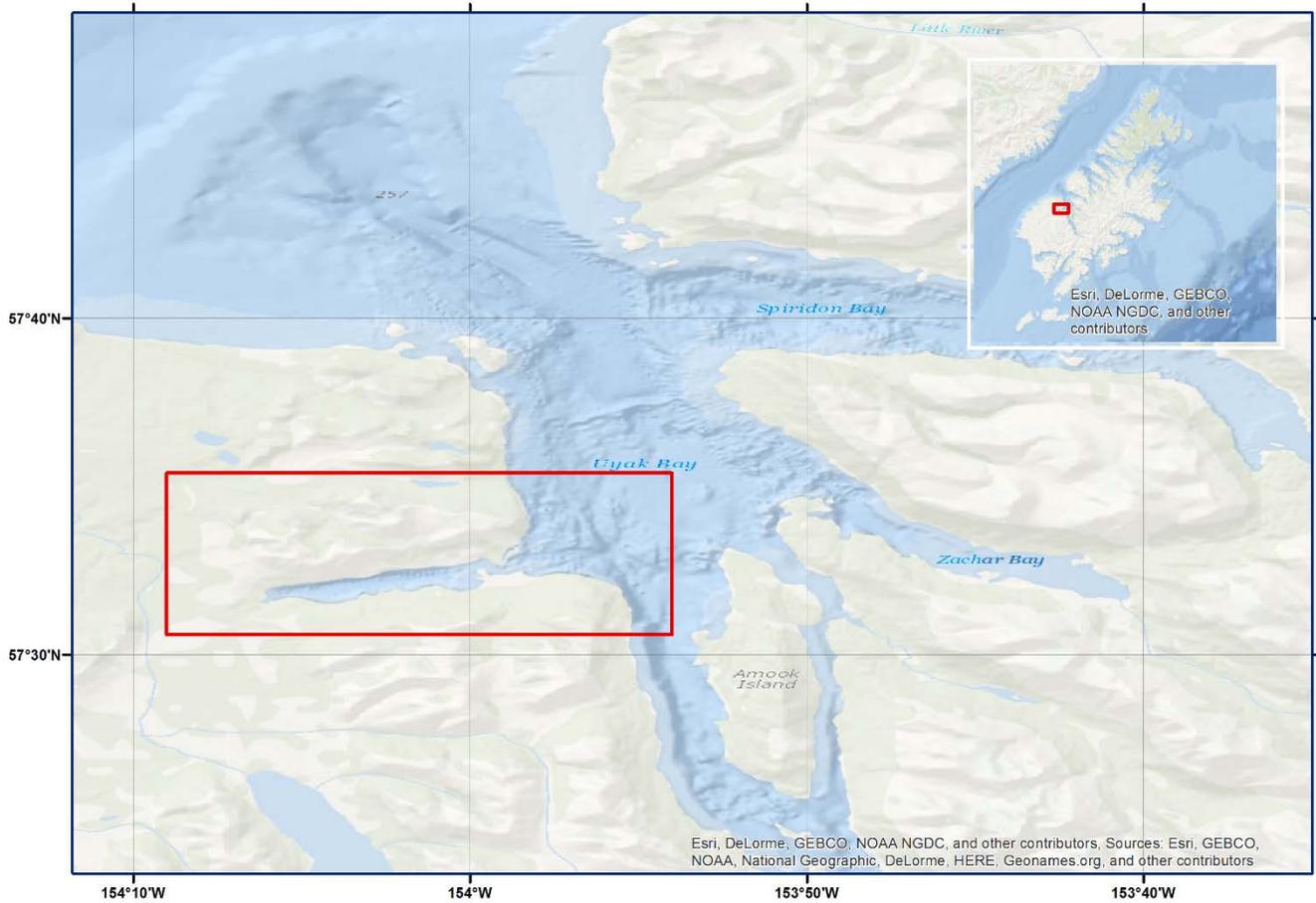


Figure 1. Map image of the boundary for the 8/15 arc-second Larsen Bay DEM in red with the location of Larsen Bay on Kodiak Island shown in the inset map.

Data Sources and Processing

Data for the DEM were provided by UAF, the Alaska Department of Commerce, Community, and Economic Development Division of Community and Regional Affairs (DCRA) and the Kodiak Island Housing Authority (KIHA), the U.S. Army Corps of Engineers Alaska District (USACE), University of Minnesota, Polar Geospatial Center (PGC), and NOAA. Figure 2 shows the source and data coverage for the Larsen Bay DEM.

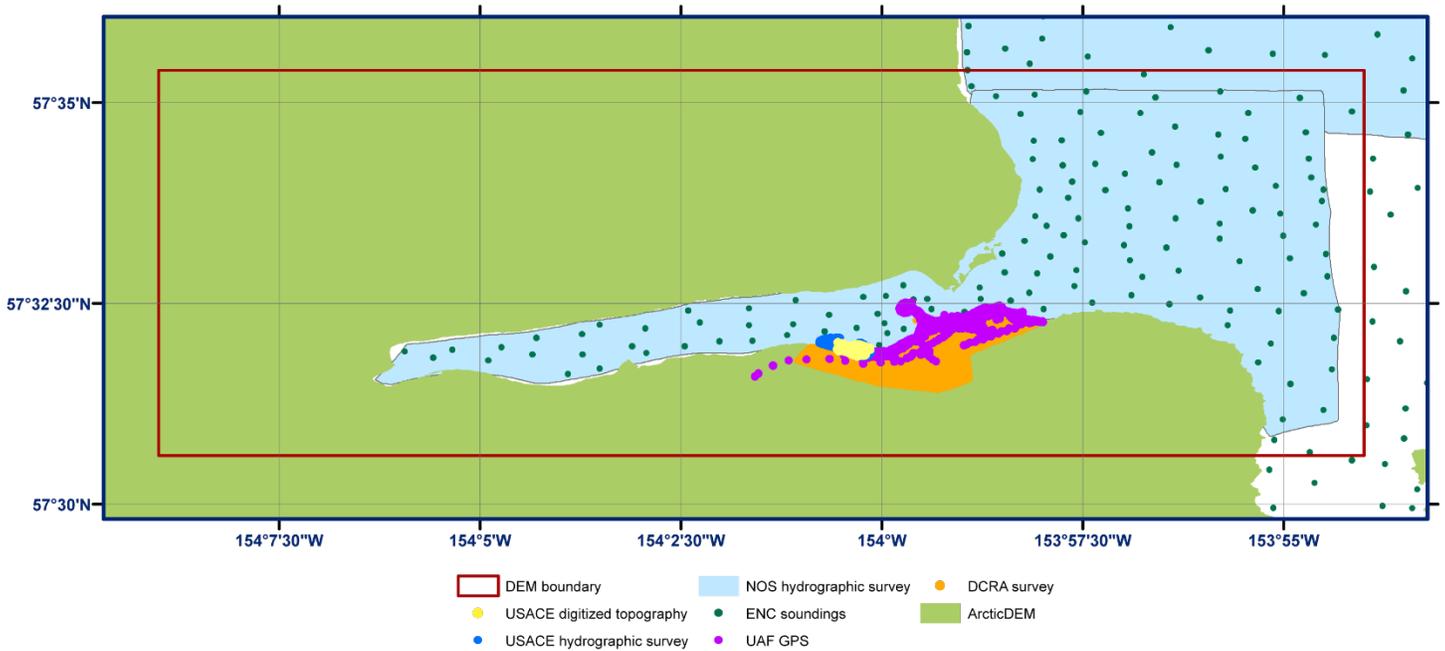


Figure 2. Source and coverage of the datasets used in compiling the Larsen Bay DEM.

Table 2 lists the bathymetric source data used in developing the Larsen Bay DEM. The NOS hydrographic survey data were downloaded from NCEI and converted to MHHW using a constant value of -4.189 m based on NOAA tide station #9457391 (Table 3). The USACE harbor condition survey data binned at 9 feet were provided by UAF and converted to MHHW with the same -4.189 m constant value. Soundings were extracted from NOAA Electronic Navigation Chart (ENC) to fill in the small area on the eastern edge of the DEM where there were no other recent survey data. A bathymetric pre-surface grid at 8/15 arc-second was generated using all the bathymetry data and an ‘xyz’ file of the coastline set to zero elevation. The surface was clipped to the coastline before using as an input in the final grid.

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

<i>Source</i>	<i>Date</i>	<i>Data Type</i>	<i>Spatial Resolution</i>	<i>Horizontal Datum</i>	<i>Vertical Datum</i>
ENC	2005	Extracted ENC soundings	~100 meter +	WGS 84 geographic	MLLW
NOS H10965 and H10966	2000	Hydrographic BAG survey	1:10,000 and 1:20,000	NAD 83 UTM Zone 5 North	MLLW
USACE	2014	Project survey map digitized bathymetric survey points	~4 meter point spacing	NAD 83 AK (CORS96) State Plane Zone 5 (feet)	MLLW

Table 3: Relationship between MHHW and other vertical datums in the Larsen Bay region.

<i>Vertical Datum</i>	<i>Larsen Bay, Kodiak Island</i>
	# 9457724
MHHW	4.189 meters
MHW	3.907
MTL	2.199
MSL	2.176
MLW	0.492
MLLW	0.0

Topographic data used in developing the Larsen Bay DEM are listed in Table 4.

Table 4: Topographic data sources used in compiling the Larsen Bay DEM.

<i>Source</i>	<i>Date</i>	<i>Data Type</i>	<i>Spatial Resolution</i>	<i>Horizontal Datum</i>	<i>Vertical Datum</i>
PGC	2016	Optically Derived DSM	5 meter	WGS 1984 NSIDC Sea Ice Polar Stereographic North	WGS84 Ellipsoid
UAF		GPS points		WGS 1984 geographic	MHHW
DCRA and KIHA	2007	AutoCAD survey drawing	10 m	NAD 1983 Alaska State Plane Zone 5 (feet)	NAVD 88 Geoid 06
USACE	2013	Project survey map digitized topographic survey points	~25 feet point spacing	NAD 1983 Alaska State Plane Zone 5 (feet)	MLLW

The USACE Alaska District hydrographic condition survey for Larsen Bay Harbor was downloaded in PDF format, georeferenced, and topographic points were hand digitized providing additional elevation information for Larsen Bay Harbor breakwater.

UAF provided the DCRA topographic data in CAD format. DTM elevation points and contour lines were extracted from the CAD file with ArcGIS. The topographic contours lines transformed to point format using the “vertices to points” tool. These DCRA data were transformed from NAVD 88 Geoid 06 to MHHW using a constant value of 4.05 m.

The PGC ArcticDEM provided elevation data for all the area outside of the DCRA data boundary. Conversions to MHHW were done using an average value of 14.32 m based on the average difference to GPS data.

DEM Development

Development of the Larsen Bay DEM followed procedures documented in NGDC Technical Report of Kodiak, Alaska (Carignan et al., 2013). Gridding weight was modified to Table 6.

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

<i>Dataset</i>	<i>Relative Gridding Weight</i>
USACE digitized topographic points	1000
USACE harbor condition survey	1000
UAF GPS	1000
DCRA topographic contours and DTM points	100
NOS surveys	100
Bathymetric pre-surface	10
ENC soundings	1
Coastline	1
ArcticDEM	1

DEM Analysis

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

Acknowledgement

The authors thank Amy Macpherson and Dmitry Nicolsky (UAF) for providing data used in developing the Larsen Bay, Alaska DEM. ArcticDEM Alaska Mosaic DEMs provided by the Polar Geospatial Center under NSF PLR awards 1043681, 1559691, and 1542736. ArcticDEM(s) were created from DigitalGlobe, Inc., imagery and funded under National Science Foundation awards 1043681, 1559691, and 1542736.

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.

ArcticDEM Alaska Version 1.0, (2016). University of Minnesota, Polar Geospatial Center (PGC). <http://pgc.umn.edu/> [September 2016].