SINGLE-BEAM BATHYMETRY DATA NEAR KOTLIK, ALASKA, COLLECTED JULY 2021

Jacquelyn R. Overbeck, Jessica E. Christian, and Richard M. Buzard

Raw Data File 2021-14

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DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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SINGLE-BEAM BATHYMETRY DATA NEAR KOTLIK, ALASKA, COLLECTED JULY 2021

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INTRODUCTION

The State of Alaska Division of Geological & Geophysical Surveys (DGGS) used a M2Ocean Hydroball—an integrated echosounder, Global Navigation Satellite System (GNSS) antenna, and inclinometer—to collect bathymetric transects near Kotlik on July 7 and 9, 2021 (fig. 1). The goal of the survey is to provide bathymetric data for the purpose of assessing coastal hazards and for river erosion studies. Bathymetric data were corrected using a coincident water level time series referenced to a vertical datum using GNSS survey. The bathymetric data were processed using CIDCO DepthStar. This data collection is being released as a Raw Data File with an open end-user license. All files can be downloaded from the DGGS website at https://doi.org/10.14509/30764.

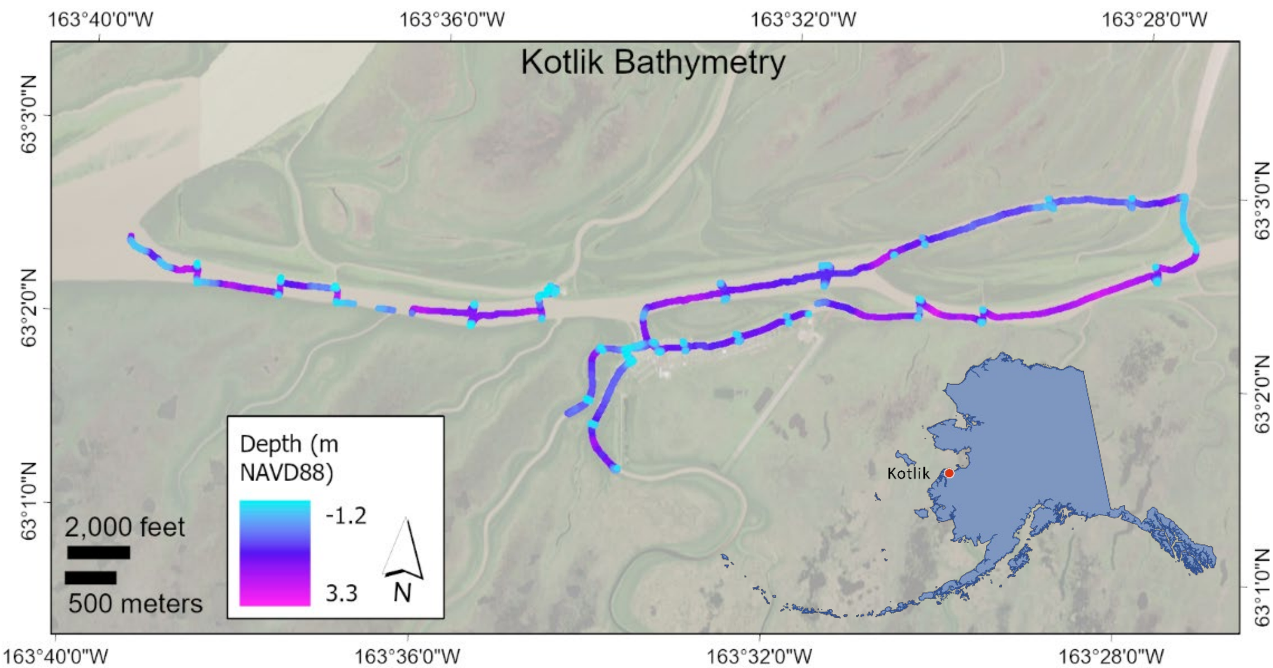

Figure 1. Map of single-beam bathymetry product boundaries for Kotlik.

LIST OF DELIVERABLES

- Point Elevation Text File
- Metadata

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MISSION PLAN

Bathymetric Survey Details

DGGS used a M2Ocean Hydroball bathymetric sensor, which is composed of a Tallysman TW3972 GNSS antenna, Imagenex 852 single-beam echosounder, and Honeywell HMR3000 inclinometer. The Hydroball was placed in a catamaran configuration and towed behind a small skiff at speeds below 4 knots (fig. 2). A total of 21.7 kilometers of river were surveyed, which included 25 cross-river transects.

Figure 2. Hydroball catamaran towing configuration.

Weather and Towing Conditions

The survey was completed on July 7 and 9, 2021, from 9:42 AM to 3:00 PM and 10:50 AM to 12:30 PM AKDT, respectively. During the survey, the operator started and stopped collection once each day. The weather throughout the survey was fair with scattered clouds and no rain. No abnormalities were observed during collection.

SURVEY AND PROCESSING REPORT

Ground Survey Details

DGGS set up a GNSS base station using the Trimble R10 receiver sampling at 1 Hz. The base was installed over a temporary benchmark of unknown position. This provided real-time kinematic (RTK) corrections to the Trimble R8s GNSS receiver (ground rover). DGGS measured the height of a water level sensor with the R8s at installation. The corrected base position was later derived using the Online Positioning User Service (found at http://www.ngs.noaa.gov/OPUS/). The R8s position was updated using post-processing kinematic (PPK) corrections in Trimble Business Center.

Water Level Survey Details

A Solinst Levelogger was installed at Kotlik during the bathymetric survey to provide water level corrections. The Levelogger was configured to collect at 15-minute intervals and installed in a plastic bucket stilling well placed on the seafloor of the Kotlik River near the community water intake pipe (fig. 3). Barometric data were downloaded from Iowa State University Environmental Mesonet website (http://mesonet.agron.iastate.edu/request/download.phtml?network=AK_ASOS) from the airport at Emmonak (airport code PAEM) for the bathymetric survey duration. Water level data were extracted from the Levelogger using Solinst Levelogger 5 Series software and exported as .csv files. Matching of the collection time, as well as a barometric compensation of the water surface, were completed in Matlab. A linear interpolation was applied to the barometric data to match the Levelogger time series and a multiplying correction was used to convert 1 kPa to 0.101972 m depth. The corrected water level time series was converted to coordinated universal time (UTC) and exported as a .tid file for ingestion in DepthStar.

Figure 3. Solinst Levelogger stilling well configuration (left) and water level sensor location at community water intake (right).

Bathymetry Survey Details

The Hydroball produces three files for export: .dev, .bin, and 0.852, which are directly imported into CIDCO DepthStar software. Processing steps are to input survey settings, upload .dev and .tid files, filter depth returns based on minimum depth and moving average thresholds, manually add and remove points based on visual quality, georeference the hydroball position, and export as .txt. Since the catamaran configuration was used during the survey, a draft correction 0.115 m and a and a GNSS antenna position reference point to echo sounder acoustic center correction of 0.364 m were applied. The minimum depth (sonar threshold) was set at 0.7 m and moving average threshold at 0.5 m. Data were georeferenced using the water level reference survey (WLRS) sounding reduction method with a sound velocity of 1450 m/s, which is the value used for fresh water. The position source was kept raw.

ACCURACY REPORT

Coordinate System and Datum

All data are processed and delivered in NAD83 (2011) UTM Zone 3N and vertical datum NAVD88 (GEOID12B).

Horizontal Accuracy

Horizontal accuracy was not evaluated.

Vertical Accuracy

A quality control report was run in DepthStar to compute vertical offsets of overlapping points (intersections) throughout the survey. There were 55 intersections in total with an offset range between 0.000 m and 0.222 m and a vertical accuracy of 0.138 m at the 95th percentile (table 1 and fig. 4).

Table 1. Survey intersection locations and vertical separation.

Longitude	Latitude	Vertical Separation (m)
-163.579095	63.03618050	0.006
-163.579095	63.03618010	0.088
-163.579095	63.03617975	0.037
-163.578966	63.03582310	0.009
-163.568781	63.02906164	0.033
-163.567965	63.02615973	0.048
-163.567917	63.02655327	0.018
-163.567788	63.02679202	0.040
-163.567713	63.02687028	0.025
-163.567384	63.02718572	0.023
-163.567055	63.02750528	0.010
-163.566855	63.02769947	0.140
-163.566217	63.02833357	0.106

Longitude	Latitude	Vertical Separation (m)
-163.566095	63.02439588	0.004
-163.565531	63.02413133	0.002
-163.564361	63.02363935	0.125
-163.563930	63.02345613	0.110
-163.562594	63.03299861	0.069
-163.562565	63.03310529	0.032
-163.561652	63.03359540	0.017
-163.559230	63.03389276	0.004
-163.559157	63.03390730	0.003
-163.558797	63.03395591	0.009
-163.558257	63.03400260	0.058
-163.558008	63.03409160	0.019
-163.557787	63.03402143	0.028
-163.557669	63.03417356	0.114
-163.557532	63.03421230	0.222
-163.557203	63.03414001	0.053
-163.557075	63.03396226	0.077
-163.557034	63.03395887	0.009
-163.556986	63.03389334	0.114
-163.556895	63.03377085	0.031
-163.556787	63.03374611	0.069
-163.556640	63.03358171	0.047
-163.556612	63.03353473	0.005
-163.556529	63.03344855	0.042
-163.556312	63.03343972	0.022
-163.555974	63.03340467	0.029
-163.555534	63.03368286	0.009
-163.555526	63.03368491	0.092
-163.555516	63.03368735	0.054
-163.555512	63.03368816	0.018
-163.555483	63.03369613	0.021
-163.551485	63.03416827	0.002
-163.545470	63.03969866	0.138
-163.541667	63.03536208	0.026
-163.526145	63.04117733	0.010
-163.513042	63.04315463	0.001
-163.513042	63.04315467	0.010
-163.513042	63.04315450	0.000
-163.513042	63.04315450	0.000
-163.495361	63.03896938	0.157
-163.484174	63.04882005	0.018

Longitude	Latitude	Vertical Separation (m)
-163.463096	63.04369761	0.118

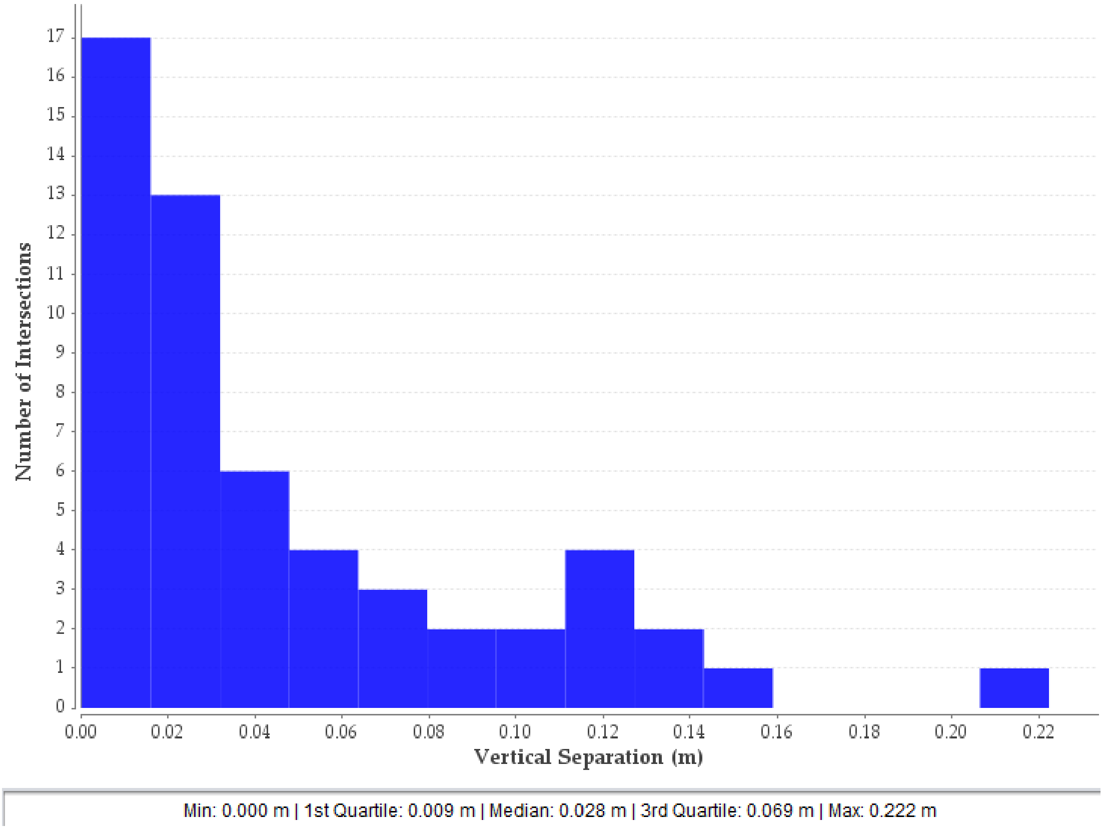

Figure 4. Histogram and summary statistics of vertical separation between intersecting survey points.

Data Consistency and Completeness

The bathymetry data have been visually inspected for data errors such as false returns. Erroneous data were removed in the data processing, which may lead to gaps between and along transects. Additional data errors may exist due to increased wave activity during segments of surveys, however, these errors were not evaluated or removed.

ACKNOWLEDGMENTS

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