PROFILE AND DISCHARGE DATA FOR FIVE WATERWAYS IN THE UTQIAĠVIK-ATQASUK-WAINWRIGHT REGION, ALASKA, COLLECTED AUGUST 2022

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PROFILE AND DISCHARGE DATA FOR FIVE WATERWAYS IN THE UTQIAĠVIK-ATQASUK-WAINWRIGHT REGION, ALASKA, COLLECTED AUGUST 2022

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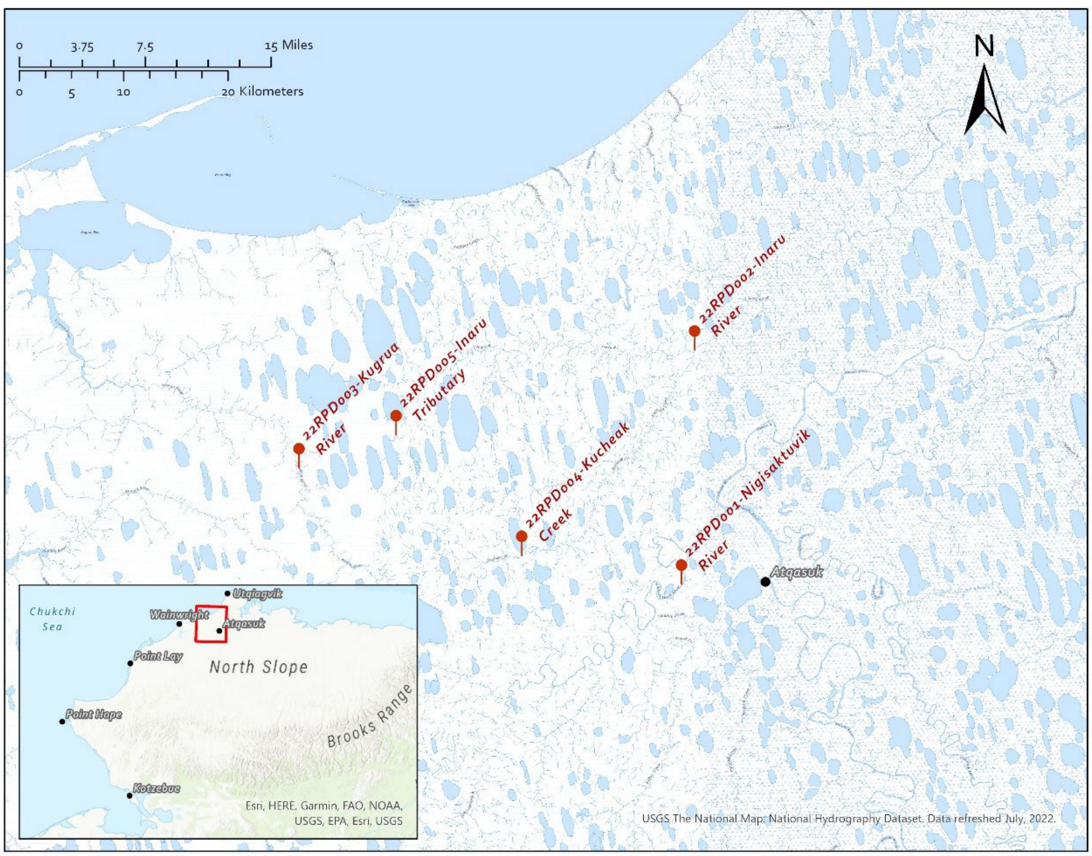
INTRODUCTION

The Alaska Division of Geological & Geophysical Surveys (DGGS) conducted fieldwork to install weather stations, stream gages, and snow sensors associated with the Arctic Strategic Transportation and Resource (ASTAR) project between August 8, 2022, and August 22, 2022. In conjunction with infrastructure installation, we collected discharge measurements and data to construct riverbed profiles at five stream gage sites between Atqasuk, Wainwright, and Utqiaġvik. The five stream gages (22RPD001—Nigisaktuvik River; 22RPD002—Inaru River; 22RPD003—Kugrua River; 22RPD004—Kucheak Creek; 22RPD005—unnamed Inaru tributary) were installed near potential river crossings for the ASTAR project (fig. 1). The waterways measured are assumed to be in a low flow stage, as they are primarily supplied by snowmelt and rainwater run-off. Though the installed gaging equipment will help determine when true low flow occurs on these waterways.

Figure 1. Location of stream profiles and discharge measurements.



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LIST OF DELIVERABLES

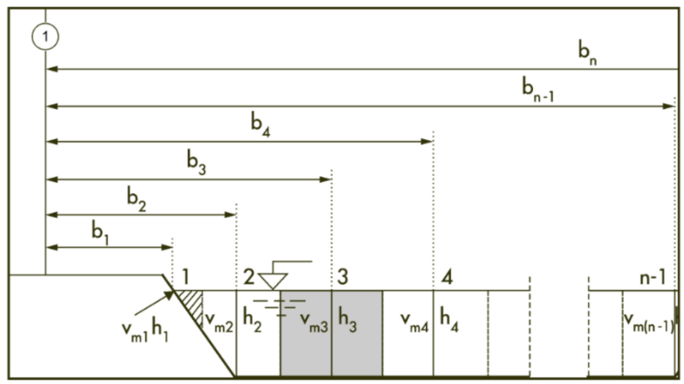
- Discharge tab-separated values (TSV) file
- Calibrated stream profile points comma-separated values (CSV) file
- Metadata

METHODS

To avoid eddies and other current anomalies, we placed gaging sites along selected waterways where the channel was relatively straight, and where flow disturbances were minimal. We collected data for profile measurements and discharge at sites 22RPD002–5 along an engineering tape placed across the streams perpendicular to the current flow. For 22RPD001 we collected discharge data at two locations (22RPD001-1 and 22RPD001-2). Discharge was measured along the profile transect for 22RPD001-1, and approximately 200 meters upstream from the profile transect for 22RPD001-2. Since the first measurement was measured in a portion of the river with low-velocity flow, the second measurement was done in a river section with a faster current. This was to verify that the original discharge measurement was within the margin of error, as the discharge sensor may not report reliable values when measuring currents with low velocity. Since 22RPD001-1 and 22RPD001-2 provided similar discharge measurements, we report both.

Discharge was measured using an OTT Hydromet MF Pro meter with a velocity sensor attached to an adjustable five-foot wading rod. We sampled at least 21 velocity measurement locations for each waterway. The discharge was measured using the mean-section method, which divides the cross-section into individual flow segments. The segments are defined by half of the distance to the neighbor vertical measurement, a vertical measurement being the location where velocity was measured using the wading rod and probe. Since the first and last vertical measurements should be as close to the stream edge as possible, the first sample location was gathered where the sensor could be completely submerged. Figure 2 depicts the definition variables for the mid-section method (OTT, 2018).

We collected all measurements from wadable rivers. First, we collected velocity measurements across the transect at a fixed interval, with the interval length depending on the channel width (OTT, 2018). Once completed, if any station accounted for ≥10 percent of the total calculated discharge, we added additional stations on either side to increase the density of measurements in high-flow areas of the channel and provide a more accurate horizontal velocity gradient. When the station depth was <2.5 ft (0.8 m), we collected a single velocity measurement at 60 percent depth. At stations with maximum depth ≥2.5 ft (0.8 m), we collected measurements at 20 percent and 80 percent depth.



$$q_3 = V_{m3} \times \left(\frac{(b_3 - b_2) + (b_4 - b_3)}{2} \right) \times h_3$$

Where:
m = station number
n = total number of stations
V = velocity at vertical
b = distance to vertical from bank
h = depth at vertical
q = flow at vertical

Figure 2. Definition variables used in the mid-section discharge measurement method (OTT, 2018).

After calculating discharge, we collected data to construct a stream bed profile, on the same day, along the same transect, using a differential real-time kinetic (RTK) global positioning system (GPS) consisting of a Trimble R12 base station and a Trimble R8 GPS receiver. The profile includes the submerged channel bed and the riverbank, or the perceived high-water mark if no bank was present. We took measurements approximately every 0.5 ft (0.15 m) across the stream channel; measurements captured outside the channel did not have as high a frequency to reduce sampling time, though the spacing between measurement locations was reduced in areas of greater vertical variability to capture the terrain accurately. The differential GPS base station data was post-processed with the National Oceanic and Atmospheric Administration's (NOAA) Online Positioning User Service (OPUS) to achieve survey quality location information (fig. 3; U.S. Department of Commerce, n.d.). We calculated the receiver locations using the survey quality base station data in Trimble Business Center, and the calibrated location information for each point was exported as a .CSV file.

RESULTS

The discharge results are reported in TSV file format. Raw data for each stream profile is reported in CSV format. The location data are reported in Decimal Degrees WGS84 coordinate system. Figure 4 plots the raw data elevation vs. the distance from zero with a 2x vertical exaggeration to enhance relief, and an offset to avoid overlap.

Figure 3: Processed differential GPS profile points plotted in 3D with satellite imagery overlay to show the extent of profile measurements.

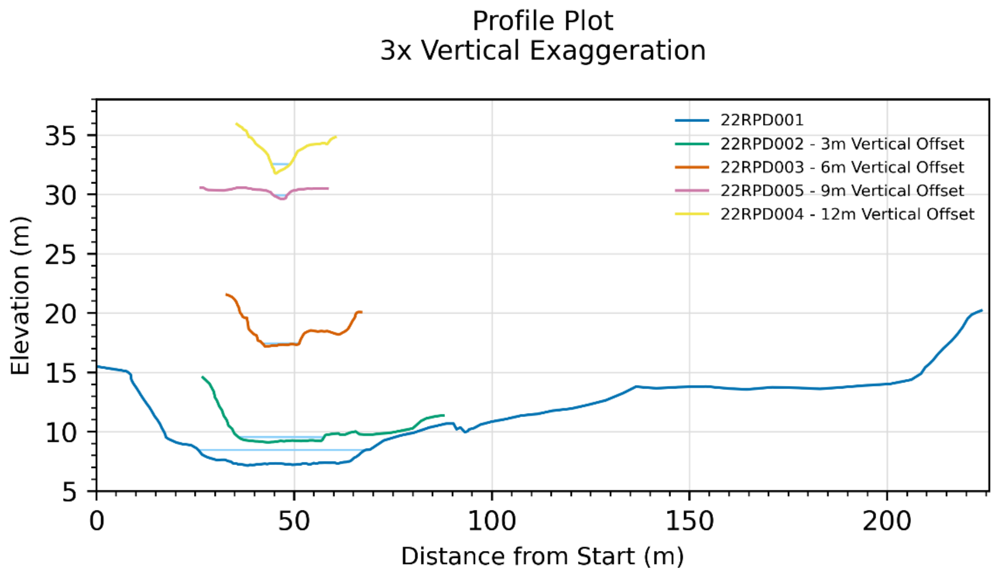


Figure 4: Riverbed profile plot with 3x vertical exaggeration and vertical offset set on profiles 2–5 to better show the relief and avoid overlap. The blue line indicates water elevation at the time of measurement. Produced by plotting the distance from the first point against the elevation.

ACKNOWLEDGMENTS

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OTT, 2018, MF Pro Basic User Manual (7th ed.): Loveland CO, OTT Hydromet. https://www.ott.com/download/ott-mf-pro-operating-instructions-1/

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