Hydrographic Survey Data Processing

Bayfield Peninsula, Wisconsin

Office for Coastal Management
National Oceanic and Atmospheric Administration

DAVID EVANS AND ASSOCIATES INC.

Hydrographic Survey Data Processing
Bayfield Peninsula, Wisconsin

Data Processing and Analysis Report
November 2020

Prepared for

WOOLPERT

Prepared by

DAVID EVANS AND ASSOCIATES INC.

David Evans and Associates, Inc.
Marine Services Division
2801 SE Columbia Way, Suite 130
Vancouver, WA 98661

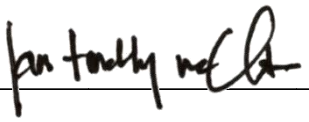
Hydrographic Survey Data Processing
Bayfield Peninsula, Wisconsin

Data Processing and Analysis Report
November 2020

Prepared by

Callan McGriff, EIT, IHO FIG Cat A
Senior Hydrographer and Production Manager
Associate
cemc@deainc.com

Reviewed by



Tim McClinton, Ph.D., P.G., GISP
Senior Geophysicist and Project Manager
Senior Associate
tmcclinton@deainc.com

1. Introduction

David Evans and Associates, Inc. (DEA) was subcontracted by Woolpert, Inc. to provide remote technical and data processing support to hydrographic survey operations conducted by the National Oceanic and Atmospheric Administration (NOAA) in the vicinity of Bayfield Peninsula and Apostle Islands National Lakeshore (APIS) in Lake Superior. The new hydrographic data will support the benthic habitat mapping and modeling needs of multiple agencies including NOAA, National Park Service (NPS), Wisconsin Department of Natural Resources, and other regional partners and stakeholders. This report describes the hydrographic data processing workflow used to produce the bathymetric and acoustic backscatter data deliverables.

2. Overview of Hydrographic Survey Operations

During July-September 2020, Cardinal Point Captains (CPC) hydrographers conducted hydrographic survey operations in three survey areas located on the western side of Bayfield Peninsula in southwestern Lake Superior (Figure 1). Survey operations took place over three legs: Leg 1 (7/25-8/5), Leg 2 (8/25-9/2), and Leg 3 (9/16-9/28). CPC utilized the Research Vessel (R/V) *Echo*, which was equipped with a Teledyne-Reson SeaBat 7125 multibeam echosounder for simultaneously acquiring bathymetry and acoustic backscatter imagery. During survey operations, DEA provided remote technical support to assist CPC with vessel setup, system calibrations, and initial hydrographic data testing and quality control, and coordinated transfers of raw hydrographic data.

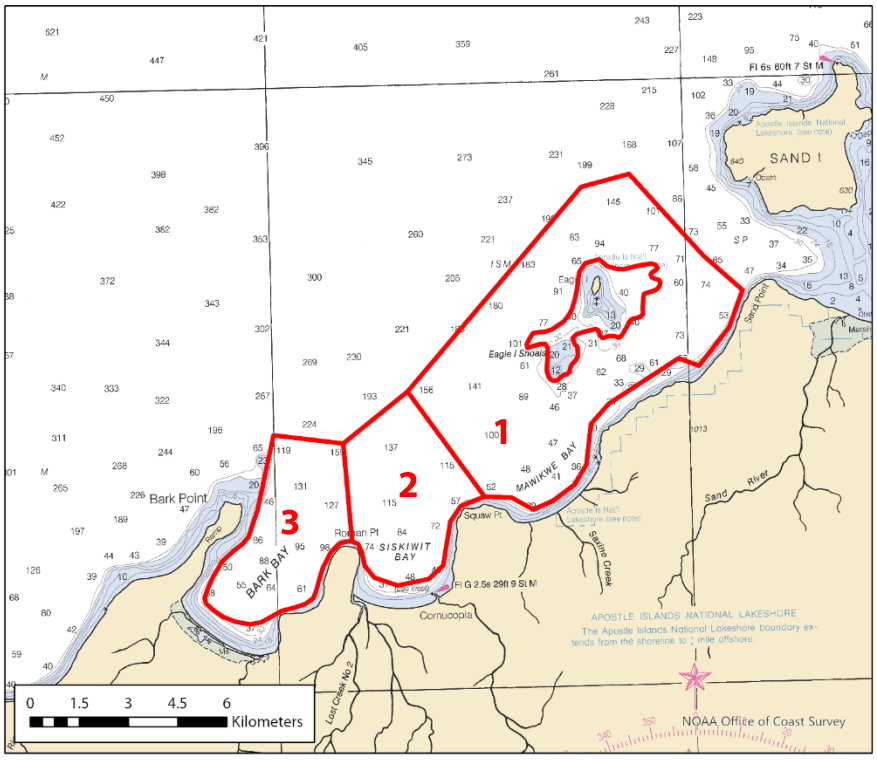


Figure 1 Hydrographic survey areas at Bayfield Peninsula in Lake Superior. Background is NOAA chart 14961 with soundings in feet relative to Lake Superior Low Water Datum (601.1 feet).

3. Hydrographic Data Processing and Analysis Workflow

3.1. Data Transfers

Data transfers were conducted through shipments of portable hard drives, for which DEA provided shipping materials and logistics support. Upon receipt of the data drive(s) from CPC, DEA transferred the data to secure servers in DEA's Vancouver, WA office, where the data were inventoried and prepared for processing. All raw data, processed data, derivative products, and interim deliverables were routinely backed up during the execution of this project.

3.2. Bathymetric Data Processing

After initial data assessments were complete, the raw multibeam data were prepared for import into CARIS Hydrographic Information Processing System (HIPS) software (version 11.3.8). Upon import into CARIS HIPS software, the raw multibeam data were converted from native Teledyne-Reson s7k file format into CARIS HDCS format. The converted multibeam data were stored logically by survey day. Soundings with a Reson quality flag of 0 or 1 (indicating poor brightness and/or collinearity of data) were rejected automatically on import. These soundings were reviewed later during manual inspection.

A CARIS HIPS Vessel File (HVF), which stored sensor offsets for the survey vessel, was constructed using values for the *Echo* as provided and documented by CPC hydrographers. Multibeam patch test data (conducted 7/25/2020) were analyzed and alignment corrections were calculated and applied to soundings. Vessel attitude (heading, pitch, roll, heave) and position data (global navigation satellite system (GNSS) corrections) were manually reviewed and verified. Applanix POSPac software was used to calculate Smoothed Best Estimate of Trajectory (SBET) files, which combined the vessel attitude and position data to produce a corrected horizontal position solution and to extract ellipsoidally referenced heights. Soundings were converted from ellipsoid heights (North American Datum of 1983; NAD83) to the project vertical datum (North American Vertical Datum of 1988; NAVD88) in CARIS HIPS using the GEOID12B model. Sound speed profiles were incorporated to correct multibeam slant range measurements and compensate for refraction in the water column. Sound speed profiles were imported into CARIS HIPS and applied to soundings using the "closest in distance and time" function. Static draft measurements were conducted periodically during hydrographic survey operations. Draft measurements were used to compute Global Positioning System (GPS) tides relative to the ellipsoid and to obtain an approximate waterline for the application of sound speed profiles.

After position, motion, waterline, and sound velocity corrections were applied, soundings were gridded for review and directed editing. Preliminary grid resolution was 2 meters (m). Review of bathymetric data was conducted by reviewing multiple bathymetry child layers (e.g. standard deviation, density) in CARIS HIPS and using editing and QC tools to view and edit erroneous soundings ("fliers"), systematic biases, timing errors, or alignment offsets. Upon completion of directed editing, soundings were gridded at 2m and 1m for surface review and analysis.

3.3 Bathymetric Data Analysis

3.3.1 Total Propagated Uncertainty (TPU) Computation

Best estimates for TPU values were entered into the *Echo* HVF. The manufacturers' published values were entered in the static sensor accuracy fields. In addition to static uncertainty values applied in the HVF, real-time sonar uncertainty sources were incorporated into the depth estimates of these data. Real-time uncertainty values from the sonar were logged by Hypack acquisition software and read into CARIS HIPS at the time of data conversion. Real-time estimates for delayed heave were recorded and loaded into CARIS HIPS via the "Import Auxiliary Data" function. Uncertainties associated with vessel navigation, roll, pitch, and yaw were post-processed using Applanix POSPac software and were also loaded into CARIS HIPS via the "Import Auxiliary Data" function. These real-time and postprocessed uncertainty sources were applied during TPU computation. TPU components and values are provided in Table 1.

Table 1 Total Propagated Uncertainty (TPU) values for R/V *Echo*.

Component		Unit of Measurement	Uncertainty Value	Application	Source
Motion	Gyro	Degrees	0.020	HVF	Manufacturer
	Heave	Percent Amplitude	5.00	RMS file	Values from post-processed uncertainty applied during "Delayed Heave" in HIPS
		Meters	0.050	RMS file	Values from post-processed uncertainty applied during "Delayed Heave" in HIPS
	Roll	Degrees	0.010	HVF	Manufacturer
	Pitch	Degrees	0.010	HVF	Manufacturer
Navigation	Position	Meters	0.010	RMS file	Values from real time uncertainty
Latency	Transducer Timing	Seconds	0.005	HVF	Manufacturer
	Nav Timing		0.005	HVF	
	Gyro Timing		0.005	HVF	
	Heave Timing		0.005	HVF	
	Pitch Timing		0.005	HVF	
	Roll Timing		0.005	HVF	
Sensor Offsets	Offset X	Meters	0.030	HVF	Estimate based on uncertainty of instrument used for vessel baseline survey
	Offset Y		0.030	HVF	
	Offset Z		0.030	HVF	
Speed Over Ground	Vessel Speed	Meters Per Second	0.030	HVF	Manufacturer
Draft and Loading	Loading	Meters	0.000	HVF	No loading with ERS[1]
	Draft		0.010		Estimate based on physical draft mark precision
	Delta Draft		0.000		Average standard deviation of settlement and squat moving lines
Alignment	MRU[2] gyro	Degrees	0.040	HVF	Estimated based on patch test results
	MRU[2] roll/pitch	Degrees	0.080	HVF	
Sound Velocity	Measured sound speed	Meters Per Second	1.000	Sounding corrections in CARIS HIPS	Estimated based on speed of sound through water column
	Surface sound speed		0.500		Estimated based on sound speed at sonar head

[1]Ellipsoid Referenced Survey
[2]Motion Reference Unit

3.3.2 Density Analysis

Node density was evaluated to verify that at least 95% of nodes were populated with at least five soundings as per NOAA Hydrographic Surveys Specifications and Deliverables (HSSD) requirements. Coverage and density were analyzed using NOAA Pydro QC tools to evaluate both the 1m and 2m bathymetric surfaces for complete coverage requirements. Results indicated that the 1m bathymetric surface did not meet density requirements, with only 73% of nodes containing >5 soundings. The 2m bathymetric surface passed the density analysis (98% of nodes with >5 soundings). The results of the density analysis indicated that a grid resolution of 2m was more appropriate for the data set.

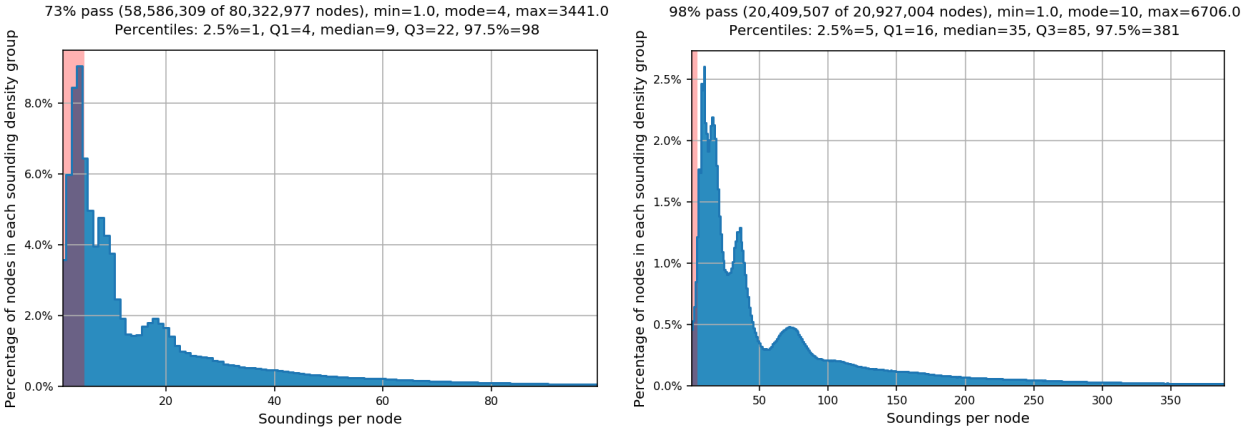


Figure 1 Density analysis results for 1m bathymetric surface (left) and 2m bathymetric surface (right) with summary statistics. Red shaded region indicates nodes with <5 soundings. Note change in scale of horizontal axes. The 1m bathymetric surface did not meet sounding density requirements.

3.3.3 Surface Difference Review

A crossline analysis was performed using CARIS HIPS QC Report tool, which compared crossline data to a gridded reference surface and reported results by beam number. While true crosslines were not acquired during survey operations, several quasi-crosslines acquired on 9/19/2020, the final day of survey operations, were evaluated. Crosslines were compared to the 2m bathymetric surface. Crossline analysis results indicated that the survey accuracy exceeded International Hydrographic Organization (IHO) Special Order standards (horizontal accuracy: 2m at 95% confidence level; vertical accuracy: 0.25m at 95% confidence level). Results are shown graphically in Figure 2 and in tabular form in Appendix A.

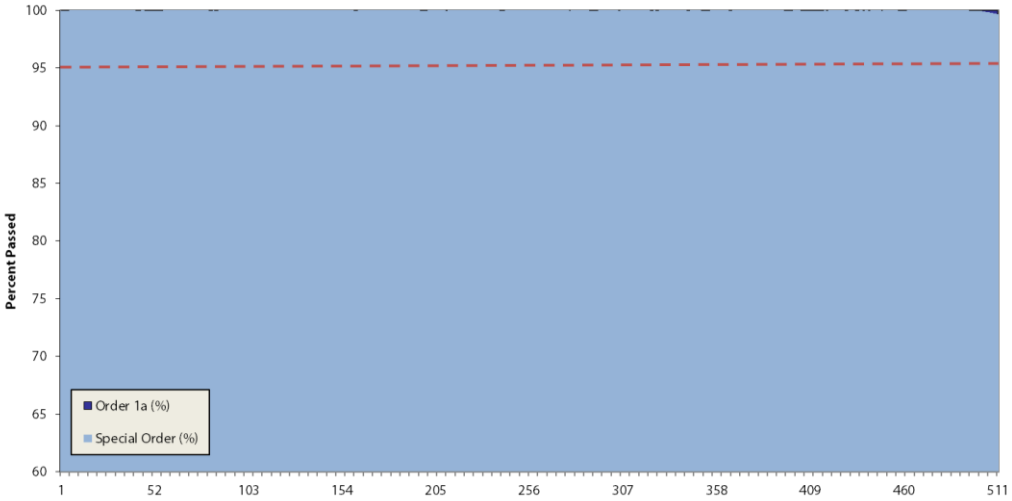


Figure 2 Crossline analysis results for 2m bathymetric surface. Red dashed line indicates 95% confidence interval. Survey accuracy exceeds IHO Special Order standards.

3.3.4 Bathymetric Surface Generation

After the completion of bathymetric data processing, review, and analysis, soundings were gridded using a standard swath angle filter to produce bathymetric surfaces with grid resolutions of 1m (as per project specifications) and 2m (Figure 3), the recommended product resolution based on sounding density. As per project specifications, no interpolation was applied to the bathymetric surfaces. The bathymetric surfaces were exported in bathymetric attributed grid (BAG) and Geotiff formats. The BAG format contains two data layers: Depth and Uncertainty (standard deviation of depth). A multidirectional shaded relief image was derived from the 2m bathymetric grid using ArcGIS software and exported in Geotiff format. Bathymetry products are referenced to NAD83 Universal Transverse Mercator (UTM) Zone 15 North with horizontal units in meters and vertical elevation in meters relative to NAVD88.

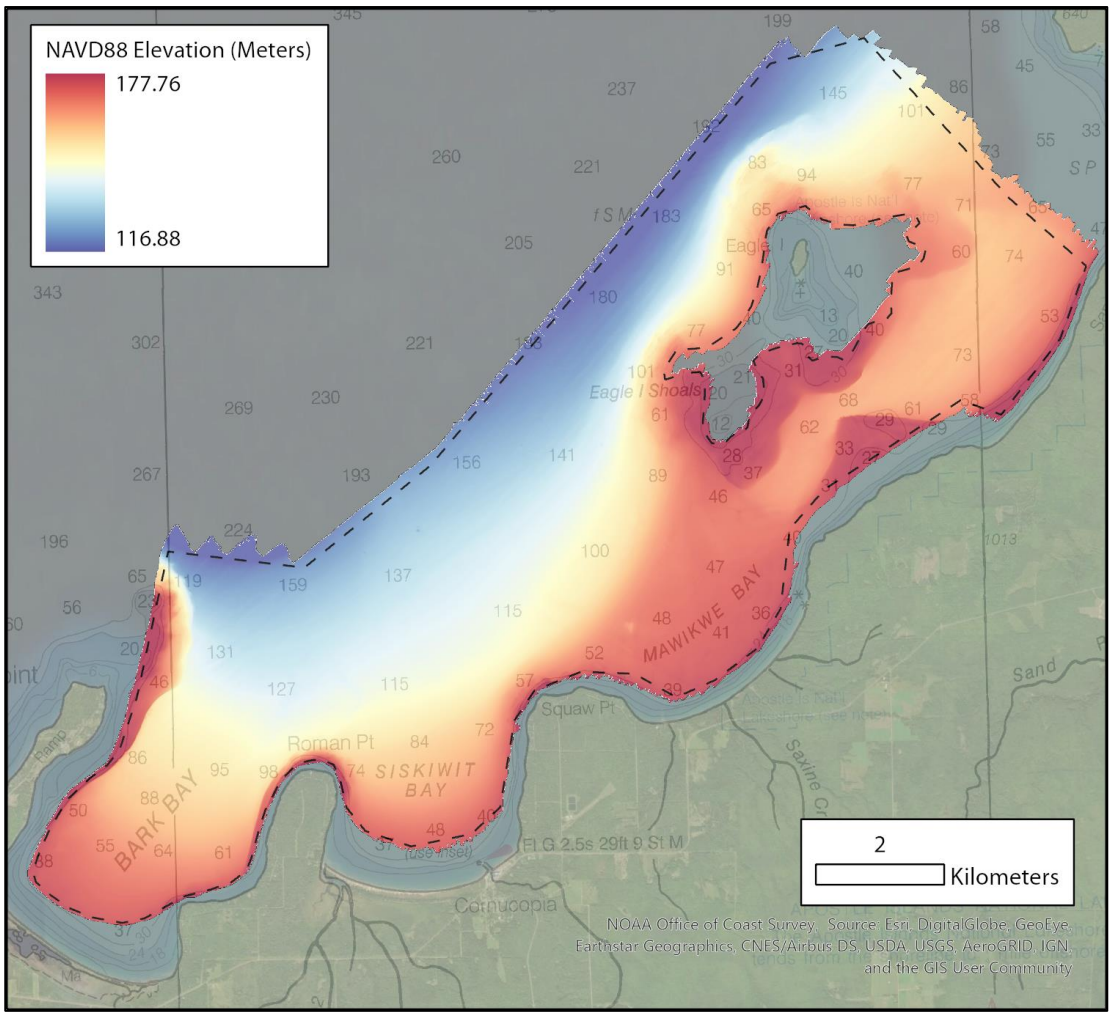


Figure 3 Multibeam bathymetry surface (2m grid resolution) for Areas 1-3 with multidirectional shading applied. Black dashed line indicates boundary of survey area. Background is NOAA chart 14966 with soundings shown in feet relative to Lake Superior Low Water Datum (601.1 feet).

3.3.5 Multibeam Backscatter Imagery Processing

After completion of bathymetric data processing, review, and analysis, multibeam backscatter imagery processing was conducted using Quality Positioning Systems (QPS) Fledermaus Geocoder Toolbox (FMGT) software (version 7.9.3). Processed bathymetry data files were exported from CARIS HIPS as Generic Sensor Format (GSF) files. The FMGT workflow paired each native sonar file (Teledyne-Reson s7k format) with its processed GSF file, thus incorporating corrected position and motion data. A beam pattern correction was computed and applied to remove angular bias from the backscatter imagery. Angle Varying Gain (AVG) was applied using the standard "Flat" algorithm and window size of 300 pings. A backscatter imagery mosaic was produced using standard line weighting procedures. The backscatter mosaic was then reviewed manually for motion artifacts and/or brightness offsets. Manual editing was performed to adjust brightness values between adjacent survey lines and/or survey days using the "Head Bias" tool in QPS FMGT software. After the completion of backscatter data processing and quality review, final backscatter image mosaics were produced with pixel resolutions of 1m (as per project specifications) and 2m (Figure 4), the recommended product resolution based on sounding density. The backscatter imagery mosaics were exported in Geotiff format. The backscatter imagery mosaics are referenced to NAD83 UTM Zone 15 North with horizontal units in meters. Backscatter intensity is shown in logarithmic units of decibels (dB).

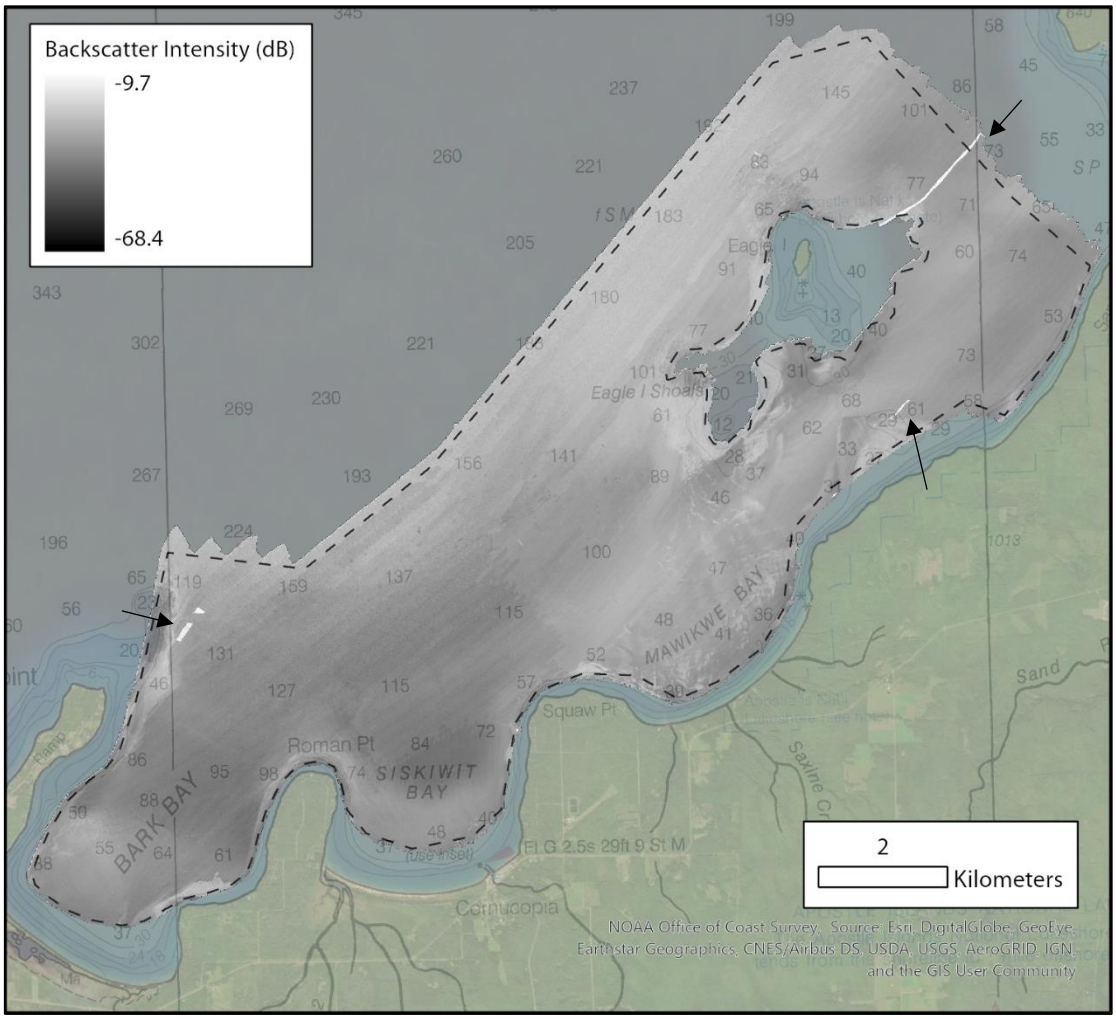


Figure 4 Multibeam backscatter imagery mosaic (2m pixel resolution) for Areas 1-3. Black dashed line indicates boundary of survey area. Arrows indicate significant data gaps where no backscatter data was recorded (refer to section 4.1). Background is NOAA chart 14966 with soundings shown in feet relative to Lake Superior Low Water Datum (601.1 feet).

4. Discussion and Recommendations

4.1 Data Gaps

Data gaps were present throughout the survey area. Data gaps occurred in both along- and across-track directions (Figure 5). The across-track data gaps were suspected to be the result of very brief time gaps between individual multibeam sonar data files. Due to known software limitations at the time of survey operations, the most current software driver to properly link communications with Hypack acquisition software and the Teledyne-Reson sonar controller was not available. The legacy software driver introduced a sub-second time gap between stopping the current multibeam sonar file and starting the subsequent multibeam sonar file, resulting in an across-track data gap. The size of these data gaps was generally <10m along track but did span the width of the sonar swath in some cases except where covered by adjacent sonar swaths. The size of these data gaps was also dependent on vessel speed. Along-track data gaps were also present, although less frequent, and were generally due to insufficient overlap between adjacent sonar swaths.

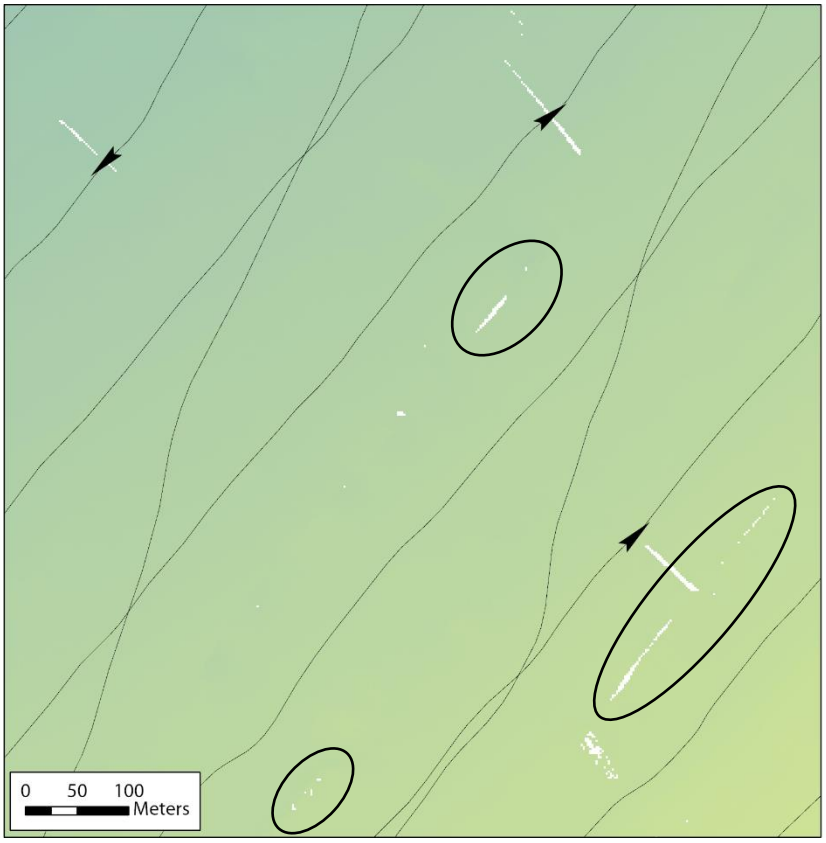


Figure 5 Along- and across-track data gaps in multibeam data set. Across-track data gaps frequently occurred between individual multibeam sonar files; black lines are survey tracklines with arrows indicating start/stop point between individual sonar files. Along-track data gaps, indicated by black circles, were less frequent and generally due to insufficient overlap between adjacent sonar swaths.

DEA evaluated the use of spatial interpolation procedures to fill the data gaps. The spatial interpolation procedure utilizes the surrounding soundings to interpolate depth values for data gaps. After applying interpolation ("Fill Holidays" in CARIS HIPS software) with a 5x5 processing window, nearly all data gaps were filled. As part of the final deliverables accompanying this report, DEA has provided an

interpolated bathymetry surface (2m grid resolution) in BAG and Geotiff formats as well as a polygon shapefile indicating areas that were filled by interpolation.

Three relatively large data gaps are visible in the backscatter imagery. These data gaps correspond to survey lines along which bathymetric data were acquired, however backscatter data were not recorded. These gaps were not able to be filled by spatial interpolation methods.

4.2 Data Artifacts

There are several artifacts present in the final bathymetry and backscatter data products:

- Poor sounding density in deep areas: Survey data acquired in deeper areas feature poor sounding density likely due to low sonar power/gain settings which did not produce a strong bottom detection. The poor sounding density has a detrimental effect on the visual appearance and depth uncertainty in these areas.
- Refraction artifacts throughout the survey area: Refraction artifacts were the result of a large water temperature contrast between the lake surface and lake bottom coupled with insufficient sound velocity measurements. The large water temperature (and therefore water density) contrast resulted in sound speed variations of up to 40 meters per second (m/s) within the water column (Figure 6). The quantity and spatial distribution of sound velocity measurements acquired during survey operations were generally insufficient to appropriately sample the water temperature variation. Due to the resulting poor sound velocity modeling in CARIS HIPS software, the outer beams of each swath were curved upward, resulting in an apparent vertical mismatch between adjacent sonar outer swaths. The artifacts were mitigated by filtering each swath to remove the outer beams, however insufficient overlap between adjacent sonar swaths frequently limited the capacity for filtering. (Figure 7).

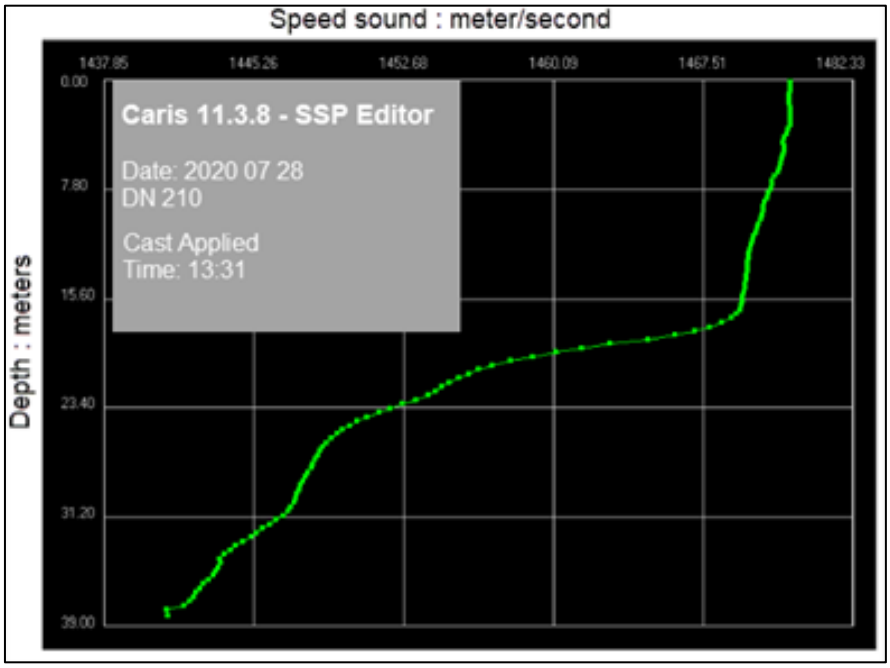


Figure 6 Example sound speed profile acquired on 7/28/2020 during survey operations. Underwater sound speed varies from approximately 1475m/s near the surface to approximately 1445m/s near the lake bottom at a depth of approximately 39m.

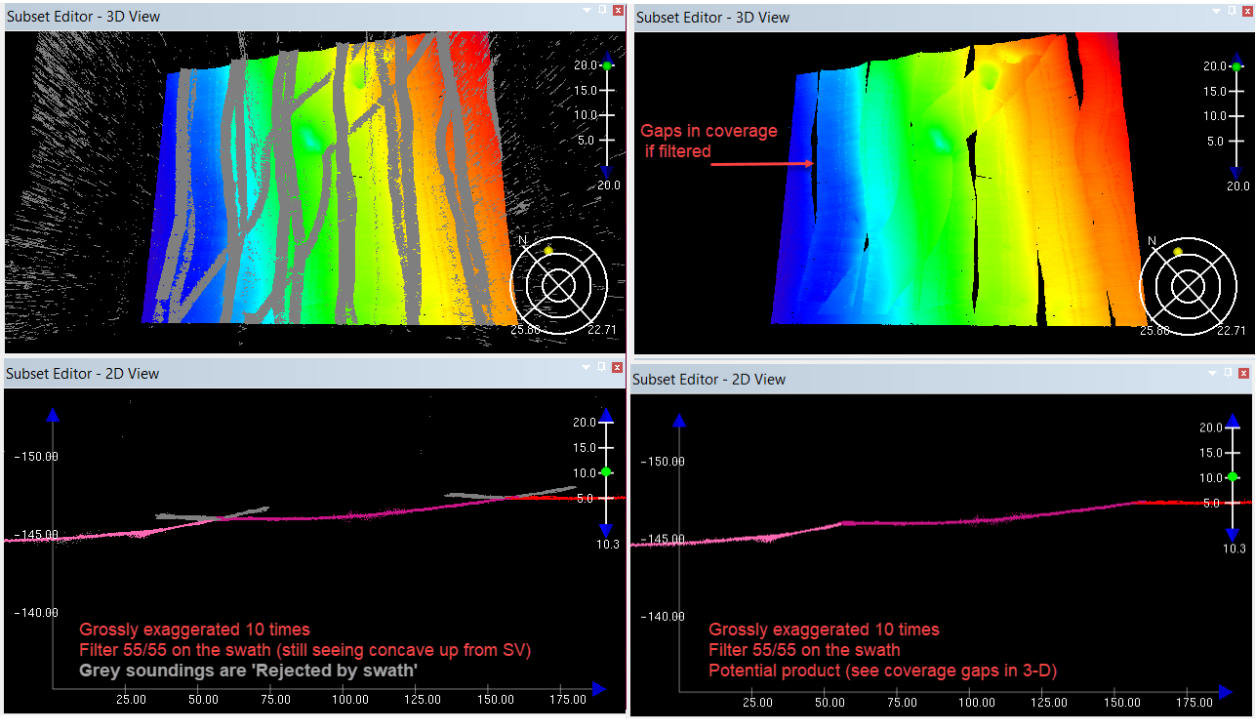


Figure 7 Refraction artifacts in multibeam bathymetry. Top images are plan view; bottom images are across-track profile view. The refraction artifacts were mitigated by filtering each swath to remove the curved outer beams (shown in grey) caused by poor sound velocity modeling, however this was limited due to insufficient overlap which resulted in data gaps between swaths (top right).

- Variations in multibeam backscatter intensity. Variations in multibeam backscatter intensity were visible in the backscatter imagery mosaic as abrupt light or dark patches within a single multibeam data file or mismatches between survey lines and/or survey days. These variations were typically due to changes in sonar operating settings and are not related to substrate variations. DEA examined metadata for multibeam sonar data files and confirmed that sonar settings were frequently adjusted, most likely to tune the sonar for optimal bathymetric data acquisition. A significant amount of manual editing was conducted to blend multibeam backscatter imagery between survey swaths and survey days, however some artifacts remain in the final backscatter imagery.

4.3 Recommended Product Resolution

The specifications and deliverables for this project included bathymetry and backscatter products at 1m grid/pixel resolution. Based on an analysis of sounding density and the numerous data gaps throughout the survey area, DEA recommends a grid/pixel resolution of 2m with spatial interpolation for bathymetry and backscatter products. Both 1m and 2m products are provided with the deliverables.

5. Draft Hydrographic Data Deliverables

The hydrographic data deliverables consist of the following products:

- Bathymetry surface (1m grid resolution; no interpolation applied) in Bathymetric Attributed Grid (BAG) and Geotiff formats. Note that the BAG format contains both Depth and Uncertainty (standard deviation of depth) bands.

- Bathymetry surface (2m grid resolution with interpolation applied) in Bathymetric Attributed Grid (BAG) and Geotiff formats. Note that the BAG format contains both Depth and Holiday (gaps filled by interpolation) bands.
- Polygon shapefile showing interpolated areas in 2m bathymetric surface, in ESRI shapefile format
- Multidirectional, shaded-relief bathymetry derived from the 2m bathymetry surface, in Geotiff format
- Backscatter imagery (1m pixel resolution; no interpolation applied) in Geotiff format
- Backscatter imagery (2m pixel resolution with interpolation applied) in Geotiff format
- Survey tracklines in Environmental Systems Research Institute (ESRI) shapefile format

Metadata are included for all draft hydrographic data deliverables.

All deliverables are referenced to NAD83 Universal Transverse Mercator (UTM) Zone 15 North with horizontal units in meters. Elevation values in bathymetric products are referenced to NAVD88 with units of elevation in meters. Backscatter intensity values in backscatter products are in dB.

All raw survey data (native formats) and processed hydrographic data (Generic Sensor Format (GSF)) will be provided separately on a portable hard drive.

APPENDIX A: Crossline Comparison

Beam Number	Count	Max (+)	Min (-)	Mean	Std Dev	Special Order (%)	Order 1a (%)
1	46660	0.784	1.208	-0.056	0.207	99.979	100.000
2	46803	0.813	1.183	-0.056	0.205	99.981	100.000
3	46973	0.799	1.191	-0.056	0.204	99.987	100.000
4	47174	0.842	1.190	-0.057	0.202	99.985	100.000
5	47382	0.943	1.150	-0.057	0.201	99.992	100.000
6	47470	0.937	1.131	-0.057	0.200	99.998	100.000
7	47556	0.944	1.120	-0.057	0.198	100.000	100.000
8	47687	1.008	1.113	-0.057	0.197	100.000	100.000
9	47829	1.065	1.106	-0.058	0.196	100.000	100.000
10	47984	1.124	1.091	-0.058	0.194	100.000	100.000
11	48084	1.112	1.178	-0.058	0.193	99.998	100.000
12	48199	1.108	1.122	-0.058	0.191	99.996	100.000
13	48286	1.113	1.124	-0.058	0.190	99.996	100.000
14	48383	1.079	1.222	-0.058	0.188	99.998	100.000
15	48461	1.075	1.170	-0.058	0.186	99.998	100.000
16	48578	0.710	1.108	-0.057	0.184	100.000	100.000
17	48609	0.722	1.042	-0.057	0.183	100.000	100.000
18	48715	0.720	1.412	-0.056	0.181	99.998	100.000
19	48847	0.701	1.350	-0.056	0.180	99.998	100.000
20	48875	0.763	1.284	-0.056	0.178	99.998	100.000
21	48922	0.689	1.222	-0.055	0.177	100.000	100.000
22	48970	0.724	1.157	-0.055	0.175	100.000	100.000
23	49060	0.690	1.088	-0.055	0.173	100.000	100.000
24	49071	0.716	1.027	-0.054	0.172	100.000	100.000
25	49146	0.760	0.970	-0.054	0.170	100.000	100.000
26	49233	0.681	0.931	-0.053	0.169	100.000	100.000
27	49272	0.671	0.918	-0.053	0.167	100.000	100.000
28	49307	0.755	0.924	-0.053	0.166	100.000	100.000
29	49334	0.820	0.932	-0.052	0.164	100.000	100.000
30	49355	0.879	0.880	-0.052	0.163	100.000	100.000
31	49361	0.685	0.891	-0.051	0.162	100.000	100.000
32	49375	0.676	0.859	-0.051	0.161	100.000	100.000
33	49384	0.750	0.856	-0.051	0.159	100.000	100.000
34	49391	0.709	0.846	-0.050	0.158	100.000	100.000
35	49426	0.714	0.857	-0.050	0.157	100.000	100.000
36	49451	0.731	0.829	-0.050	0.155	100.000	100.000
37	49430	0.854	0.823	-0.050	0.154	100.000	100.000
38	49444	0.942	0.848	-0.050	0.153	100.000	100.000
39	49433	0.928	0.816	-0.049	0.151	100.000	100.000
40	49454	0.945	1.439	-0.050	0.150	99.998	100.000
41	49486	0.967	2.644	-0.050	0.149	99.996	99.998
42	49499	0.952	2.552	-0.049	0.148	99.994	99.998
43	49485	0.974	2.460	-0.049	0.146	99.994	99.998
44	49492	0.897	2.357	-0.049	0.145	99.992	99.998
45	49526	0.891	2.252	-0.049	0.143	99.996	99.998

46	49533	0.787	2.068	-0.048	0.142	99.996	100.000
47	49544	0.675	2.054	-0.048	0.141	99.992	100.000
48	49586	0.766	1.719	-0.048	0.140	99.994	100.000
49	49626	0.775	1.680	-0.047	0.139	99.994	100.000
50	49660	0.782	1.632	-0.047	0.138	99.994	100.000
51	49665	0.766	1.658	-0.047	0.137	99.994	100.000
52	49663	0.877	1.578	-0.047	0.135	99.994	100.000
53	49705	0.937	2.195	-0.046	0.135	99.994	99.998
54	49733	1.041	2.117	-0.046	0.134	99.994	100.000
55	49746	0.724	2.044	-0.045	0.133	99.992	100.000
56	49755	0.822	1.995	-0.045	0.131	99.992	100.000
57	49783	0.831	1.895	-0.044	0.130	99.996	100.000
58	49766	0.867	1.815	-0.043	0.129	99.996	100.000
59	49803	0.857	1.322	-0.043	0.127	100.000	100.000
60	49863	0.869	1.652	-0.042	0.127	99.998	100.000
61	49874	0.885	1.601	-0.042	0.126	99.998	100.000
62	49886	0.876	1.264	-0.042	0.125	100.000	100.000
63	49900	0.894	1.231	-0.041	0.123	100.000	100.000
64	49917	0.903	1.130	-0.040	0.123	100.000	100.000
65	49903	0.913	1.118	-0.040	0.121	100.000	100.000
66	49916	0.936	0.826	-0.040	0.120	100.000	100.000
67	49913	0.951	1.661	-0.039	0.119	99.998	100.000
68	49919	0.947	1.592	-0.039	0.119	99.996	100.000
69	49908	0.873	1.521	-0.038	0.117	99.998	100.000
70	49963	0.803	1.454	-0.038	0.116	99.998	100.000
71	49988	0.810	1.283	-0.038	0.115	100.000	100.000
72	49971	0.819	1.209	-0.037	0.114	100.000	100.000
73	49968	0.970	0.927	-0.037	0.113	100.000	100.000
74	49966	0.978	0.883	-0.036	0.112	100.000	100.000
75	49989	1.021	0.865	-0.036	0.111	100.000	100.000
76	50001	1.239	1.061	-0.035	0.110	99.998	100.000
77	50007	1.248	0.959	-0.035	0.109	99.996	100.000
78	50009	1.248	0.896	-0.034	0.108	99.998	100.000
79	50038	1.253	0.929	-0.034	0.108	99.998	100.000
80	50053	1.255	0.948	-0.033	0.106	99.996	100.000
81	50065	1.258	0.961	-0.033	0.105	99.996	100.000
82	50086	1.259	1.347	-0.032	0.104	99.994	100.000
83	50079	1.290	1.287	-0.032	0.104	99.994	100.000
84	50054	1.288	1.229	-0.031	0.103	99.996	100.000
85	50045	1.300	1.172	-0.031	0.103	99.994	100.000
86	50070	1.303	1.030	-0.030	0.103	99.994	100.000
87	50082	1.305	1.008	-0.030	0.102	99.996	100.000
88	50095	1.299	0.998	-0.030	0.101	99.996	100.000
89	50114	1.290	0.988	-0.029	0.100	99.996	100.000
90	50136	1.118	0.990	-0.029	0.099	99.998	100.000
91	50162	1.120	0.984	-0.029	0.099	99.998	100.000
92	50165	1.121	0.884	-0.029	0.098	99.998	100.000
93	50153	1.124	0.865	-0.028	0.098	99.996	100.000

94	50154	1.138	1.291	-0.028	0.098	99.996	100.000
95	50186	1.133	1.057	-0.027	0.097	99.998	100.000
96	50198	0.996	1.071	-0.027	0.097	100.000	100.000
97	50199	0.966	1.098	-0.027	0.097	100.000	100.000
98	50208	0.932	1.036	-0.026	0.096	100.000	100.000
99	50246	0.911	0.977	-0.026	0.096	100.000	100.000
100	50234	0.913	0.918	-0.025	0.095	100.000	100.000
101	50211	0.766	2.190	-0.025	0.095	99.998	100.000
102	50222	0.760	1.371	-0.025	0.094	99.998	100.000
103	50200	0.771	1.313	-0.024	0.094	99.996	100.000
104	50199	0.776	1.251	-0.024	0.094	100.000	100.000
105	50206	0.846	1.185	-0.023	0.093	100.000	100.000
106	50224	0.938	0.862	-0.023	0.092	100.000	100.000
107	50254	1.023	0.794	-0.022	0.092	100.000	100.000
108	50232	0.831	0.856	-0.022	0.092	100.000	100.000
109	50236	0.836	0.869	-0.022	0.092	100.000	100.000
110	50238	0.830	0.885	-0.021	0.091	100.000	100.000
111	50226	0.761	0.906	-0.021	0.091	100.000	100.000
112	50219	0.771	0.902	-0.020	0.091	100.000	100.000
113	50215	0.732	0.905	-0.020	0.091	100.000	100.000
114	50227	0.752	1.071	-0.020	0.090	100.000	100.000
115	50248	0.749	1.035	-0.019	0.091	100.000	100.000
116	50268	0.755	0.973	-0.018	0.091	100.000	100.000
117	50264	0.742	0.924	-0.018	0.091	100.000	100.000
118	50264	0.750	1.022	-0.017	0.091	100.000	100.000
119	50241	0.823	1.003	-0.017	0.091	100.000	100.000
120	50263	0.786	0.951	-0.017	0.091	100.000	100.000
121	50258	0.868	0.923	-0.016	0.091	100.000	100.000
122	50236	0.874	0.884	-0.016	0.091	100.000	100.000
123	50237	0.897	0.889	-0.015	0.091	100.000	100.000
124	50245	0.816	0.904	-0.015	0.091	100.000	100.000
125	50261	0.821	0.837	-0.015	0.091	100.000	100.000
126	50268	0.912	0.930	-0.015	0.091	100.000	100.000
127	50276	0.760	0.966	-0.015	0.091	100.000	100.000
128	50306	0.878	0.994	-0.014	0.092	100.000	100.000
129	50296	0.878	1.024	-0.014	0.091	100.000	100.000
130	50292	0.877	1.194	-0.014	0.092	100.000	100.000
131	50299	0.875	1.187	-0.013	0.092	100.000	100.000
132	50309	0.868	1.114	-0.013	0.092	100.000	100.000
133	50303	0.870	1.059	-0.012	0.092	100.000	100.000
134	50271	0.874	0.997	-0.012	0.092	100.000	100.000
135	50265	0.839	0.938	-0.011	0.092	100.000	100.000
136	50288	0.822	0.916	-0.011	0.092	100.000	100.000
137	50297	0.879	1.139	-0.010	0.093	100.000	100.000
138	50298	0.787	0.862	-0.010	0.092	100.000	100.000
139	50280	0.790	0.834	-0.009	0.092	100.000	100.000
140	50263	0.793	0.850	-0.009	0.092	100.000	100.000
141	50260	0.727	0.916	-0.008	0.092	100.000	100.000

142	50245	1.009	0.974	-0.008	0.092	100.000	100.000
143	50249	1.082	0.967	-0.007	0.093	100.000	100.000
144	50262	0.983	1.033	-0.007	0.093	100.000	100.000
145	50244	1.042	1.077	-0.006	0.093	100.000	100.000
146	50236	1.166	1.125	-0.006	0.094	100.000	100.000
147	50243	0.760	1.161	-0.005	0.094	100.000	100.000
148	50225	0.818	1.155	-0.005	0.095	100.000	100.000
149	50218	0.810	1.130	-0.004	0.095	100.000	100.000
150	50227	0.808	0.967	-0.004	0.096	100.000	100.000
151	50200	0.814	0.925	-0.003	0.096	100.000	100.000
152	50156	0.817	0.891	-0.002	0.096	100.000	100.000
153	50137	0.912	1.078	-0.002	0.096	100.000	100.000
154	50142	0.967	1.051	-0.001	0.096	100.000	100.000
155	50125	1.017	1.035	-0.001	0.097	100.000	100.000
156	50123	1.039	1.015	0.000	0.097	100.000	100.000
157	50107	1.259	0.972	0.001	0.098	99.998	100.000
158	50122	1.149	0.926	0.001	0.098	100.000	100.000
159	50123	1.180	0.904	0.002	0.098	100.000	100.000
160	50091	1.267	0.897	0.002	0.099	99.998	100.000
161	50106	1.297	1.117	0.002	0.100	99.990	100.000
162	50084	1.334	1.052	0.003	0.101	99.986	100.000
163	50042	1.346	0.851	0.003	0.100	99.996	100.000
164	50000	1.135	1.083	0.003	0.100	100.000	100.000
165	49943	1.168	0.958	0.003	0.101	100.000	100.000
166	49896	1.175	2.057	0.004	0.101	99.998	99.998
167	49879	1.329	1.170	0.004	0.100	99.998	100.000
168	49867	1.449	1.150	0.005	0.100	99.998	100.000
169	49868	0.738	1.207	0.005	0.101	100.000	100.000
170	49888	0.743	1.141	0.006	0.101	100.000	100.000
171	49854	0.739	0.904	0.007	0.102	100.000	100.000
172	49873	0.748	1.536	0.007	0.103	99.998	100.000
173	49848	0.954	1.046	0.008	0.103	100.000	100.000
174	49823	0.862	0.969	0.008	0.104	100.000	100.000
175	49831	0.903	1.209	0.009	0.104	100.000	100.000
176	49813	0.948	1.174	0.009	0.104	100.000	100.000
177	49849	1.069	1.139	0.009	0.104	100.000	100.000
178	49881	1.103	1.175	0.009	0.105	100.000	100.000
179	49877	1.100	1.109	0.010	0.105	100.000	100.000
180	49905	1.138	0.887	0.010	0.106	100.000	100.000
181	49941	0.675	0.886	0.010	0.106	100.000	100.000
182	49939	0.856	0.985	0.011	0.107	100.000	100.000
183	49925	0.938	0.961	0.011	0.108	100.000	100.000
184	49923	0.885	0.965	0.011	0.108	100.000	100.000
185	49927	0.815	1.085	0.012	0.109	100.000	100.000
186	49924	1.018	1.148	0.012	0.110	100.000	100.000
187	49927	0.814	2.110	0.012	0.111	99.998	99.998
188	49986	0.832	1.985	0.013	0.111	99.998	99.998
189	49966	0.835	1.258	0.013	0.111	99.998	100.000

190	49981	0.817	1.091	0.013	0.111	100.000	100.000
191	49972	0.811	1.028	0.014	0.112	100.000	100.000
192	49994	0.783	1.018	0.014	0.112	100.000	100.000
193	50023	0.955	1.033	0.015	0.112	100.000	100.000
194	50040	1.002	1.546	0.016	0.114	99.998	100.000
195	50031	1.451	1.077	0.016	0.114	99.998	100.000
196	50052	1.485	1.339	0.017	0.115	99.996	100.000
197	50016	1.524	1.424	0.017	0.115	99.994	100.000
198	50046	0.846	1.392	0.017	0.115	99.994	100.000
199	50097	0.830	1.371	0.017	0.116	99.990	100.000
200	50059	1.121	1.384	0.017	0.116	99.992	100.000
201	50059	1.007	1.306	0.018	0.116	99.998	100.000
202	50125	1.056	1.274	0.018	0.117	100.000	100.000
203	50061	1.116	1.351	0.019	0.117	99.998	100.000
204	50072	1.141	1.345	0.019	0.118	99.998	100.000
205	50059	1.120	1.260	0.020	0.119	100.000	100.000
206	50086	1.060	1.155	0.020	0.119	100.000	100.000
207	50078	1.099	1.325	0.021	0.120	100.000	100.000
208	50114	1.297	1.220	0.021	0.120	99.998	100.000
209	50083	1.340	1.203	0.021	0.120	99.998	100.000
210	50048	1.019	1.424	0.022	0.120	99.996	100.000
211	50017	1.120	1.367	0.022	0.121	99.994	100.000
212	49964	0.942	1.347	0.023	0.120	99.998	100.000
213	50038	0.836	1.345	0.023	0.120	99.998	100.000
214	49985	0.827	1.292	0.024	0.120	100.000	100.000
215	49994	0.791	1.275	0.024	0.120	100.000	100.000
216	50026	0.797	1.250	0.024	0.121	100.000	100.000
217	49974	1.260	1.068	0.025	0.121	100.000	100.000
218	50015	0.934	1.123	0.026	0.121	100.000	100.000
219	49988	1.256	0.983	0.026	0.121	99.998	100.000
220	49978	1.189	1.056	0.027	0.121	100.000	100.000
221	49942	1.169	0.949	0.027	0.122	100.000	100.000
222	49974	1.239	0.951	0.028	0.121	100.000	100.000
223	49927	0.844	0.931	0.028	0.121	100.000	100.000
224	49892	0.838	0.920	0.027	0.120	100.000	100.000
225	49886	0.845	0.790	0.028	0.120	100.000	100.000
226	49894	0.925	0.847	0.028	0.121	100.000	100.000
227	49922	0.850	0.895	0.028	0.121	100.000	100.000
228	49977	0.868	0.846	0.028	0.121	100.000	100.000
229	50007	0.874	0.927	0.029	0.121	100.000	100.000
230	50018	1.014	0.799	0.029	0.121	100.000	100.000
231	50020	1.122	0.885	0.030	0.122	100.000	100.000
232	50043	1.134	0.872	0.030	0.122	100.000	100.000
233	50023	0.948	1.331	0.030	0.121	99.998	100.000
234	50031	1.024	0.753	0.030	0.121	100.000	100.000
235	49993	0.931	0.737	0.030	0.121	100.000	100.000
236	50028	0.894	1.032	0.031	0.120	100.000	100.000
237	50040	0.900	1.026	0.031	0.121	100.000	100.000

238	50076	0.910	0.861	0.031	0.121	100.000	100.000
239	50089	0.934	1.339	0.032	0.120	99.998	100.000
240	50060	0.915	1.337	0.032	0.122	99.984	100.000
241	50080	0.922	1.437	0.032	0.123	99.968	100.000
242	49990	0.944	1.523	0.033	0.121	99.980	100.000
243	50009	1.072	0.779	0.034	0.120	100.000	100.000
244	49982	0.745	0.789	0.034	0.120	100.000	100.000
245	49990	0.738	0.880	0.035	0.120	100.000	100.000
246	49969	0.953	0.761	0.036	0.119	100.000	100.000
247	49959	0.926	0.724	0.036	0.120	100.000	100.000
248	49939	0.785	0.772	0.037	0.120	100.000	100.000
249	49940	0.804	0.777	0.037	0.120	100.000	100.000
250	49947	0.831	0.672	0.038	0.119	100.000	100.000
251	49970	0.831	1.241	0.038	0.120	100.000	100.000
252	50001	0.861	1.250	0.039	0.120	100.000	100.000
253	49991	0.835	1.157	0.039	0.120	100.000	100.000
254	49970	0.835	1.110	0.039	0.119	100.000	100.000
255	49944	1.159	0.728	0.039	0.119	100.000	100.000
256	49901	0.820	0.761	0.039	0.118	100.000	100.000
257	49927	1.147	0.732	0.039	0.118	100.000	100.000
258	49920	0.853	0.762	0.039	0.118	100.000	100.000
259	49937	0.837	0.774	0.040	0.118	100.000	100.000
260	49949	0.818	0.725	0.040	0.118	100.000	100.000
261	49948	0.816	0.707	0.041	0.118	100.000	100.000
262	49955	0.951	0.719	0.041	0.119	100.000	100.000
263	49921	0.912	0.728	0.041	0.119	100.000	100.000
264	49888	0.873	0.841	0.042	0.119	100.000	100.000
265	49867	0.869	0.779	0.042	0.119	100.000	100.000
266	49877	0.882	0.887	0.042	0.119	100.000	100.000
267	49878	0.854	1.019	0.042	0.119	100.000	100.000
268	49860	0.960	0.844	0.042	0.119	100.000	100.000
269	49857	1.301	0.856	0.041	0.118	99.998	100.000
270	49817	1.220	0.848	0.042	0.118	100.000	100.000
271	49794	1.191	0.834	0.042	0.118	100.000	100.000
272	49901	1.382	1.140	0.041	0.119	99.998	100.000
273	49892	1.358	0.808	0.041	0.119	99.996	100.000
274	49872	1.305	0.850	0.042	0.119	99.996	100.000
275	49872	1.322	0.881	0.042	0.118	99.998	100.000
276	49862	1.522	0.897	0.043	0.118	99.998	100.000
277	49839	1.424	1.013	0.043	0.119	99.996	100.000
278	49874	1.405	1.056	0.044	0.119	99.994	100.000
279	49870	1.290	1.022	0.044	0.119	99.998	100.000
280	49840	0.943	0.972	0.044	0.118	100.000	100.000
281	49785	0.905	1.003	0.044	0.118	100.000	100.000
282	49783	0.889	0.830	0.045	0.117	100.000	100.000
283	49751	0.898	0.938	0.046	0.117	100.000	100.000
284	49731	0.924	0.974	0.046	0.117	100.000	100.000
285	49750	1.232	0.994	0.046	0.117	100.000	100.000

286	49709	1.203	0.980	0.046	0.118	100.000	100.000
287	49751	1.142	1.142	0.046	0.117	100.000	100.000
288	49757	1.468	1.305	0.047	0.116	99.996	100.000
289	49756	1.459	0.947	0.047	0.116	99.992	100.000
290	49688	1.373	0.988	0.047	0.117	99.990	100.000
291	49713	1.826	1.023	0.047	0.117	99.994	100.000
292	49657	1.807	1.030	0.047	0.116	99.992	100.000
293	49674	1.280	1.064	0.047	0.116	99.994	100.000
294	49630	1.328	1.137	0.046	0.117	99.996	100.000
295	49652	1.185	1.248	0.046	0.117	100.000	100.000
296	49643	1.078	1.268	0.046	0.117	100.000	100.000
297	49642	0.970	1.130	0.046	0.116	100.000	100.000
298	49625	1.260	0.886	0.046	0.114	100.000	100.000
299	49591	0.980	0.761	0.046	0.114	100.000	100.000
300	49559	0.923	0.798	0.046	0.114	100.000	100.000
301	49532	0.914	0.844	0.046	0.113	100.000	100.000
302	49499	0.982	0.878	0.046	0.113	100.000	100.000
303	49514	0.949	0.865	0.046	0.113	100.000	100.000
304	49521	1.316	0.753	0.046	0.113	99.998	100.000
305	49550	1.323	0.858	0.046	0.113	99.994	100.000
306	49552	1.280	0.950	0.045	0.113	99.996	100.000
307	49567	0.972	0.876	0.045	0.112	100.000	100.000
308	49552	1.024	0.843	0.046	0.111	100.000	100.000
309	49557	1.279	0.922	0.045	0.111	99.998	100.000
310	49570	1.224	0.801	0.045	0.111	100.000	100.000
311	49576	1.287	0.868	0.045	0.110	99.996	100.000
312	49579	1.223	0.891	0.045	0.110	100.000	100.000
313	49604	1.164	0.939	0.045	0.110	100.000	100.000
314	49615	1.153	1.121	0.044	0.110	100.000	100.000
315	49618	0.871	1.037	0.044	0.109	100.000	100.000
316	49598	0.840	1.086	0.044	0.109	100.000	100.000
317	49622	1.498	1.230	0.044	0.109	99.998	100.000
318	49618	1.087	0.979	0.043	0.109	100.000	100.000
319	49592	0.963	0.991	0.043	0.108	100.000	100.000
320	49606	0.918	1.019	0.042	0.107	100.000	100.000
321	49593	0.821	1.394	0.041	0.107	99.998	100.000
322	49558	2.124	0.961	0.040	0.108	99.994	100.000
323	49550	2.096	1.010	0.040	0.109	99.992	100.000
324	49508	1.980	1.054	0.040	0.108	99.996	100.000
325	49503	1.433	1.219	0.040	0.108	99.982	100.000
326	49522	1.407	1.400	0.039	0.108	99.988	100.000
327	49543	1.219	0.993	0.038	0.108	100.000	100.000
328	49518	1.384	0.858	0.038	0.107	99.998	100.000
329	49522	1.321	0.908	0.037	0.106	99.998	100.000
330	49511	1.280	1.006	0.037	0.106	100.000	100.000
331	49511	1.067	1.098	0.036	0.106	100.000	100.000
332	49517	1.121	1.398	0.035	0.104	99.998	100.000
333	49450	2.111	1.262	0.035	0.104	99.996	100.000

334	49490	1.107	1.406	0.035	0.104	99.996	100.000
335	49456	1.130	1.459	0.034	0.103	99.998	100.000
336	49434	1.165	1.360	0.033	0.103	99.998	100.000
337	49449	1.150	1.393	0.033	0.102	99.998	100.000
338	49472	1.165	1.678	0.032	0.102	99.996	100.000
339	49463	1.115	1.236	0.032	0.101	100.000	100.000
340	49506	1.066	1.134	0.031	0.101	100.000	100.000
341	49534	1.131	1.197	0.031	0.101	100.000	100.000
342	49601	1.983	1.201	0.030	0.102	99.994	100.000
343	49537	1.925	1.227	0.030	0.102	99.994	100.000
344	49559	1.613	1.059	0.030	0.101	99.996	100.000
345	49547	1.109	1.291	0.029	0.101	100.000	100.000
346	49584	0.936	1.337	0.028	0.100	99.996	100.000
347	49586	1.155	1.366	0.027	0.100	99.998	100.000
348	49572	0.867	1.391	0.026	0.100	99.998	100.000
349	49587	1.672	1.429	0.026	0.100	99.996	100.000
350	49620	1.605	1.550	0.025	0.100	99.992	100.000
351	49654	1.533	1.628	0.024	0.101	99.986	100.000
352	49629	1.371	1.651	0.024	0.100	99.988	100.000
353	49647	1.249	1.673	0.023	0.099	99.992	100.000
354	49653	1.172	1.678	0.023	0.099	99.994	100.000
355	49656	1.098	1.600	0.022	0.098	99.996	100.000
356	49675	1.044	1.624	0.021	0.098	99.998	100.000
357	49664	1.105	0.993	0.020	0.097	100.000	100.000
358	49691	1.269	1.043	0.019	0.097	99.998	100.000
359	49725	1.157	1.088	0.018	0.096	100.000	100.000
360	49694	1.958	1.128	0.018	0.096	99.998	100.000
361	49739	2.005	0.778	0.017	0.096	99.998	100.000
362	49739	1.965	0.811	0.016	0.095	99.996	100.000
363	49740	1.911	0.870	0.015	0.095	99.996	100.000
364	49723	1.867	1.073	0.014	0.095	99.996	100.000
365	49712	1.783	1.022	0.013	0.095	99.992	100.000
366	49721	1.720	1.084	0.012	0.095	99.994	100.000
367	49727	1.629	1.236	0.012	0.095	99.996	100.000
368	49757	1.863	1.150	0.011	0.095	99.996	100.000
369	49746	1.840	1.157	0.010	0.094	99.996	100.000
370	49737	1.720	0.807	0.009	0.094	99.996	100.000
371	49739	1.301	0.731	0.008	0.093	99.998	100.000
372	49760	1.262	0.679	0.007	0.093	99.998	100.000
373	49752	1.113	1.242	0.006	0.093	100.000	100.000
374	49752	1.266	0.732	0.005	0.093	99.998	100.000
375	49820	1.178	0.763	0.004	0.093	100.000	100.000
376	49813	1.223	0.797	0.003	0.093	100.000	100.000
377	49848	1.171	0.726	0.002	0.094	100.000	100.000
378	49829	1.089	0.745	0.001	0.094	100.000	100.000
379	49846	1.042	0.793	0.000	0.094	100.000	100.000
380	49845	1.123	0.846	-0.001	0.094	100.000	100.000
381	49848	1.042	1.220	-0.002	0.095	100.000	100.000

382	49861	1.412	0.655	-0.003	0.095	99.998	100.000
383	49842	1.428	0.696	-0.004	0.095	99.998	100.000
384	49834	1.356	0.701	-0.005	0.095	99.998	100.000
385	49793	1.085	0.817	-0.006	0.096	100.000	100.000
386	49777	0.955	0.687	-0.007	0.096	100.000	100.000
387	49750	0.829	0.727	-0.008	0.096	100.000	100.000
388	49793	0.872	0.820	-0.009	0.096	100.000	100.000
389	49808	0.864	0.995	-0.010	0.097	100.000	100.000
390	49821	0.853	1.003	-0.011	0.098	100.000	100.000
391	49843	0.947	0.772	-0.012	0.098	100.000	100.000
392	49842	0.945	0.777	-0.013	0.098	100.000	100.000
393	49852	0.947	0.758	-0.014	0.099	100.000	100.000
394	49833	1.625	1.084	-0.015	0.100	99.996	100.000
395	49824	1.680	1.251	-0.016	0.100	99.992	100.000
396	49821	1.485	0.814	-0.017	0.101	99.990	100.000
397	49792	1.645	0.854	-0.018	0.101	99.988	100.000
398	49803	1.587	1.720	-0.019	0.102	99.990	100.000
399	49777	1.529	0.807	-0.020	0.101	99.992	100.000
400	49800	1.473	0.772	-0.021	0.102	99.996	100.000
401	49770	1.072	0.789	-0.022	0.102	99.998	100.000
402	49778	1.235	0.795	-0.023	0.103	99.998	100.000
403	49764	1.236	1.107	-0.025	0.104	99.996	100.000
404	49758	1.660	1.453	-0.026	0.105	99.990	100.000
405	49752	1.351	1.339	-0.027	0.106	99.988	100.000
406	49748	1.611	1.429	-0.028	0.107	99.984	100.000
407	49710	1.574	1.109	-0.029	0.107	99.982	100.000
408	49699	1.626	1.125	-0.030	0.107	99.982	100.000
409	49672	1.568	1.164	-0.031	0.108	99.986	100.000
410	49668	1.511	2.002	-0.032	0.109	99.988	100.000
411	49699	1.426	2.039	-0.034	0.110	99.988	100.000
412	49700	1.428	1.724	-0.035	0.110	99.988	100.000
413	49650	1.287	1.371	-0.036	0.110	99.988	100.000
414	49647	1.244	1.423	-0.037	0.111	99.986	100.000
415	49656	1.189	1.477	-0.038	0.111	99.992	100.000
416	49667	1.159	1.399	-0.039	0.112	99.992	100.000
417	49662	1.239	1.575	-0.040	0.112	99.996	100.000
418	49655	1.143	1.787	-0.041	0.113	99.994	100.000
419	49606	1.152	1.764	-0.042	0.114	99.996	100.000
420	49602	1.205	1.729	-0.043	0.115	99.996	100.000
421	49589	1.090	1.778	-0.045	0.115	99.998	100.000
422	49558	1.049	1.826	-0.046	0.116	99.996	100.000
423	49539	0.982	1.877	-0.047	0.117	99.996	100.000
424	49532	0.968	1.856	-0.048	0.118	99.998	100.000
425	49536	0.890	1.975	-0.049	0.119	99.998	100.000
426	49507	0.874	2.023	-0.050	0.120	99.998	100.000
427	49530	1.082	2.069	-0.051	0.121	99.998	100.000
428	49514	1.338	1.779	-0.052	0.122	99.994	100.000
429	49511	1.299	1.804	-0.053	0.123	99.994	100.000

430	49513	1.229	2.116	-0.055	0.124	99.996	100.000
431	49511	1.210	2.259	-0.056	0.125	99.998	100.000
432	49506	1.124	2.170	-0.057	0.126	99.998	100.000
433	49509	1.086	2.291	-0.058	0.126	99.998	99.998
434	49508	1.289	1.900	-0.059	0.128	99.994	100.000
435	49488	1.213	2.402	-0.061	0.129	99.994	99.998
436	49472	1.198	2.490	-0.062	0.130	99.996	99.996
437	49486	1.119	2.535	-0.063	0.131	99.996	99.996
438	49463	1.105	2.560	-0.065	0.133	99.994	99.994
439	49452	1.097	2.593	-0.066	0.133	99.996	99.996
440	49432	1.051	2.657	-0.067	0.134	99.996	99.996
441	49441	1.018	2.714	-0.068	0.136	99.994	99.994
442	49432	0.981	2.760	-0.070	0.136	99.996	99.996
443	49445	1.039	2.584	-0.071	0.137	99.998	99.998
444	49436	0.976	2.622	-0.072	0.138	99.998	99.998
445	49429	0.921	2.865	-0.073	0.140	99.996	99.996
446	49420	0.990	2.670	-0.074	0.141	99.996	99.996
447	49434	0.996	2.687	-0.076	0.142	99.996	99.996
448	49407	1.458	2.962	-0.077	0.144	99.994	99.996
449	49395	1.390	2.788	-0.078	0.145	99.996	99.998
450	49375	1.337	2.403	-0.079	0.146	99.996	99.998
451	49350	1.288	1.093	-0.081	0.148	99.998	100.000
452	49344	1.256	1.371	-0.081	0.149	99.998	100.000
453	49342	1.193	1.266	-0.082	0.151	100.000	100.000
454	49352	1.091	1.226	-0.084	0.153	100.000	100.000
455	49342	1.085	1.267	-0.085	0.154	100.000	100.000
456	49348	1.009	1.306	-0.086	0.155	99.998	100.000
457	49348	0.989	2.079	-0.088	0.157	99.984	100.000
458	49353	1.139	1.949	-0.089	0.158	99.984	100.000
459	49322	1.114	1.549	-0.090	0.159	99.988	100.000
460	49323	1.080	1.578	-0.092	0.161	99.986	100.000
461	49299	1.181	2.007	-0.093	0.162	99.988	100.000
462	49300	1.117	1.526	-0.094	0.163	99.996	100.000
463	49300	1.074	1.568	-0.096	0.164	99.996	100.000
464	49281	1.021	1.593	-0.097	0.165	99.998	100.000
465	49274	0.827	1.068	-0.099	0.166	100.000	100.000
466	49263	1.448	2.518	-0.100	0.168	99.996	99.998
467	49257	1.396	0.954	-0.101	0.168	99.998	100.000
468	49240	1.335	0.973	-0.103	0.170	99.998	100.000
469	49210	1.275	0.992	-0.104	0.172	99.998	100.000
470	49205	1.221	1.008	-0.106	0.173	100.000	100.000
471	49158	1.160	1.022	-0.107	0.174	99.998	100.000
472	49150	1.100	1.023	-0.108	0.176	99.998	100.000
473	49109	1.044	1.046	-0.110	0.178	99.998	100.000
474	49114	0.989	1.056	-0.111	0.179	99.998	100.000
475	49073	0.986	1.025	-0.112	0.182	99.998	100.000
476	49049	0.873	1.027	-0.113	0.183	99.998	100.000
477	49024	0.817	1.028	-0.115	0.185	99.998	100.000

478	48993	1.021	1.022	-0.116	0.187	99.998	100.000
479	48993	0.992	1.048	-0.117	0.188	100.000	100.000
480	48993	0.962	1.097	-0.119	0.190	100.000	100.000
481	48976	0.932	1.146	-0.120	0.191	99.998	100.000
482	48934	0.900	1.194	-0.122	0.193	100.000	100.000
483	48931	0.861	1.241	-0.123	0.194	100.000	100.000
484	48895	0.819	1.289	-0.124	0.196	99.998	100.000
485	48845	0.789	1.335	-0.125	0.198	99.998	100.000
486	48863	0.988	1.280	-0.126	0.200	99.998	100.000
487	48835	0.932	1.309	-0.127	0.201	99.996	100.000
488	48769	0.875	1.063	-0.128	0.203	99.998	100.000
489	48751	0.900	1.085	-0.129	0.205	100.000	100.000
490	48720	0.991	1.083	-0.131	0.207	100.000	100.000
491	48715	0.889	1.097	-0.132	0.209	100.000	100.000
492	48664	1.167	1.092	-0.133	0.210	99.998	100.000
493	48616	1.117	1.099	-0.134	0.212	100.000	100.000
494	48580	1.086	1.113	-0.136	0.214	100.000	100.000
495	48496	1.061	1.123	-0.137	0.216	99.998	100.000
496	48432	1.052	1.128	-0.138	0.218	99.994	100.000
497	48358	1.029	1.156	-0.140	0.219	99.990	100.000
498	48304	1.175	1.167	-0.141	0.221	99.992	100.000
499	48242	0.982	1.188	-0.142	0.222	99.983	100.000
500	48146	1.023	1.314	-0.144	0.224	99.969	100.000
501	48106	0.971	1.200	-0.145	0.226	99.963	100.000
502	48062	0.933	1.223	-0.147	0.228	99.936	100.000
503	47971	0.900	1.226	-0.148	0.229	99.904	100.000
504	47853	0.854	1.245	-0.149	0.231	99.889	100.000
505	47744	0.808	1.258	-0.151	0.233	99.845	100.000
506	47641	0.782	2.577	-0.152	0.235	99.826	99.998
507	47549	0.806	2.519	-0.153	0.237	99.796	99.998
508	47403	0.798	2.570	-0.155	0.238	99.766	99.998
509	47276	0.907	1.320	-0.156	0.240	99.753	100.000
510	47194	0.938	1.315	-0.157	0.241	99.718	100.000
511	47082	0.816	1.304	-0.158	0.243	99.688	100.000