

Listening for Sediment Transport (L4ST) Project Report

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Experiment Name:

Listening for sediment transport and ice breakup in an Arctic river: Exploring the potential of geophones for quantifying bedload transport and river ice break up in the Canning River, Alaska

Project Description:

In this project, we installed two passive seismic stations along the Canning River on Alaska's North Slope to monitor river bedload transport and river ice breakup from 26 March to 31 July 2023. Each station consisted of a 4.5 Hz 3-channel geophone, a Centaur data logger, battery, and solar panel. These stations were installed on low river terraces 30-40 m away from the bank of the active river channel. To characterize signal propagation through the ground at these two stations, we conducted active seismic experiments using five SmartSolo nodes and manual signal generation with a sledge hammer and aluminum plate. We conducted active experiments at the end of the passive station deployment, on 28 and 31 July 2023. At each station, we arranged the single nodes in three arrays. For each array, we triggered 10 shots on one end of the array and 10 shots on the opposite end of the array, to analyze signal propagation through the substrate. Our goal is to use the active seismic experiment data to calibrate the passive geophone data, and ultimately estimate changes in river water discharge, ice cover, and bed sediment transport rates in the Canning River over spring to summer 2023.

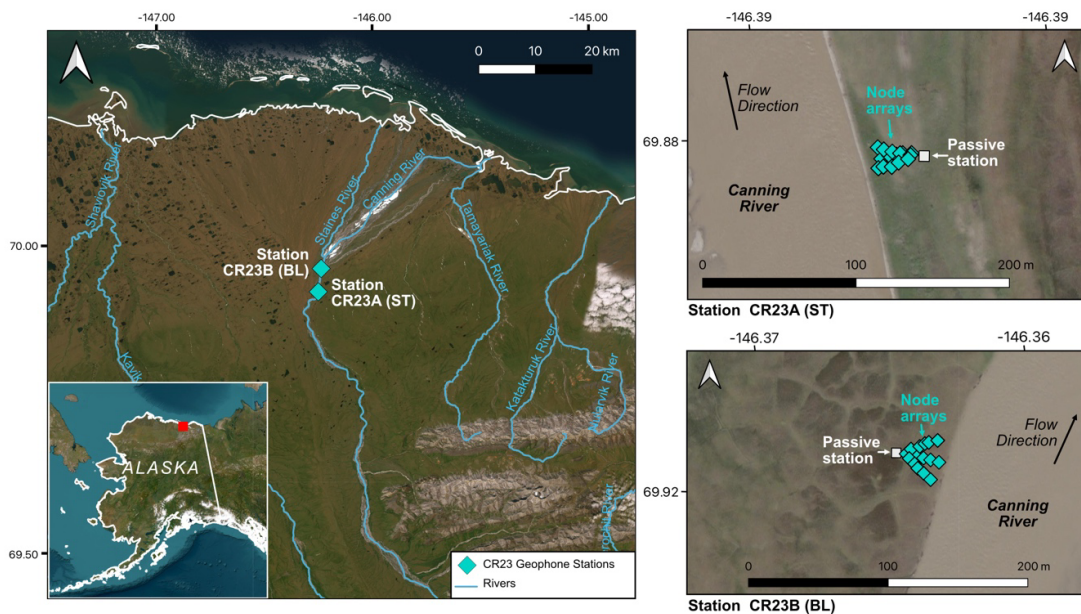


Figure 1. Overview map of Canning River study area showing locations of passive geophone stations and active experiment node arrays.

Table 1. Node array location data.

Array	Numeric Array	Distance from plate (m)	sensor S/N	latitude (decimal degrees)	longitude (decimal degrees)	Elevation (m)	station #	Time on (AK time)	Time on (UTC)
CR23_BL_A	11	25	45301 4324	69.918757	-146.3626	95	0215	7/31/23 10:49	7/31/23 16:49
CR23_BL_A	11	20	45301 3626	69.918737	-146.3625	95	0214	7/31/23 10:49	7/31/23 16:49
CR23_BL_A	11	15	45301 3349	69.918716	-146.3624	95	0213	7/31/23 10:49	7/31/23 16:49
CR23_BL_A	11	10	45301 2136	69.91869	-146.3623	95	0212	7/31/23 10:49	7/31/23 16:49
CR23_BL_A	11	5	45301 3711	69.918637	-146.3622	95	0211	7/31/23 10:49	7/31/23 16:49
CR23_BL_B	12	25	45301 4324	69.91879	-146.3626	95	0225	7/31/23 12:29	7/31/23 20:29
CR23_BL_B	12	20	45301 3626	69.918801	-146.3624	95	0224	7/31/23 12:29	7/31/23 20:29
CR23_BL_B	12	15	45301 3349	69.918816	-146.3623	95	0223	7/31/23 12:29	7/31/23 20:29
CR23_BL_B	12	10	45301 2136	69.918821	-146.3623	95	0222	7/31/23 12:29	7/31/23 20:29
CR23_BL_B	12	5	45301 3711	69.918827	-146.3621	95	0221	7/31/23 12:29	7/31/23 20:29
CR23_BL_C	13	25	45301 4324	69.91873	-146.3627	95	0235	7/31/23 13:36	7/31/23 21:36
CR23_BL_C	13	20	45301 3626	69.918691	-146.3626	95	0234	7/31/23 13:36	7/31/23 21:36
CR23_BL_C	13	15	45301 3349	69.918659	-146.3625	95	0233	7/31/23 13:36	7/31/23 21:36
CR23_BL_C	13	10	45301 2136	69.918621	-146.3624	95	0232	7/31/23 13:36	7/31/23 21:36
CR23_BL_C	13	5	45301 3711	69.918579	-146.3624	95	0231	7/31/23 13:36	7/31/23 21:36
CR23_ST_A	01	4.9	45301 3711	69.881596	-146.3883	105	0111	7/28/23 11:05	7/28/23 19:00
CR23_ST_A	01	10	45301 2136	69.88161	-146.3882	105	0112	7/28/23 11:05	7/28/23 19:00
CR23_ST_A	01	15	45301 3349	69.88161	-146.3881	105	0113	7/28/23 11:05	7/28/23 19:00
CR23_ST_A	01	20	45301 3626	69.881614	-146.3879	105	0114	7/28/23 11:05	7/28/23 19:00
CR23_ST_A	01	25	45301 4324	69.881609	-146.3878	105	0115	7/28/23 11:05	7/28/23 19:00
CR23_ST_B	02	5	45301 3711	69.88165	-146.3884	105	0121	7/28/23 13:50	7/28/23 20:50
CR23_ST_B	02	10	45301 2136	69.88165	-146.3883	105	0122	7/28/23 13:50	7/28/23 20:50
CR23_ST_B	02	15	45301 3349	69.881623	-146.3881	105	0123	7/28/23 13:50	7/28/23 20:50
CR23_ST_B	02	20	45301 3626	69.881616	-146.388	105	0124	7/28/23 13:50	7/28/23 20:50
CR23_ST_B	02	27	45301 4324	69.881598	-146.3878	105	0125	7/28/23 13:50	7/28/23 20:50

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CR23_ST_C	03	5	45301 3711	69.881542	-146.3884	105	0131	7/28/23 13:40	7/29/23 1:40
CR23_ST_C	03	10	45301 2136	69.881548	-146.3883	105	0132	7/28/23 13:40	7/29/23 1:40
CR23_ST_C	03	15	45301 3349	69.881541	-146.3882	105	0133	7/28/23 13:40	7/29/23 1:40
CR23_ST_C	03	20	45301 3626	69.881562	-146.388	105	0134	7/28/23 13:40	7/29/23 1:40
CR23_ST_C	03	25	45301 4324	69.881576	-146.3879	105	0135	7/28/23 13:40	7/29/23 1:40

Table 2. Shot timing and plate location data.

Array	Numeric Array	Shot-ID (id_s)	Numeric ID	Latitude (deg)	Longitude (deg)	Elevation (m)	Date	Shot-time(UTC)
CR23_ST_A1	101	A1-1	1010	69.881666	-146.38850	105	07/28/23	19:05:46.806767
CR23_ST_A1	101	A1-2	1011	69.881666	-146.38850	105	07/28/23	19:07:11.458738
CR23_ST_A1	101	A1-3	1012	69.881666	-146.38850	105	07/28/23	19:07:49.477636
CR23_ST_A1	101	A1-4	1013	69.881666	-146.38850	105	07/28/23	19:08:20.361380
CR23_ST_A1	101	A1-5	1014	69.881666	-146.38850	105	07/28/23	19:08:53.330600
CR23_ST_A1	101	A1-6	1015	69.881666	-146.38850	105	07/28/23	19:09:26.659921
CR23_ST_A1	101	A1-7	1016	69.881666	-146.38850	105	07/28/23	19:10:05.293704
CR23_ST_A1	101	A1-8	1017	69.881666	-146.38850	105	07/28/23	19:10:36.948032
CR23_ST_A1	101	A1-9	1018	69.881666	-146.38850	105	07/28/23	19:11:06.495966
CR23_ST_A1	101	A1-10	1019	69.881666	-146.38850	105	07/28/23	19:11:49.835510
CR23_ST_A2	201	A2-1	2010	69.881597	-146.38768	105	07/28/23	19:31:32.262892
CR23_ST_A2	201	A2-2	2011	69.881597	-146.38768	105	07/28/23	19:32:13.100862
CR23_ST_A2	201	A2-3	2012	69.881597	-146.38768	105	07/28/23	19:32:51.878354
CR23_ST_A2	201	A2-4	2013	69.881597	-146.38768	105	07/28/23	19:33:23.729116
CR23_ST_A2	201	A2-5	2014	69.881597	-146.38768	105	07/28/23	19:33:52.491291
CR23_ST_A2	201	A2-6	2015	69.881597	-146.38768	105	07/28/23	19:34:20.283012
CR23_ST_A2	201	A2-7	2016	69.881597	-146.38768	105	07/28/23	19:34:50.550678
CR23_ST_A2	201	A2-8	2017	69.881597	-146.38768	105	07/28/23	19:35:20.541895
CR23_ST_A2	201	A2-9	2018	69.881597	-146.38768	105	07/28/23	19:35:51.323011
CR23_ST_A2	201	A2-10	2019	69.881597	-146.38768	105	07/28/23	19:36:15.729755
CR23_ST_B1	102	B1-1	1020	69.881597	-146.38768	105	07/28/23	20:58:24.171058
CR23_ST_B1	102	B1-2	1021	69.881597	-146.38768	105	07/28/23	20:58:56.662270
CR23_ST_B1	102	B1-3	1022	69.881597	-146.38768	105	07/28/23	20:59:20.120673
CR23_ST_B1	102	B1-4	1023	69.881597	-146.38768	105	07/28/23	20:59:48.793873
CR23_ST_B1	102	B1-5	1024	69.881597	-146.38768	105	07/28/23	21:00:09.010789
CR23_ST_B1	102	B1-6	1025	69.881597	-146.38768	105	07/28/23	21:00:28.020579
CR23_ST_B1	102	B1-7	1026	69.881597	-146.38768	105	07/28/23	21:00:49.265855
CR23_ST_B1	102	B1-8	1027	69.881597	-146.38768	105	07/28/23	21:01:10.836670

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CR23_ST_B1	102	B1-9	1028	69.881597	-146.38768	105	07/28/23	21:01:30.454486
CR23_ST_B1	102	B1-10	1029	69.881597	-146.38768	105	07/28/23	21:01:51.233788
CR23_ST_B2	202	B2-1	2020	69.8816	-146.38846	105	07/28/23	21:06:59.718322
CR23_ST_B2	202	B2-2	2021	69.8816	-146.38846	105	07/28/23	21:07:27.353959
CR23_ST_B2	202	B2-3	2022	69.8816	-146.38846	105	07/28/23	21:07:45.090611
CR23_ST_B2	202	B2-4	2023	69.8816	-146.38846	105	07/28/23	21:08:04.110119
CR23_ST_B2	202	B2-5	2024	69.8816	-146.38846	105	07/28/23	21:08:25.677820
CR23_ST_B2	202	B2-6	2025	69.8816	-146.38846	105	07/28/23	21:08:45.677478
CR23_ST_B2	202	B2-7	2026	69.8816	-146.38846	105	07/28/23	21:09:05.925264
CR23_ST_B2	202	B2-8	2027	69.8816	-146.38846	105	07/28/23	21:09:24.625007
CR23_ST_B2	202	B2-9	2028	69.8816	-146.38846	105	07/28/23	21:09:43.444594
CR23_ST_B2	202	B2-10	2029	69.8816	-146.38846	105	07/28/23	21:10:01.927345
CR23_ST_C1	103	C1-1	1030	69.881537	-146.38851	105	07/28/23	01:43:28.877774
CR23_ST_C1	103	C1-2	1031	69.881537	-146.38851	105	07/28/23	01:44:00.562333
CR23_ST_C1	103	C1-3	1032	69.881537	-146.38851	105	07/28/23	01:44:26.156282
CR23_ST_C1	103	C1-4	1033	69.881537	-146.38851	105	07/28/23	01:44:51.629358
CR23_ST_C1	103	C1-5	1034	69.881537	-146.38851	105	07/28/23	01:45:16.765480
CR23_ST_C1	103	C1-6	1035	69.881537	-146.38851	105	07/28/23	01:45:42.006897
CR23_ST_C1	103	C1-7	1036	69.881537	-146.38851	105	07/28/23	01:46:03.243523
CR23_ST_C1	103	C1-8	1037	69.881537	-146.38851	105	07/28/23	01:46:27.884047
CR23_ST_C1	103	C1-9	1038	69.881537	-146.38851	105	07/28/23	01:46:54.194943
CR23_ST_C1	103	C1-10	1039	69.881537	-146.38851	105	07/28/23	01:47:17.651365
CR23_ST_C2	203	C2-1	2030	69.881587	-146.38773	105	07/28/23	01:52:04.729339
CR23_ST_C2	203	C2-2	2031	69.881587	-146.38773	105	07/28/23	01:52:26.014776
CR23_ST_C2	203	C2-3	2032	69.881587	-146.38773	105	07/28/23	01:52:48.326027
CR23_ST_C2	203	C2-4	2033	69.881587	-146.38773	105	07/28/23	01:53:05.270409
CR23_ST_C2	203	C2-5	2034	69.881587	-146.38773	105	07/28/23	01:53:23.767668
CR23_ST_C2	203	C2-6	2035	69.881587	-146.38773	105	07/28/23	01:53:42.957426
CR23_ST_C2	203	C2-7	2036	69.881587	-146.38773	105	07/28/23	01:54:04.370180
CR23_ST_C2	203	C2-8	2037	69.881587	-146.38773	105	07/28/23	01:54:25.855533
CR23_ST_C2	203	C2-9	2038	69.881587	-146.38773	105	07/28/23	01:55:01.677846
CR23_ST_C2	203	C2-10	2039	69.881587	-146.38773	105	07/28/23	01:55:23.668265
CR23_BL_A1	111	A1-1	1110	69.918621	-146.36208	95	07/31/23	19:07:26.503591
CR23_BL_A1	111	A1-2	1111	69.918621	-146.36208	95	07/31/23	19:07:51.364070
CR23_BL_A1	111	A1-3	1112	69.918621	-146.36208	95	07/31/23	19:08:16.748411
CR23_BL_A1	111	A1-4	1113	69.918621	-146.36208	95	07/31/23	19:08:40.302797
CR23_BL_A1	111	A1-5	1114	69.918621	-146.36208	95	07/31/23	19:09:03.941195
CR23_BL_A1	111	A1-6	1115	69.918621	-146.36208	95	07/31/23	19:09:36.837154
CR23_BL_A1	111	A1-7	1116	69.918621	-146.36208	95	07/31/23	19:09:48.140617
CR23_BL_A1	111	A1-8	1117	69.918621	-146.36208	95	07/31/23	19:10:06.487819
CR23_BL_A1	111	A1-9	1118	69.918621	-146.36208	95	07/31/23	19:10:26.393251

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CR23_BL_A1	111	A1-10	1119	69.918621	-146.36208	95	07/31/23	19:10:44.645318
CR23_BL_A2	211	A2-1	2110	69.918772	-146.36273	95	07/31/23	19:20:28.901057
CR23_BL_A2	211	A2-2	2111	69.918772	-146.36273	95	07/31/23	19:20:52.631634
CR23_BL_A2	211	A2-3	2112	69.918772	-146.36273	95	07/31/23	19:21:12.701612
CR23_BL_A2	211	A2-4	2113	69.918772	-146.36273	95	07/31/23	19:21:30.517711
CR23_BL_A2	211	A2-5	2114	69.918772	-146.36273	95	07/31/23	19:22:03.966362
CR23_BL_A2	211	A2-6	2115	69.918772	-146.36273	95	07/31/23	19:22:21.497563
CR23_BL_A2	211	A2-7	2116	69.918772	-146.36273	95	07/31/23	19:22:42.601156
CR23_BL_A2	211	A2-8	2117	69.918772	-146.36273	95	07/31/23	19:23:02.931204
CR23_BL_A2	211	A2-9	2118	69.918772	-146.36273	95	07/31/23	19:23:21.412001
CR23_BL_A2	211	A2-10	2119	69.918772	-146.36273	95	07/31/23	19:23:41.000000
CR23_BL_A2	211	A2-11	21110	69.918772	-146.36273	95	07/31/23	19:23:57.735130
CR23_BL_B1	112	B1-1	1120	69.918772	-146.36273	95	07/31/23	20:49:12.624926
CR23_BL_B1	112	B1-2	1121	69.918772	-146.36273	95	07/31/23	20:49:36.037486
CR23_BL_B1	112	B1-3	1122	69.918772	-146.36273	95	07/31/23	20:49:55.642868
CR23_BL_B1	112	B1-4	1123	69.918772	-146.36273	95	07/31/23	20:50:22.049727
CR23_BL_B1	112	B1-5	1124	69.918772	-146.36273	95	07/31/23	20:50:43.004500
CR23_BL_B1	112	B1-6	1125	69.918772	-146.36273	95	07/31/23	20:51:06.363260
CR23_BL_B1	112	B1-7	1126	69.918772	-146.36273	95	07/31/23	20:51:26.203491
CR23_BL_B1	112	B1-8	1127	69.918772	-146.36273	95	07/31/23	20:51:48.477664
CR23_BL_B1	112	B1-9	1128	69.918772	-146.36273	95	07/31/23	20:52:06.873682
CR23_BL_B1	112	B1-10	1129	69.918772	-146.36273	95	07/31/23	20:52:26.326677
CR23_BL_B2	212	B2-1	2120	69.91883	-146.36196	95	07/31/23	20:57:26.050284
CR23_BL_B2	212	B2-2	2121	69.91883	-146.36196	95	07/31/23	20:57:51.103521
CR23_BL_B2	212	B2-3	2122	69.91883	-146.36196	95	07/31/23	20:58:10.237553
CR23_BL_B2	212	B2-4	2123	69.91883	-146.36196	95	07/31/23	20:58:30.006949
CR23_BL_B2	212	B2-5	2124	69.91883	-146.36196	95	07/31/23	20:58:45.225760
CR23_BL_B2	212	B2-6	2125	69.91883	-146.36196	95	07/31/23	20:59:05.312950
CR23_BL_B2	212	B2-7	2126	69.91883	-146.36196	95	07/31/23	20:59:22.628212
CR23_BL_B2	212	B2-8	2127	69.91883	-146.36196	95	07/31/23	20:59:42.038469
CR23_BL_B2	212	B2-9	2128	69.91883	-146.36196	95	07/31/23	21:00:04.936125
CR23_BL_B2	212	B2-10	2129	69.91883	-146.36196	95	07/31/23	21:00:21.399846
CR23_BL_C1	113	C1-1	1130	69.918545	-146.36229	95	07/31/23	21:47:14.081137
CR23_BL_C1	113	C1-2	1131	69.918545	-146.36229	95	07/31/23	21:47:36.016001
CR23_BL_C1	113	C1-3	1132	69.918545	-146.36229	95	07/31/23	21:47:53.044204
CR23_BL_C1	113	C1-4	1133	69.918545	-146.36229	95	07/31/23	21:48:09.744866
CR23_BL_C1	113	C1-5	1134	69.918545	-146.36229	95	07/31/23	21:48:23.701269
CR23_BL_C1	113	C1-6	1135	69.918545	-146.36229	95	07/31/23	21:48:38.457022
CR23_BL_C1	113	C1-7	1136	69.918545	-146.36229	95	07/31/23	21:48:54.878771
CR23_BL_C1	113	C1-8	1137	69.918545	-146.36229	95	07/31/23	21:49:11.134180
CR23_BL_C1	113	C1-9	1138	69.918545	-146.36229	95	07/31/23	21:49:26.688028

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CR23_BL_C1	113	C1-10	1139	69.918545	-146.36229	95	07/31/23	21:49:41.880985
CR23_BL_C2	213	C2-1	2130	69.918772	-146.36273	95	07/31/23	21:54:38.018666
CR23_BL_C2	213	C2-2	2131	69.918772	-146.36273	95	07/31/23	21:55:02.637952
CR23_BL_C2	213	C2-3	2132	69.918772	-146.36273	95	07/31/23	21:55:24.465371
CR23_BL_C2	213	C2-4	2133	69.918772	-146.36273	95	07/31/23	21:55:46.234149
CR23_BL_C2	213	C2-5	2134	69.918772	-146.36273	95	07/31/23	21:56:03.929754
CR23_BL_C2	213	C2-6	2135	69.918772	-146.36273	95	07/31/23	21:56:19.603736
CR23_BL_C2	213	C2-7	2136	69.918772	-146.36273	95	07/31/23	21:56:36.421133
CR23_BL_C2	213	C2-8	2137	69.918772	-146.36273	95	07/31/23	21:56:52.843366
CR23_BL_C2	213	C2-9	2138	69.918772	-146.36273	95	07/31/23	21:57:11.057051
CR23_BL_C2	213	C2-10	2139	69.918772	-146.36273	95	07/31/23	21:57:29.347618

Acknowledgements

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