

Appendix 19

Meadowbank Thermal Monitoring Report 2023



MEADOWBANK PROJECT

Thermal Monitoring Report

Prepared by:
Agnico Eagle Mines Limited – Meadowbank Division

Version 5
February 2024

DOCUMENT CONTROL

Version	Date (YMD)	Section	Revision
1	2020-03-31	All	All
2	2021-01-25	All	All
3	2022-03-11	All	All
4	2023-01-20	All	All
5	2024-02-23	All	All

INTRODUCTION

To observe the freeze back of the Tailings Storage Facility (TSF) and the Rockfill Storage Facilities (RSF's) at the Meadowbank Mine Project, a series of subsurface thermistors have been installed at strategic locations.

The purposes of the TSF thermistors are to monitor the Talik temperatures underneath the TSF as freezing progresses and to monitor the freezing of the tailings. The purpose of the thermistors in the RSF is to monitor the RSF temperature as freezing progresses. Appendix A of this report contains the updated data from each thermistor for 2023 as well as the location of the installed thermistors.

The thermistors data is reviewed periodically and as needed, and this will continue throughout the operational period as well as during closure. The results collected are to be used to compare the predicted thermal response of the facilities with the actual thermal response. This will allow adjustments to the Tailings Deposition Plan, the Waste Rock Management Plan and the Final Closure and Reclamation Plan.

INSTRUMENT SPECIFICATIONS

Each thermistor installed as part of the thermal monitoring plan must comply with the general specifications presented in Table 1.

Table 1: Thermistor Specifications

Items	Specifications
Accuracy	1 degree Celsius
Thermistor temperature range	-40 to 40 degrees Celsius
Method of cable termination	Amphenol connector and DAS direct connection
Cable termination enclosures	Weatherproof Animal resistant
Readout and data logger	Manual and DAS

THERMAL MONITORING OF THE TSF

The thermal monitoring program objective for the TSF is to provide the data required to validate the predictions of freeze back within the tailings and to support TSF cover and closure design. The goals of the TSF North and South Cell cover systems and landforms are to ensure long-term landform physical stability, blend with current topography, ensure safe water quality for surface runoff and seepage and control the dust level. If it is determined by monitoring during operations

that the tailings are freezing at lower rates than predicted, then mitigation procedures could be implemented if required.

An instrumentation plan for the TSF is planned to be developed to define the required instrumentation at closure once capping of the TSF is completed. The purpose of the performance monitoring system is to ensure that the cover performs as per its design intent and objectives.

The instruments installed in the North Cell TSF are located where tailings deposition was not planned to resume. No instruments are currently installed within the tailings of the South Cell but it is planned to install some to support the final design of the TSF landform cover.

THERMAL PERFORMANCE OF THE TSF

The thermistors are indicating that freeze back is occurring within the North Cell TSF.

Instruments located near the pond of water of the North Cell are showing a portion of unfrozen tailings at depth with frozen tailings at surface (with a 4-5 m active layer) and a progression of the freezing front advancing at depth. This is represented by yellow dots on Figure 1 (NC-16-1, NC-16-2, NC17-3, NC-17-2, NC-17-8). Instruments located away from the water pond show that the tailings and its foundation are entirely frozen with an active layer depth of 4-5 m. This is represented by red and orange dots on Figure 1 (NC-17-1, NC17-4, NC-17-6, NC-17-7, NCIS-01 to NCIS-04).

Instruments installed below the capping show that the active layer is contained within the rockfill. This is represented by a green dot on Figure 1 (NC-17-5).

SWD-01 shows a stable unfrozen condition in the foundation below the frozen tailings and capping.

SWD-03 indicates the return to a talik condition in the South Cell near Saddle Dam 3.

The thermal prediction of the tailings freeze-back made by Golder in 2008 indicated that for the more conservative scenario the entire tailings body would completely freeze back within a period of about 40 years after the end of operations with the freezing front advancing into the foundation beneath the tailings in the long term. The results are aligned with this modelling with most data showing a quicker freeze back than anticipated.

Further discussion on these results and how they support the long-term performance of the tailings closure landform will be presented in the design document to be submitted as part of the Final Closure and Reclamation Plan (FCRP).

THERMAL MONITORING PLAN OF THE RSF

Thermistors are currently installed within the Portage RSF.

Additional thermistors may be installed within the Portage RSF and Vault RSF at closure, if required. The monitoring plan will be reviewed to define the required instrumentation and monitoring at closure.

THERMAL REGIME OF THE RSF

The RSF thermal data for 2023 continues to follow the same trends as previous years. The thermal data indicates that the RSF is continuing to freeze back but has not yet reached a state of equilibrium. Based on thermistor data, the depth of the active layer is approximately 3 m. Work is ongoing for the final design of the top cover as part of the FCRP.

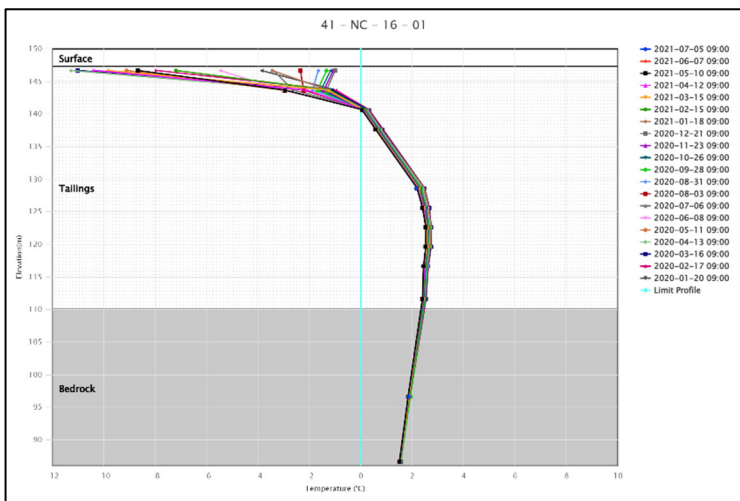
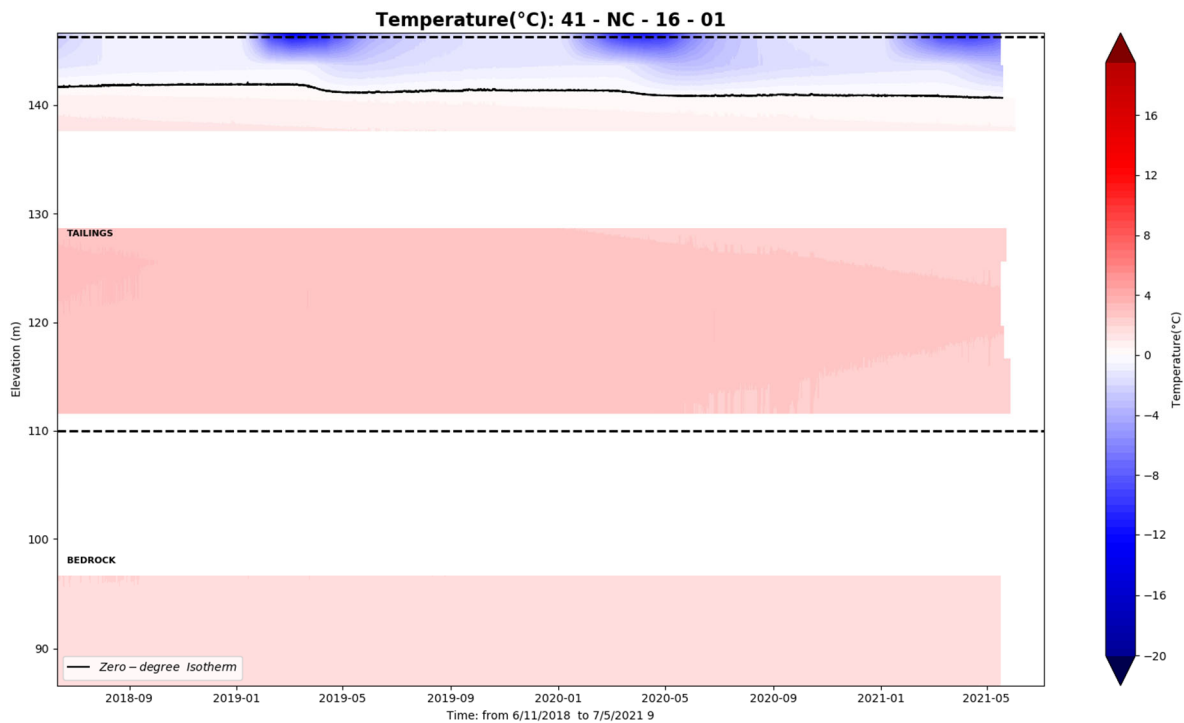
Note that data gaps in the graphs presented in this appendix are due to broken thermistor beads or communication issues. The gaps show as white areas.



Meadowbank Thermal Report 2023 – Appendix A

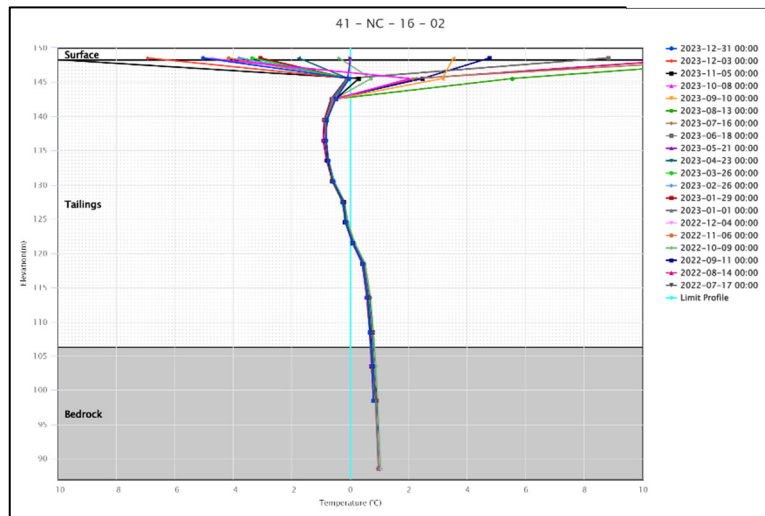
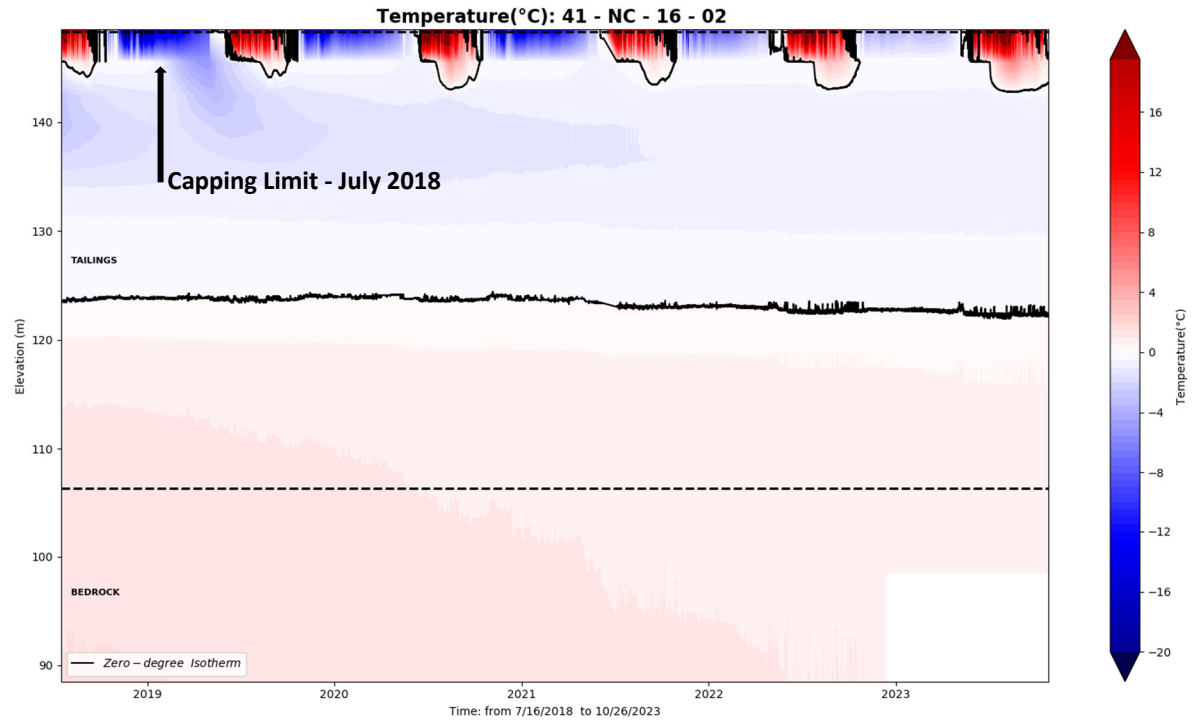
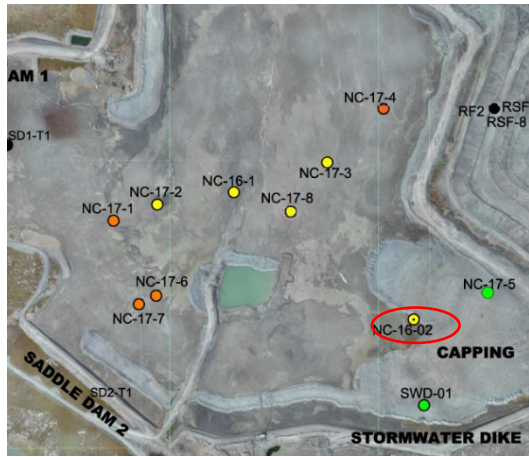
<i>Name</i>	<i>Area</i>	<i>Easting (X)</i>	<i>Northing (Y)</i>	<i>Elevation (Z)</i>	<i>Azimuth</i>	<i>Dip</i>	<i>Installed</i>	<i>Active (Y) or (N)</i>
NC-16-01	NC	637562.77	7215849.33	147.63	--	-90	2016	N
NC-16-02	NC	637969.22	7215561.87	148.33	--	-90	2016	Y
NC-17-1	NC	637290.00	7215823.00	148.10	--	-90	2018	Y
NC-17-2	NC	637391.00	7215823.00	147.61	--	-90	2017	Y
NC-17-3	NC	637775.00	7215917.00	147.65	--	-90	2015	Y
NC-17-4	NC	637901.00	7216038.00	148.48	--	-90	2015	N
NC-17-5	NC	638134.34	7215623.68	152.00	--	-90	2015	Y
NC-17-6	NC	637389.00	7215623.00	147.78	--	-90	2015	Y
NC-17-7	NC	637348.00	7215598.00	147.89	--	-90	2015	Y
NC-17-8	NC	637668.00	7215778.00	146.45	--	-90	2015	Y
NCIS-01	NC	637412.84	7216395.10	152.43	--	-90	2018	Y
NCIS-02	NC	637377.24	7216398.61	151.63	--	-90	2018	Y
NCIS-03	NC	637432.58	7216636.35	154.74	--	-90	2018	Y
NCIS-04	NC	637405.47	7216293.32	152.15	--	-90	2018	Y
SWD-01	NC	606778.00	7256254.00	162.00	--	-90	2014	Y
SWD-03	SC	638072.9	7215233.0	133	--	-90	2014	Y
SD1-1	SD1	637030.50	7215957.68	150.00	--	Liner	2009	Y
SD2-1	SD2	637290.00	7215420.00	150.00	--	Liner	2012	Y
SD4-1	SD4	638253.95	7214479.72	144.00	--	Liner	2017	Y
CD-US 0+650	CD	638626.00	7214639.00	126.40	--	Liner	2015	Y
RSF-3	RSF	638369.59	7215689.2	173.99	--	-90	2013	Y
RSF-5	RSF	638629.81	7216014.00	193.02	--	-90	2013	N
RSF-6	RSF	638845.40	7215647.00	197.79	--	-90	2013	Y
RSF-7	RSF	638153.00	7216039.00	173.50	--	-55	2015	Y
RSF-8	RSF	638156.00	7216038.00	173.85	--	-70	2015	Y
RSF-9	RSF	638290.00	7215707.00	171.26	--	-55	2015	Y
RSF-10	RSF	638293.00	7215711.00	171.70	--	-70	2015	Y
RSF-11	RSF	639071.00	7215787.00	193.13	--	-55	2015	Y
RSF-12	RSF	639066.00	7215791.00	193.51	--	-70	2015	Y
RSF-13	RSF	638916.00	7215943.00	191.69	--	-55	2015	Y
RSF-14	RSF	638917.00	7215939.00	191.81	--	-80	2015	Y
RSF-15	RSF	638612.00	7216038.00	192.10	--	-55	2015	Y
RSF-16	RSF	638610.00	7216033.00	192.39	--	-70	2015	Y
RSF-17	RSF	638570.442	7215935.4	233.183	----	-90	2021	Y
RSF-18	RSF	638495.212	7216111.896	172.605	-	-90	2021	Y

NC-16-01

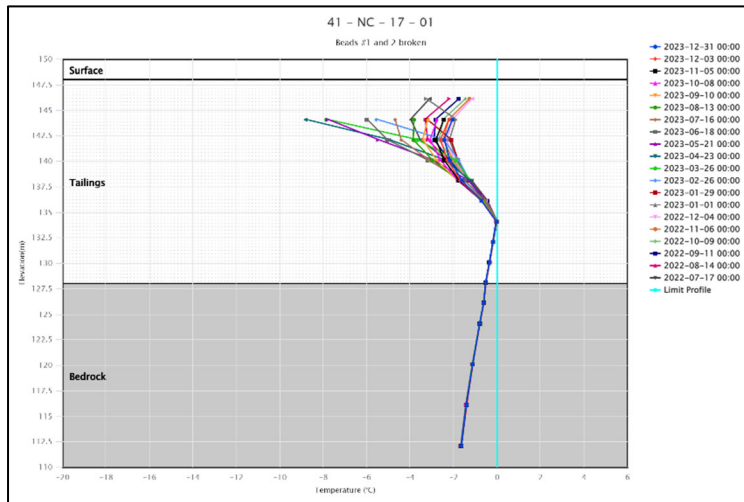
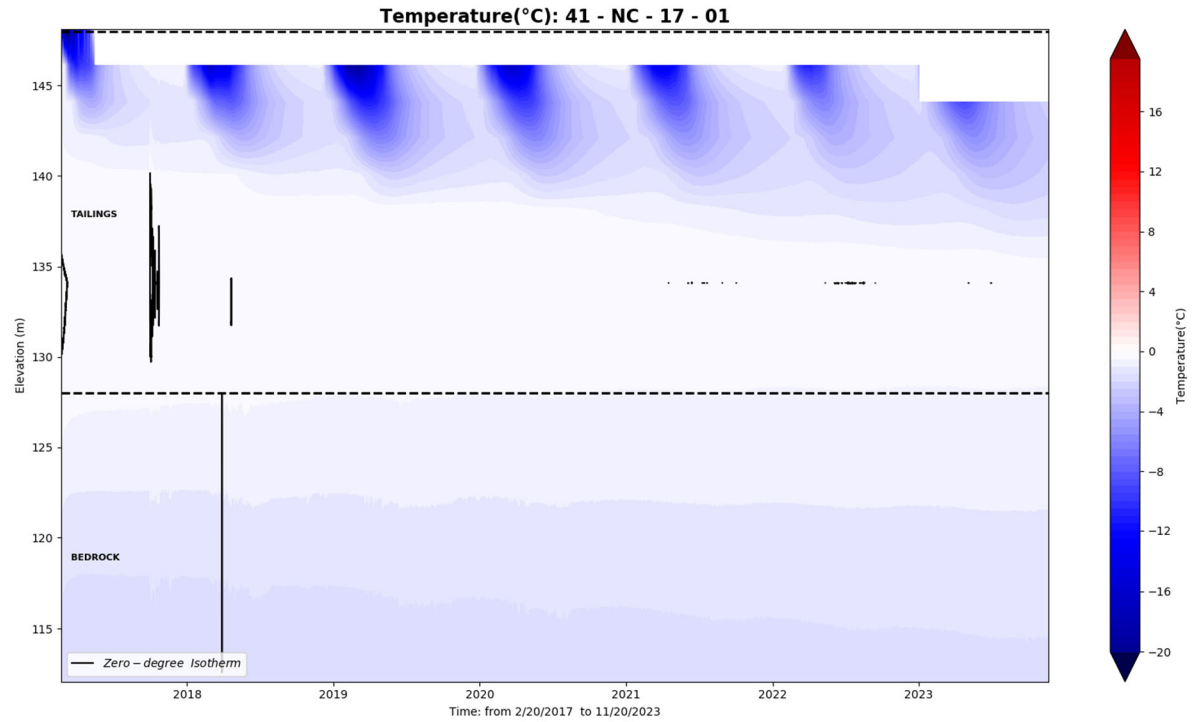
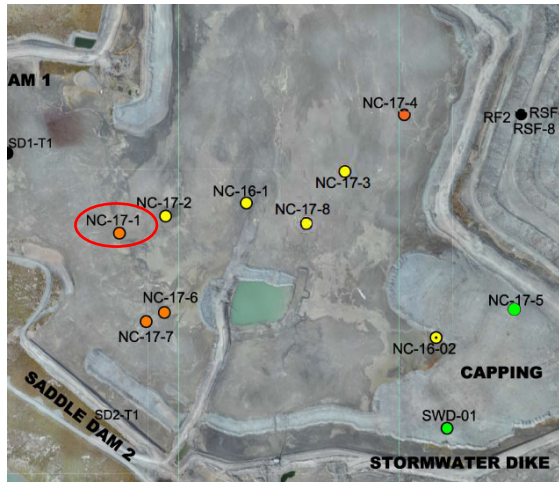


This instrument is broken and not sending anymore data, since July 2021.

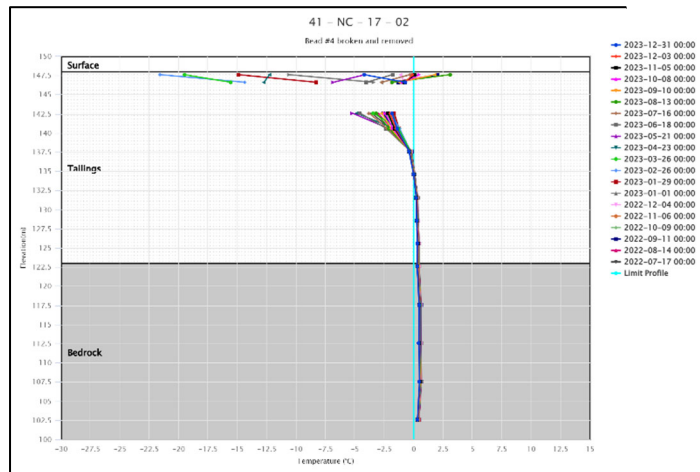
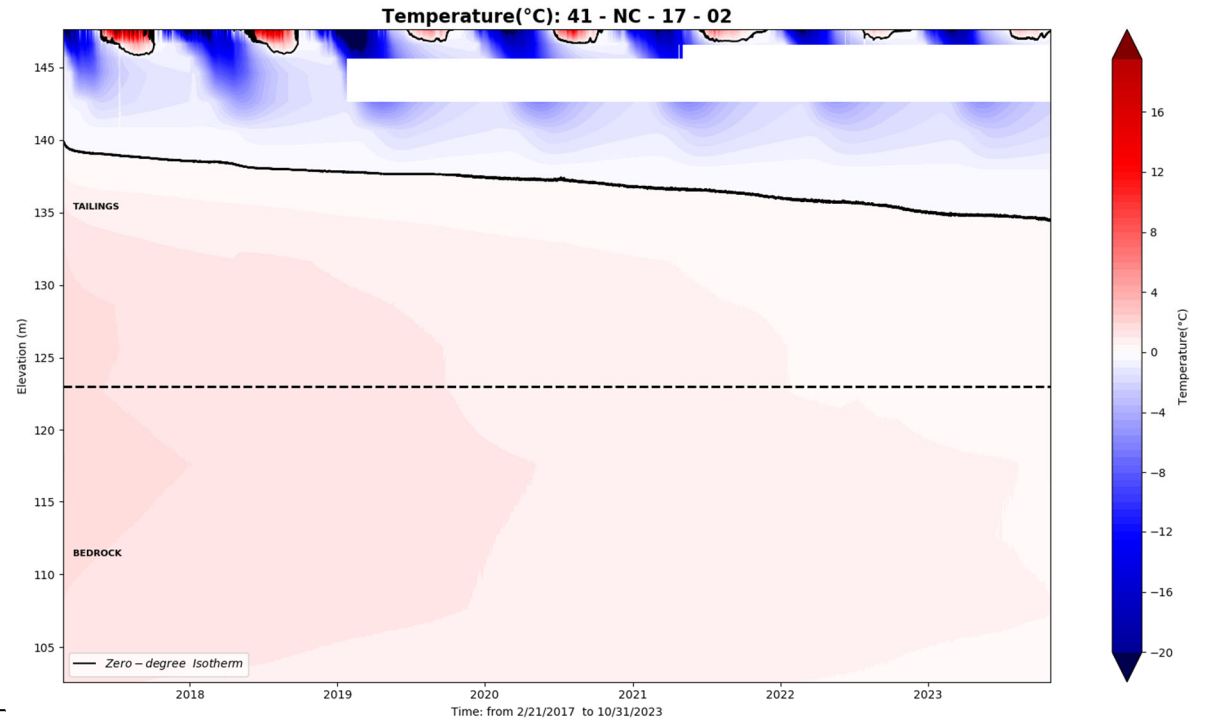
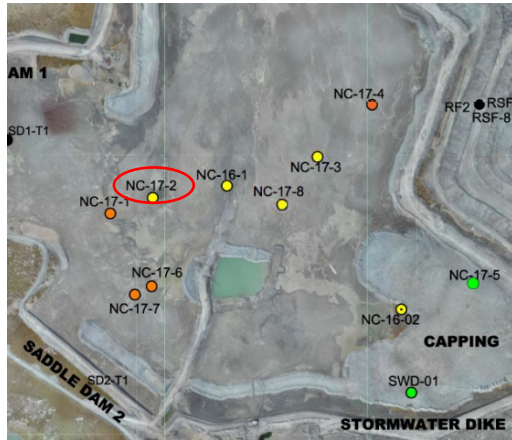
NC-16-02



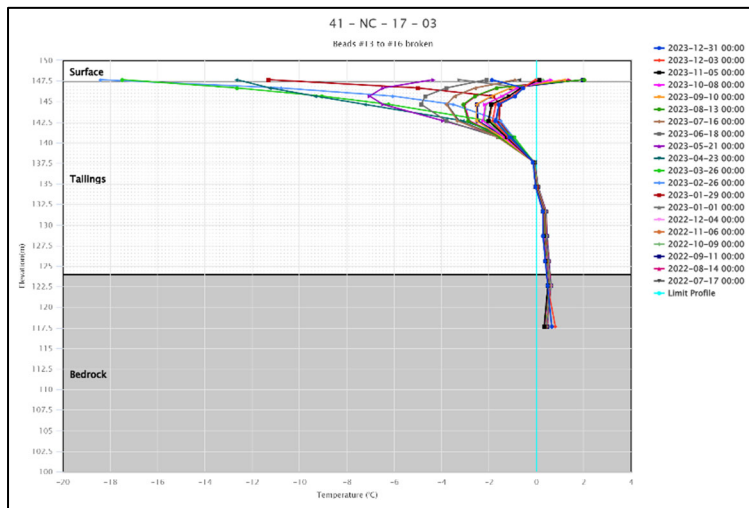
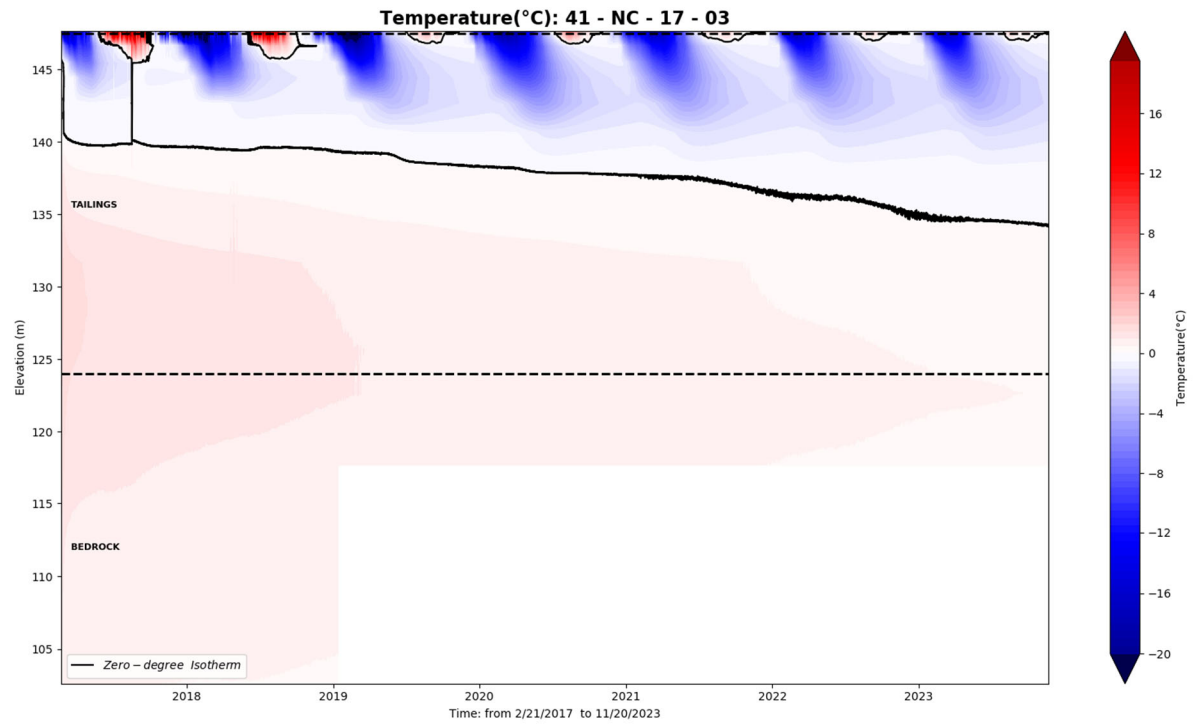
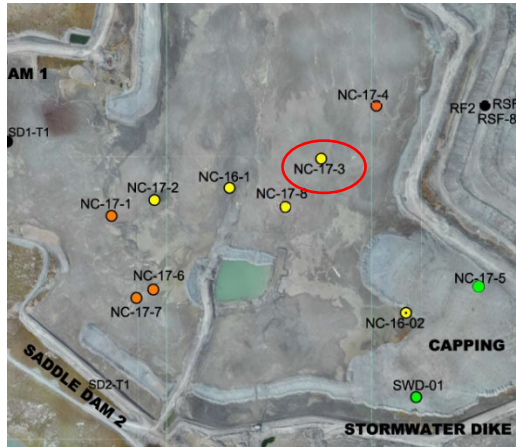
NC-17-01



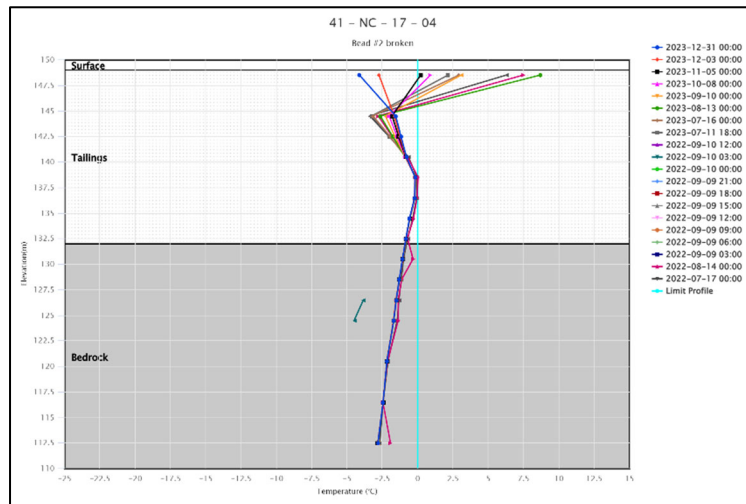
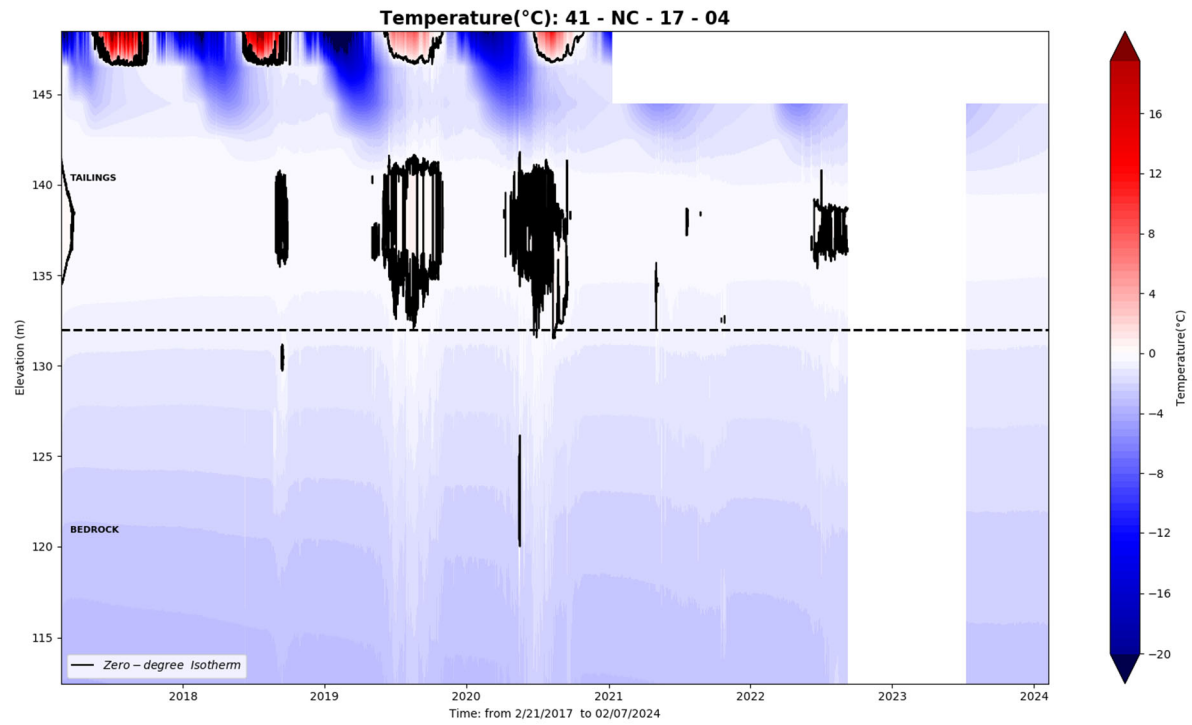
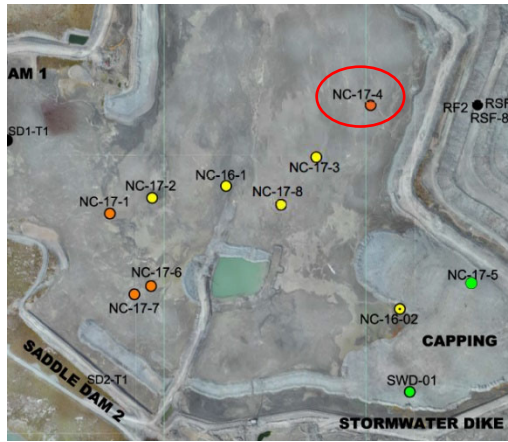
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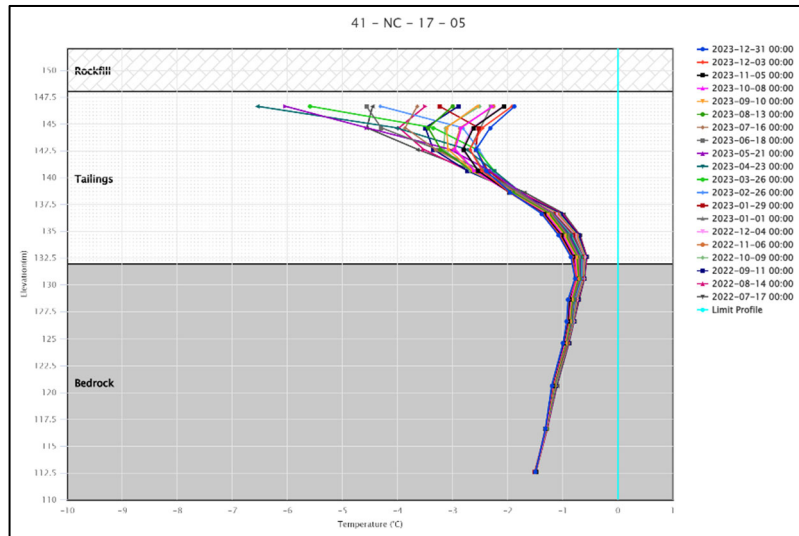
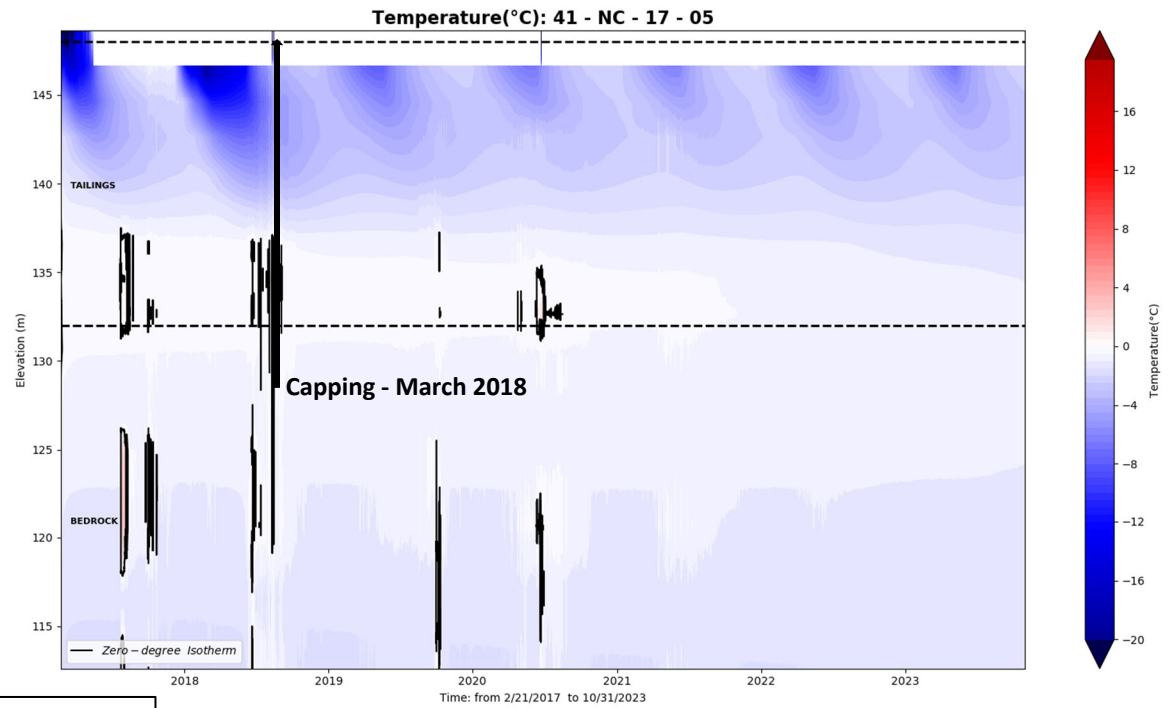
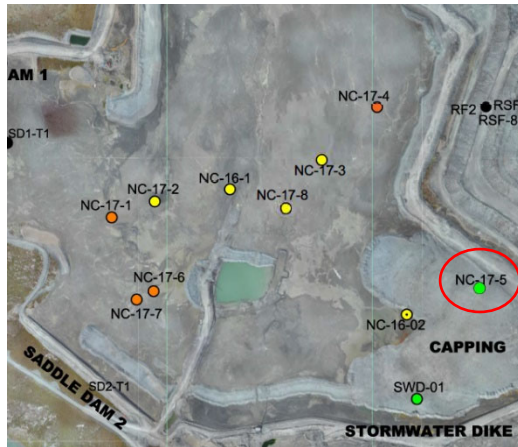
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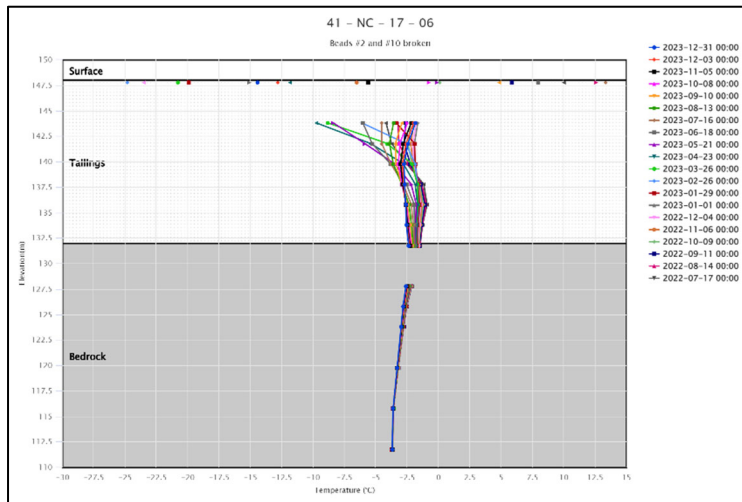
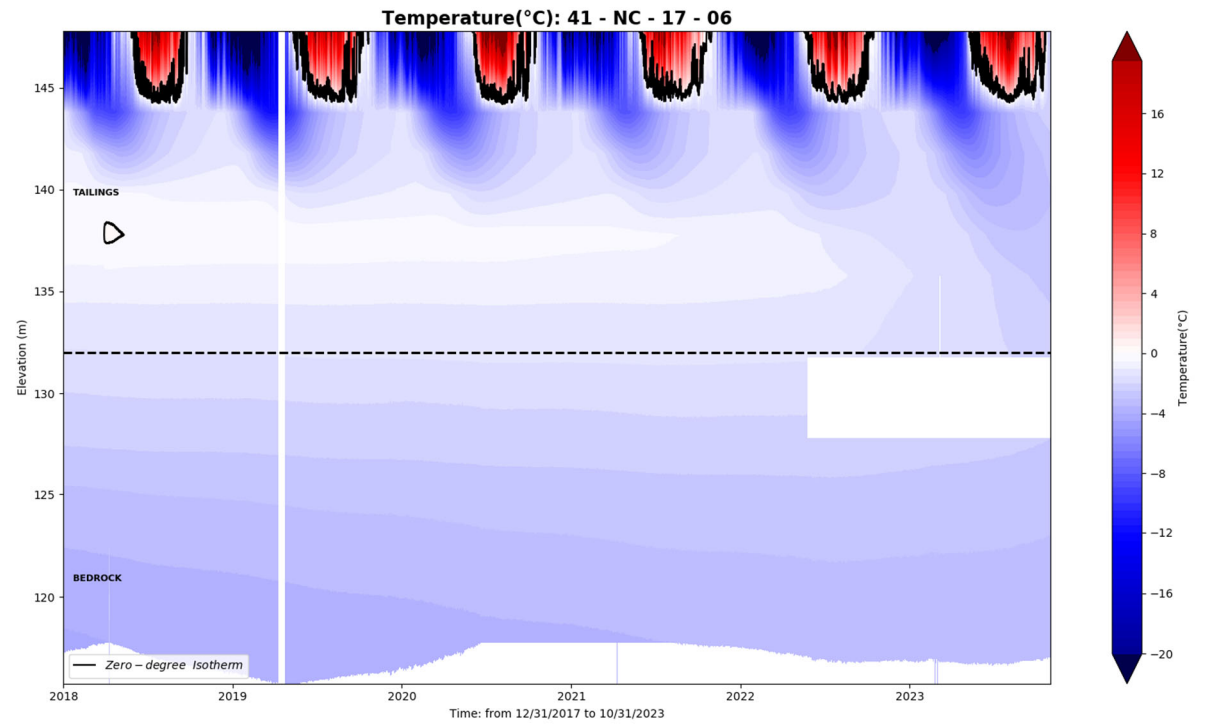
NC-17-04



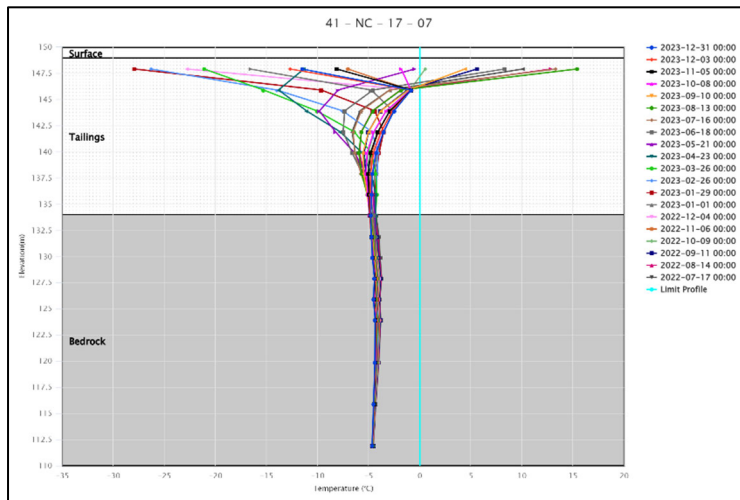
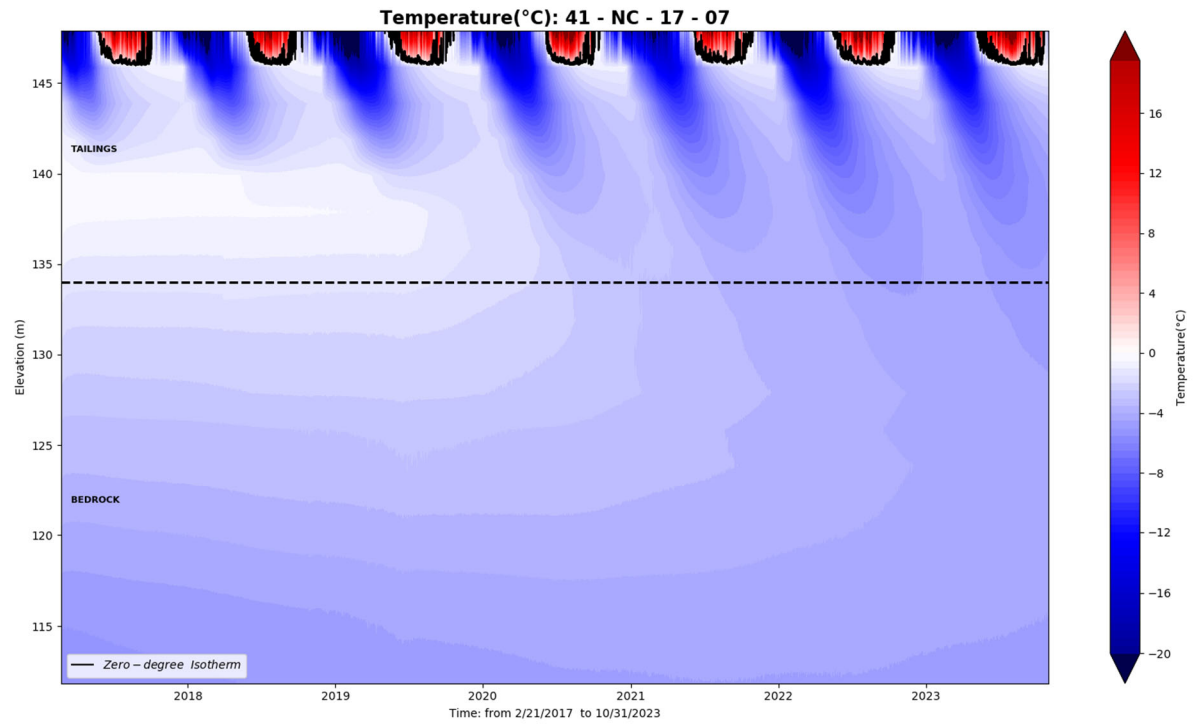
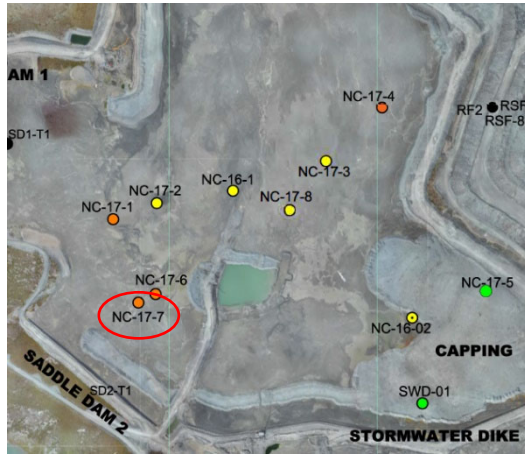
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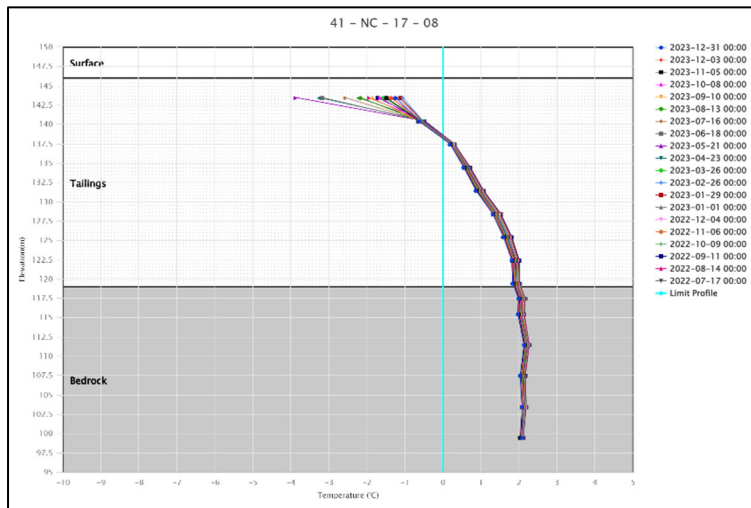
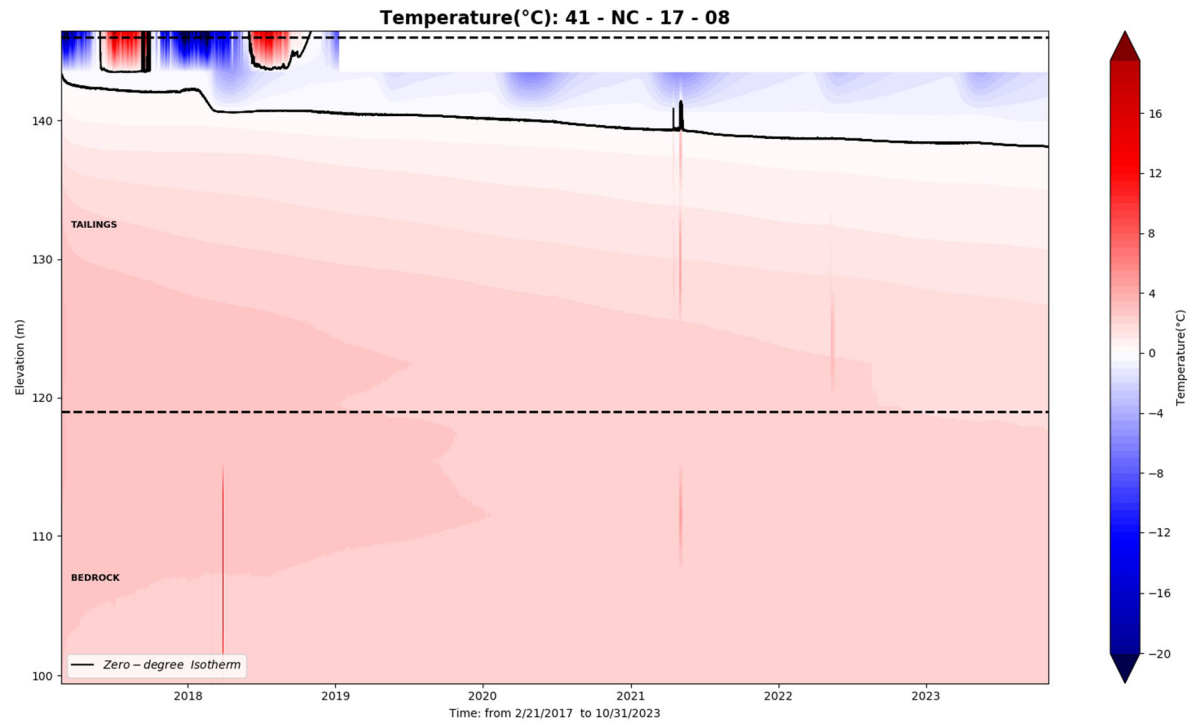
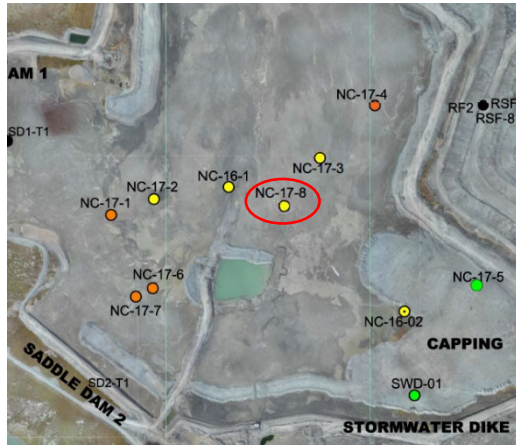
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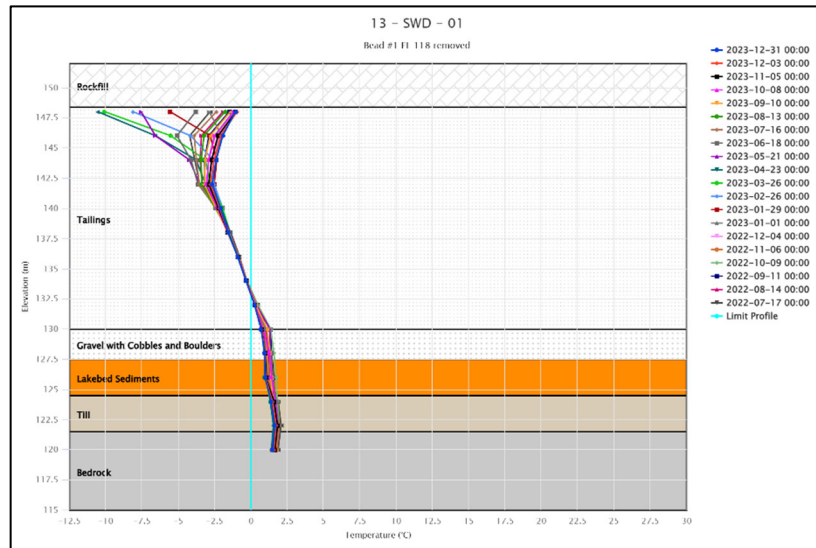
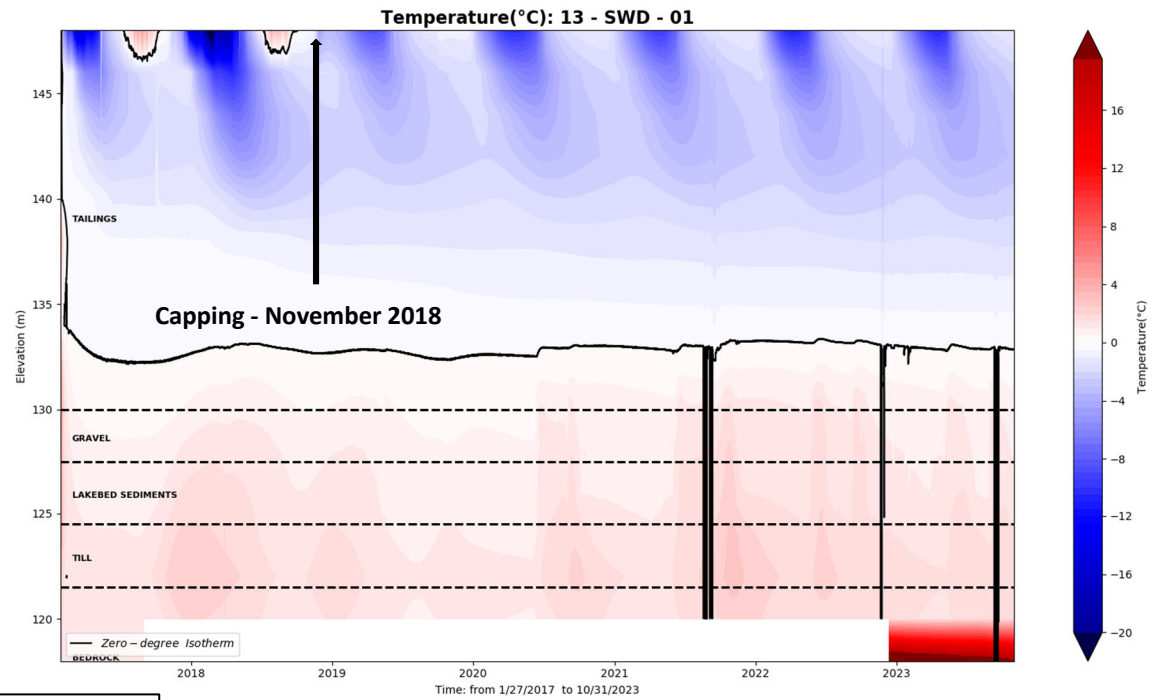
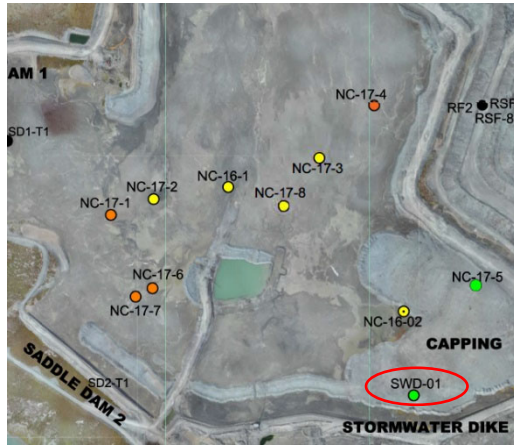
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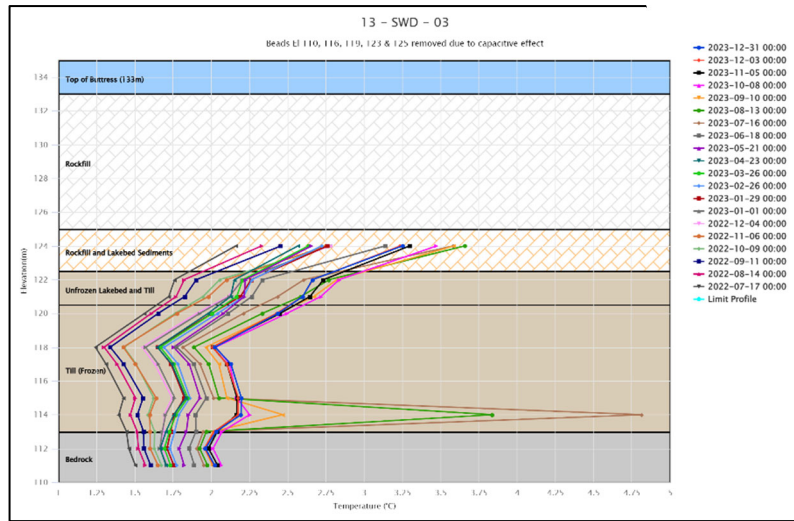
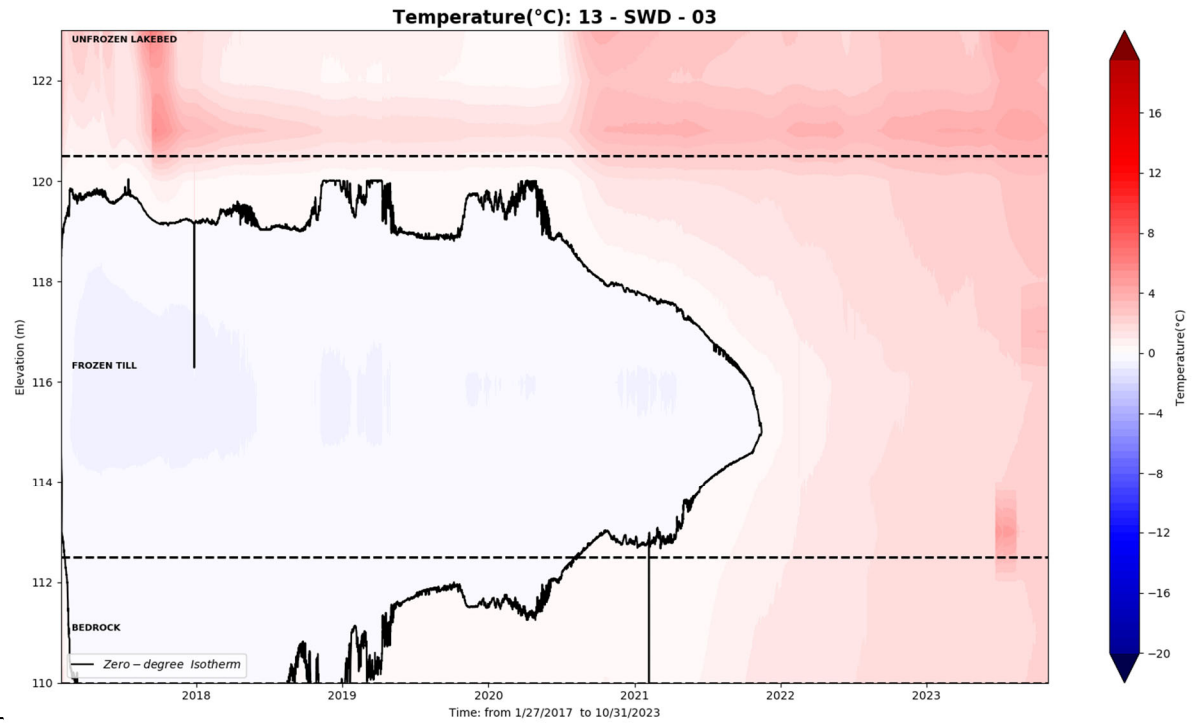
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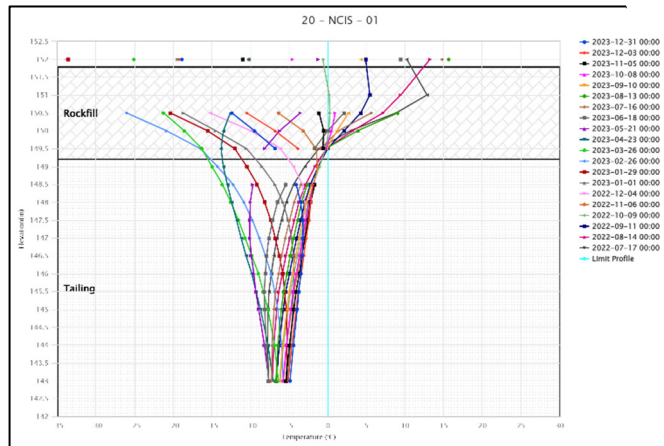
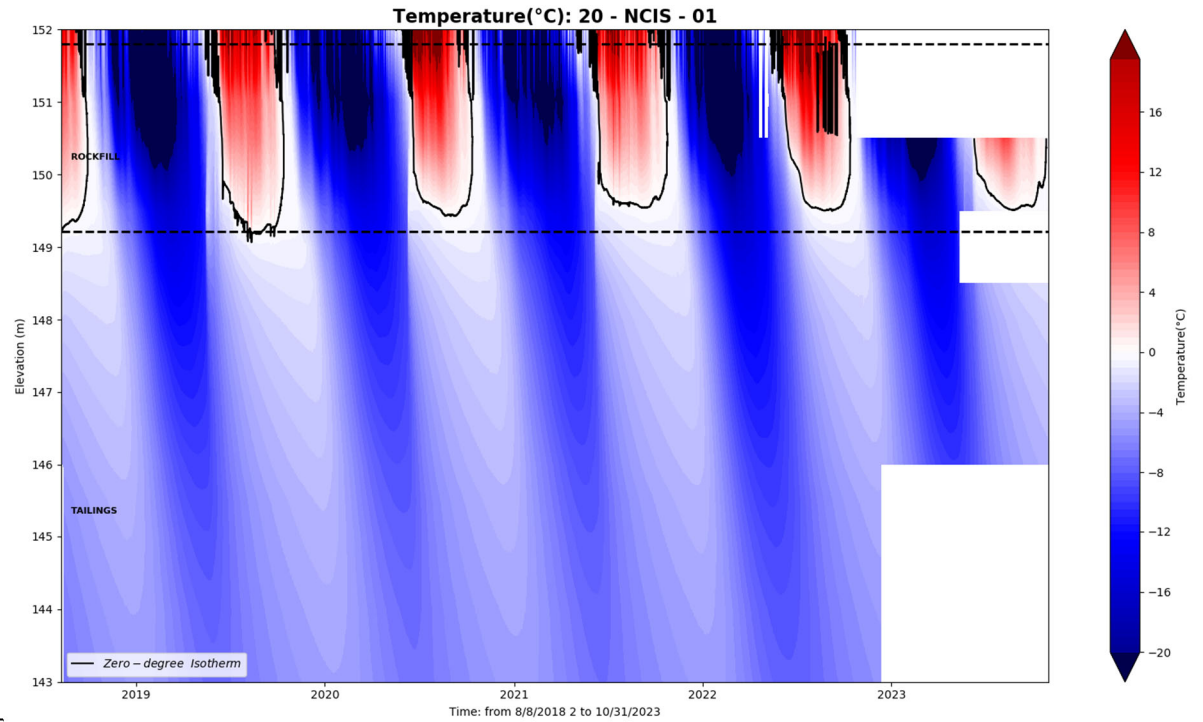
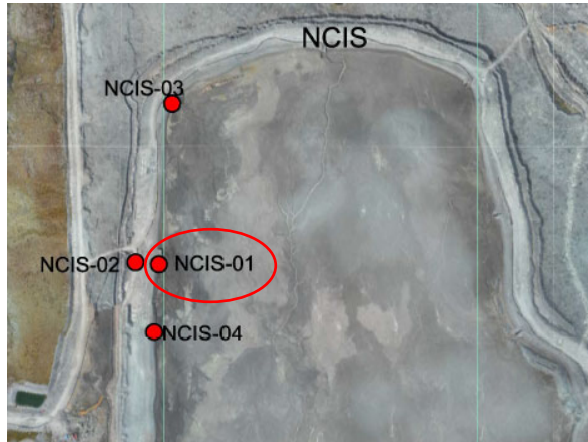
SWD-01



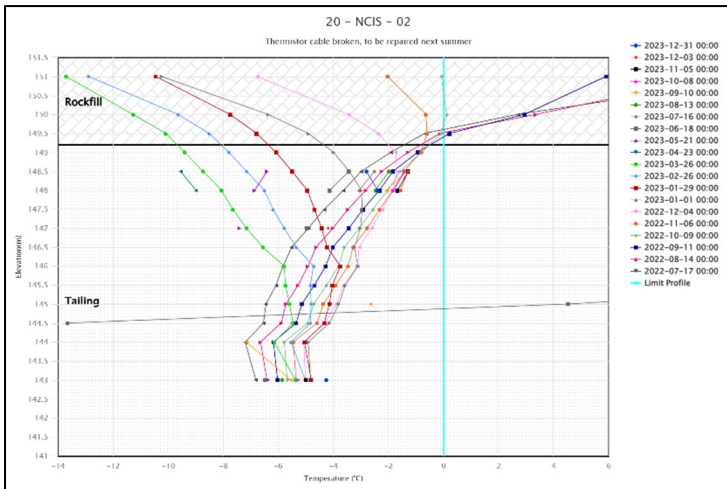
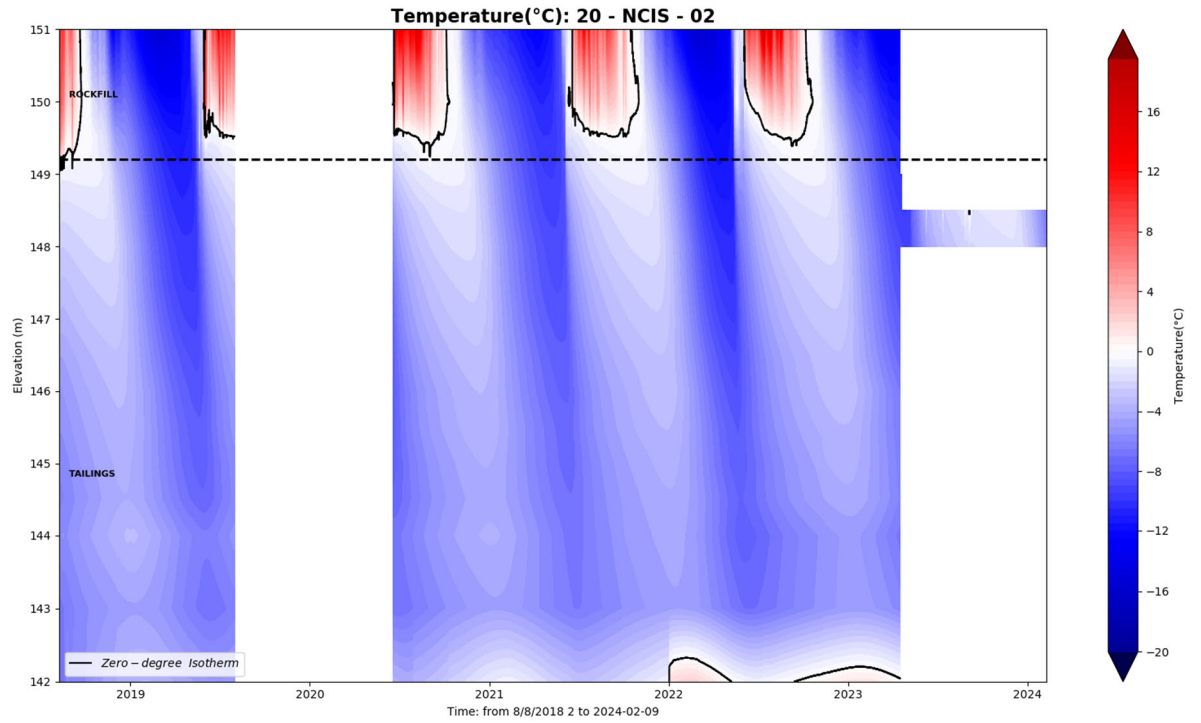
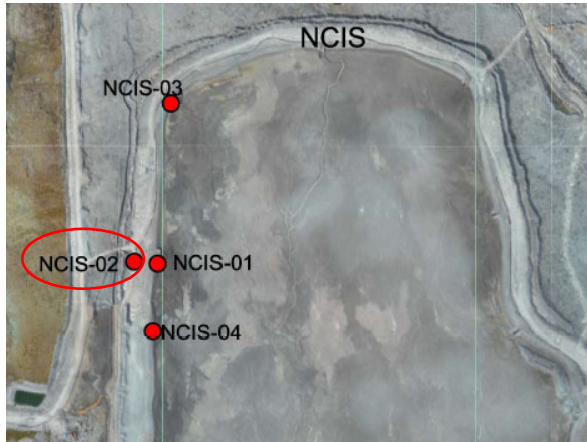
SWD-03



NCIS-01

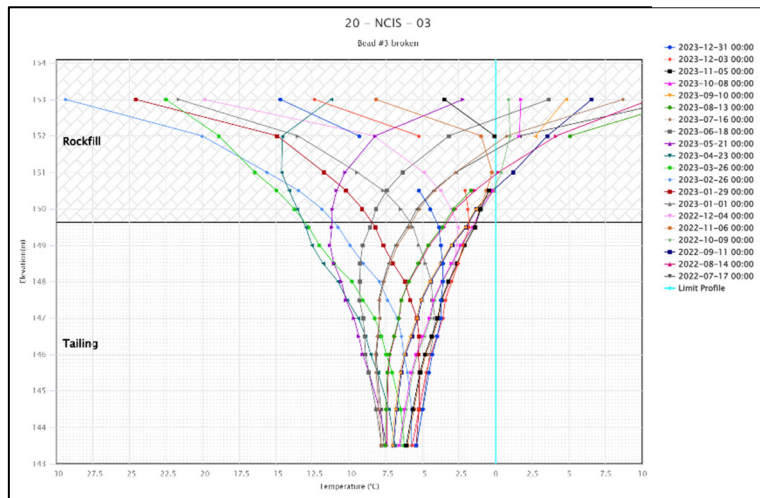
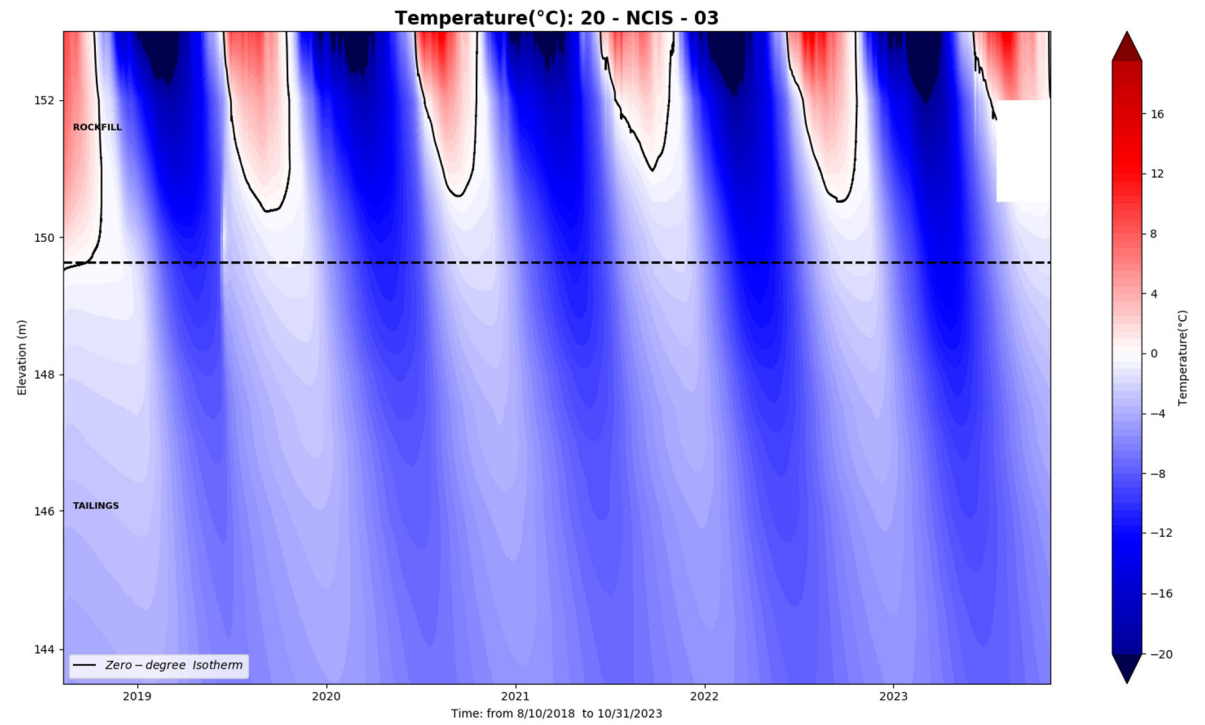
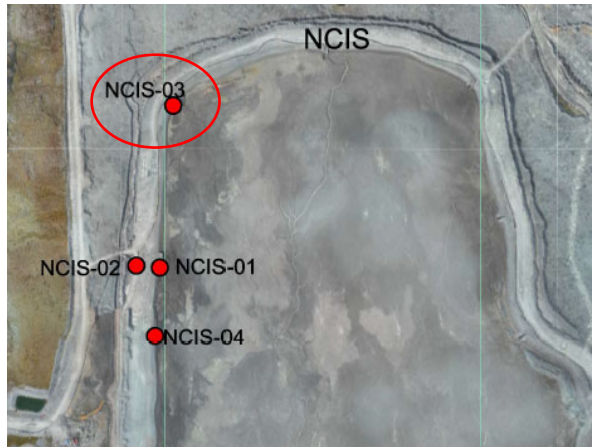


NCIS-02

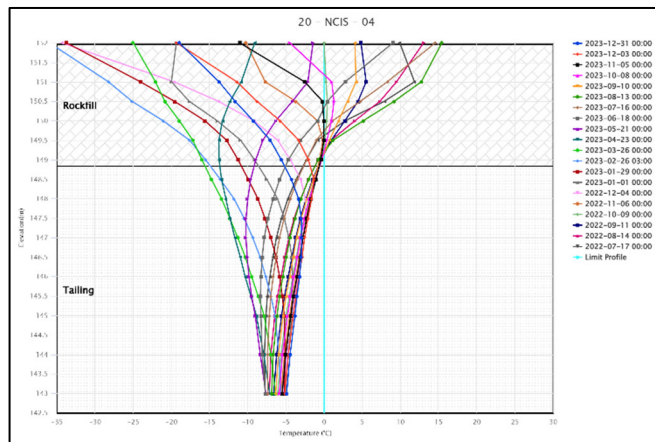
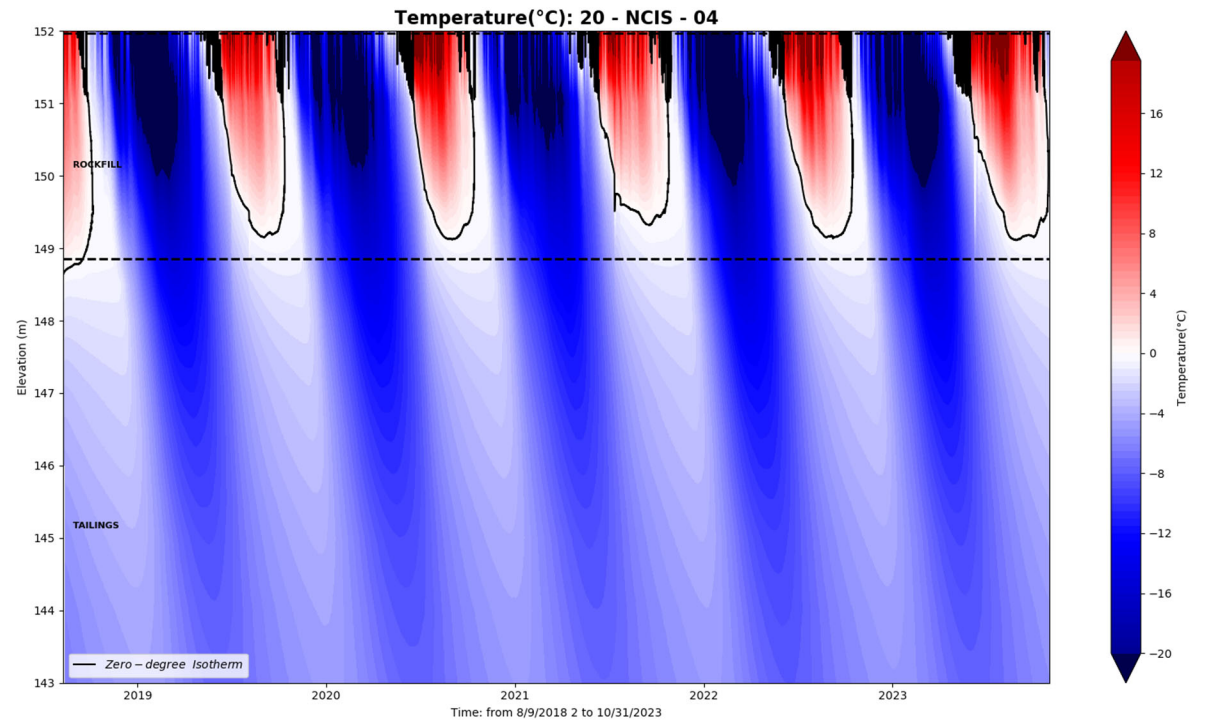
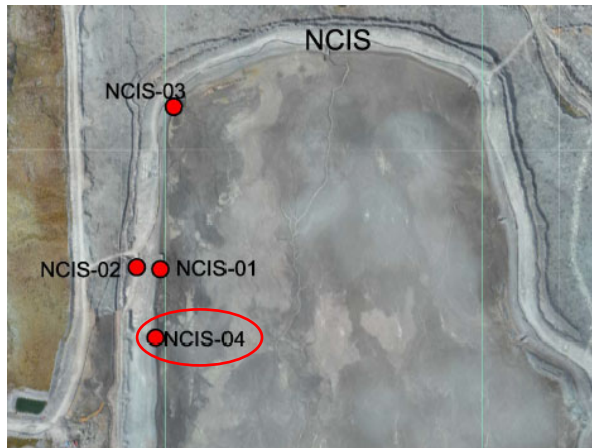


This instrument was broken and will be fixed this summer.

NCIS-03

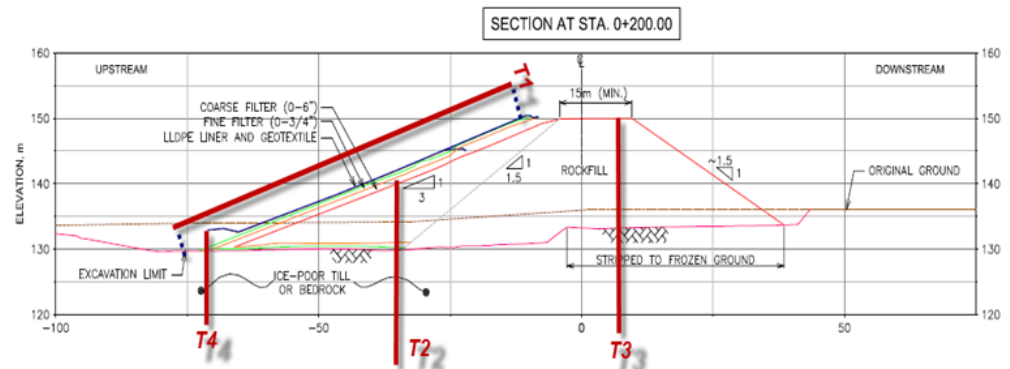
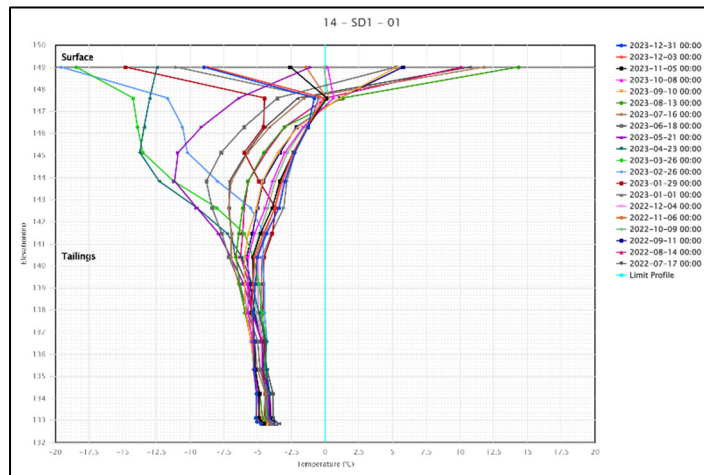
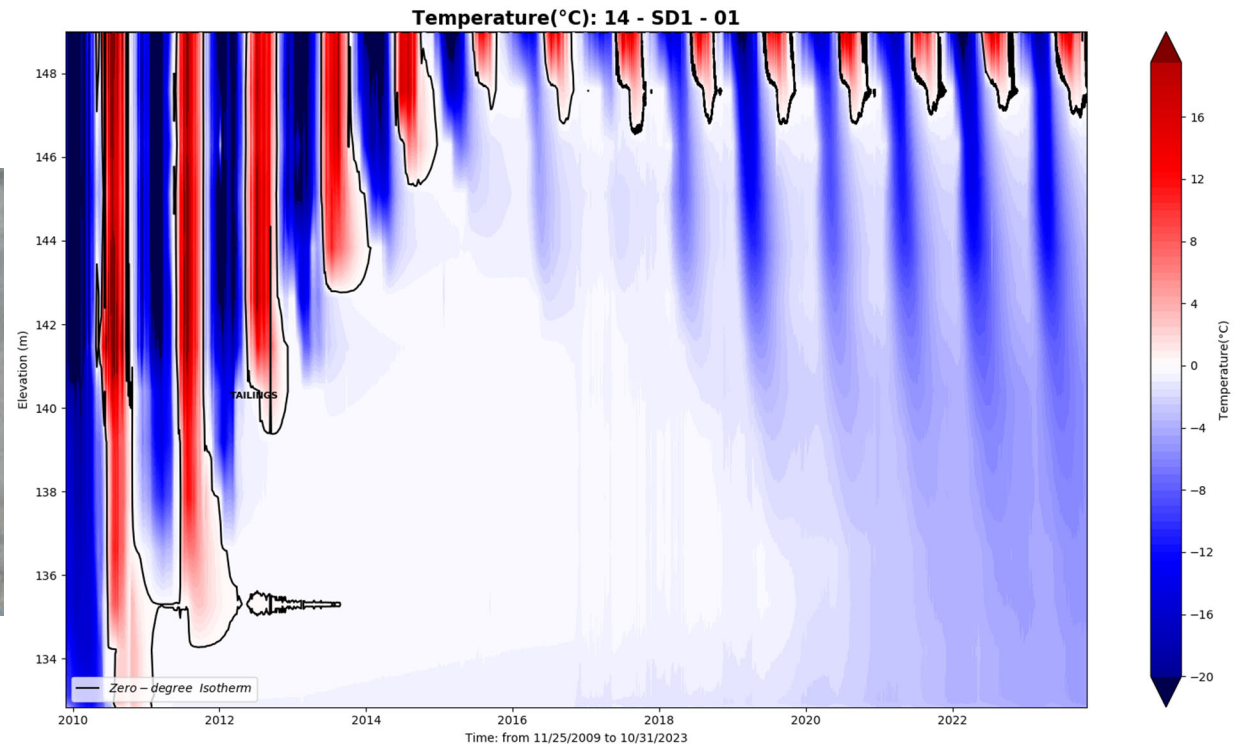
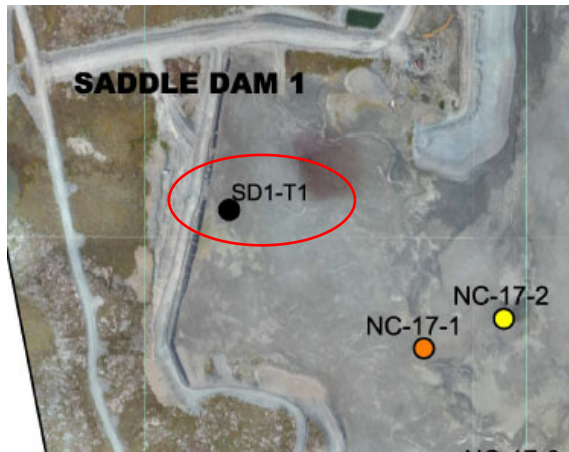


NCIS-04



SD1-1

This instrument is along the liner.

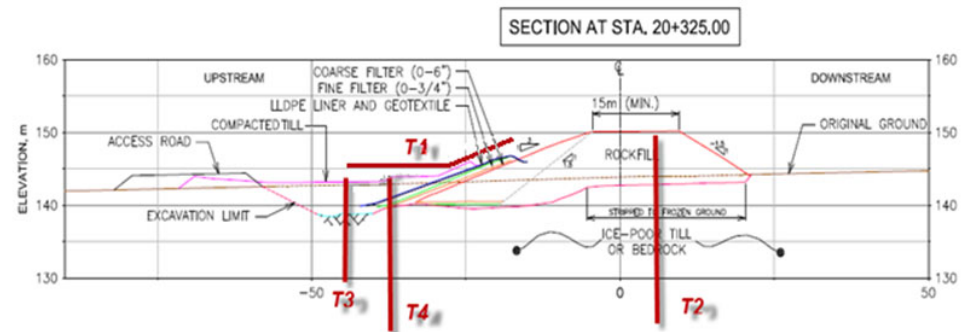
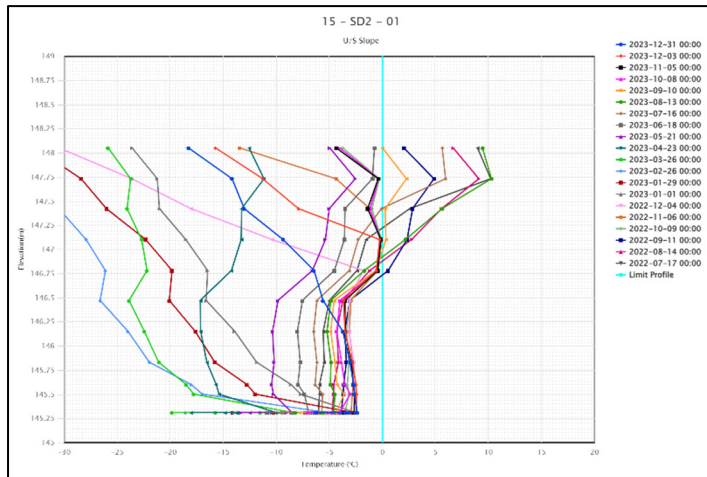
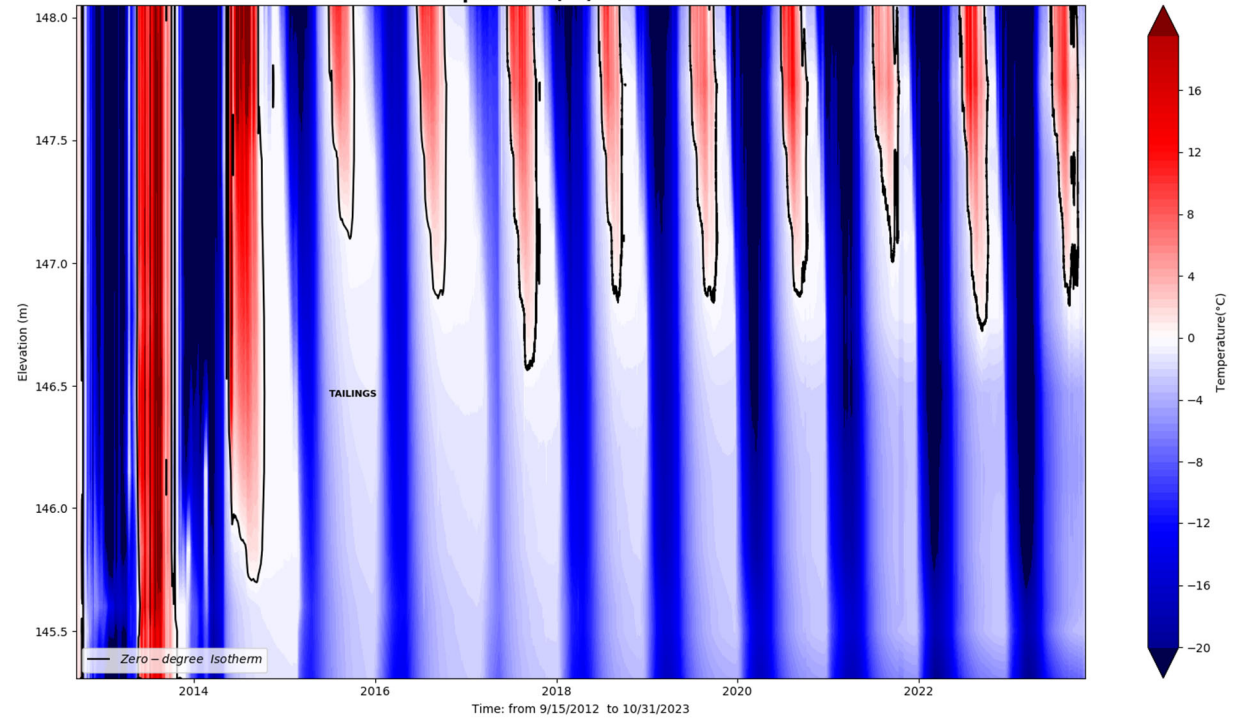


SD2-1

This instrument is along the liner.

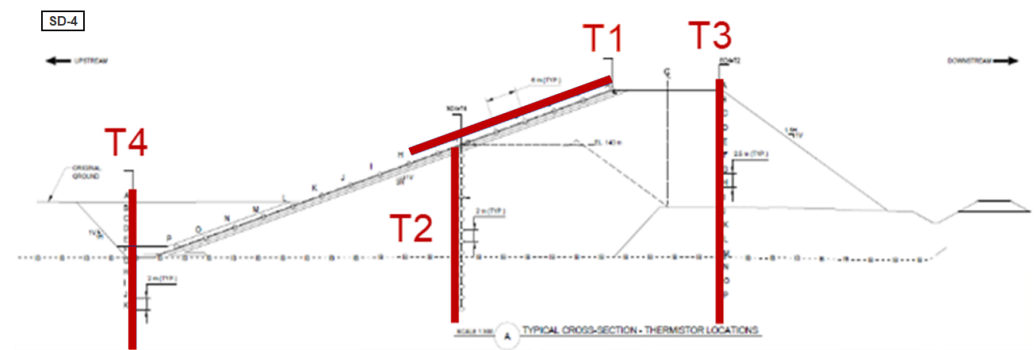
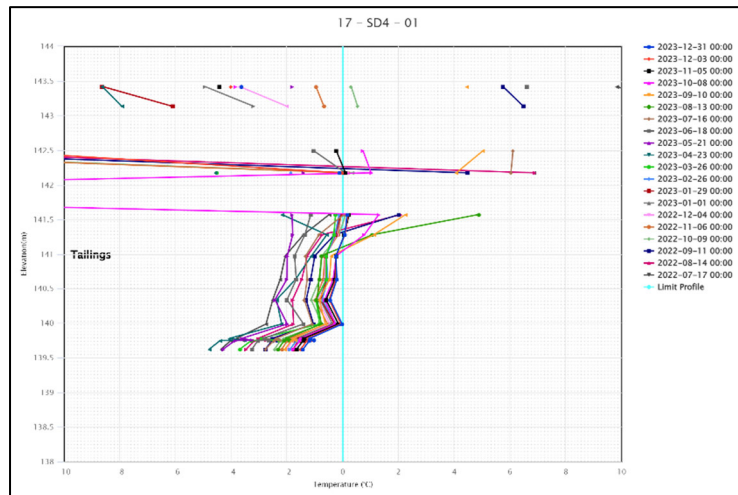
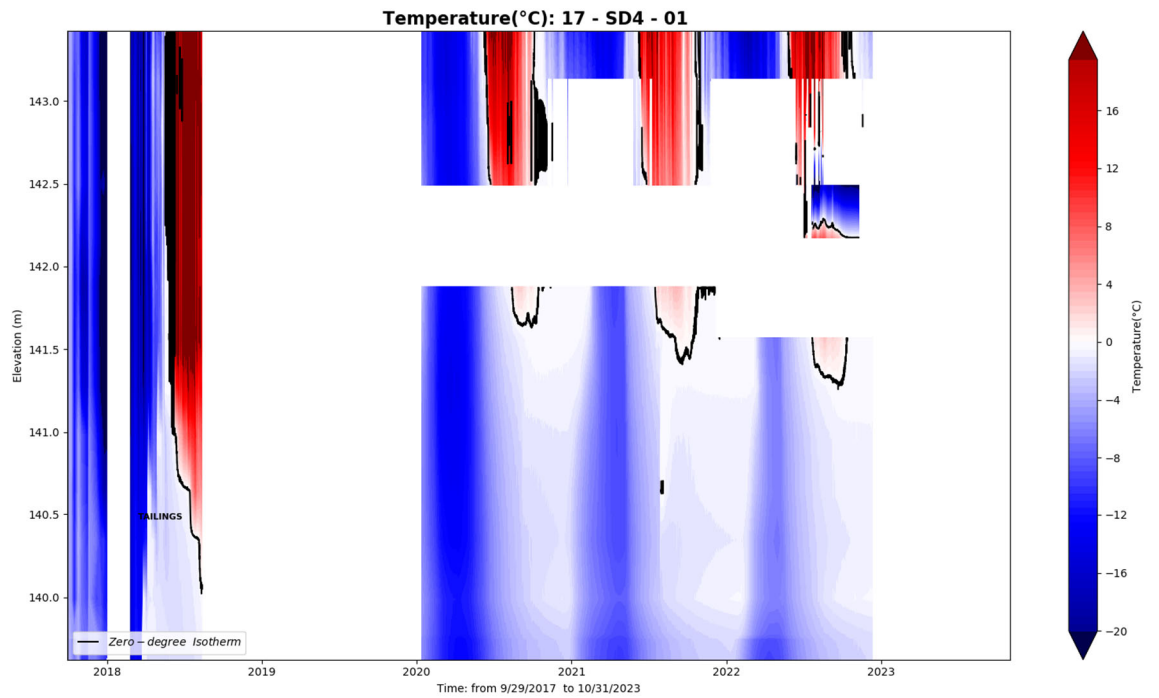
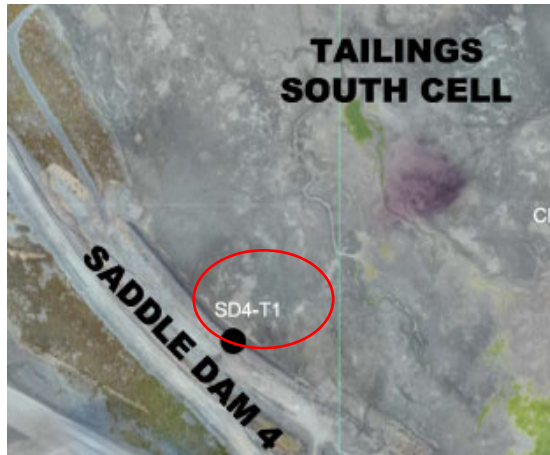


Temperature(°C): 15 - SD2 - 01



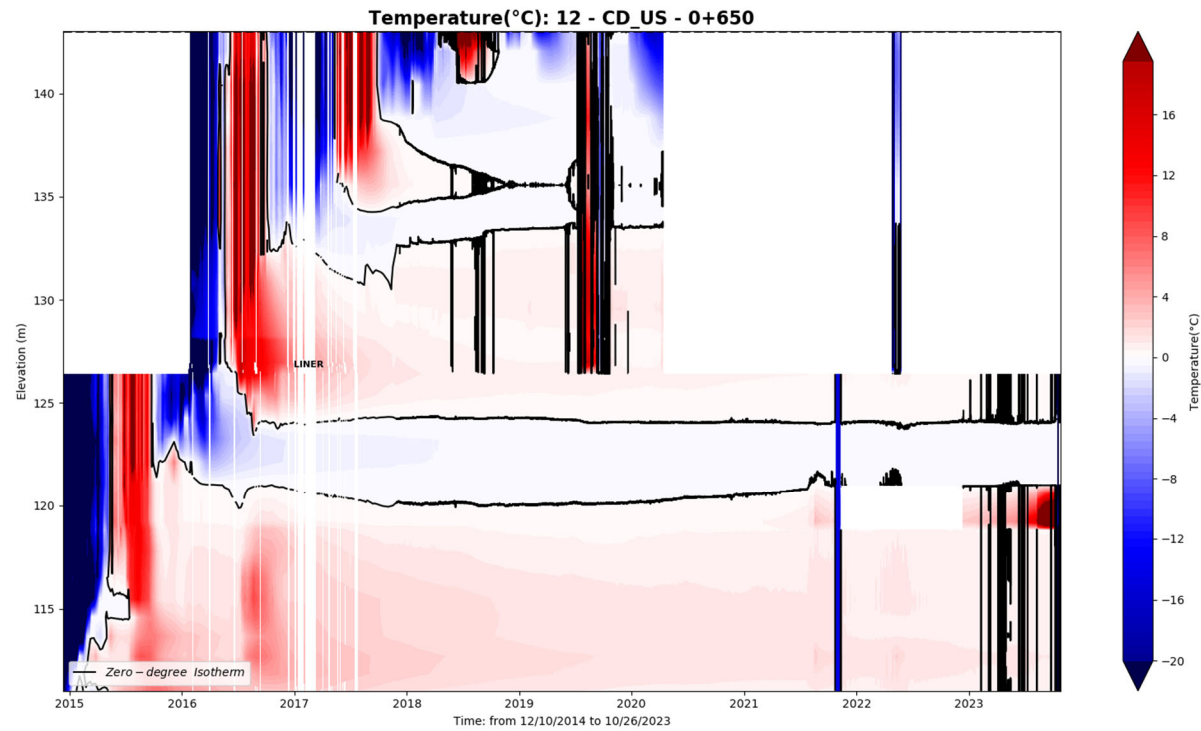
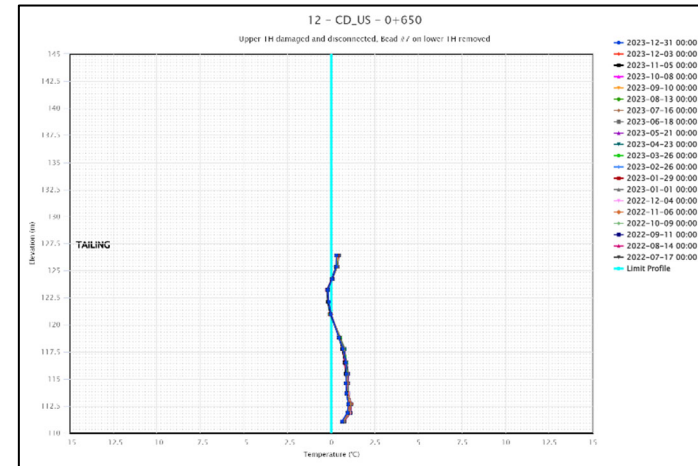
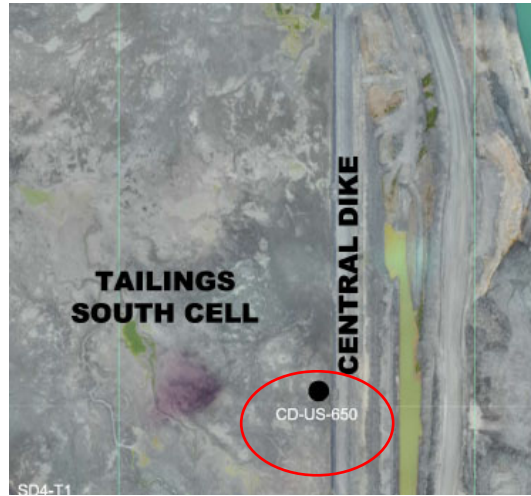
SD4-1

This instrument is along the liner. Note that the beads are no longer functioning properly, as seen on the graphs.

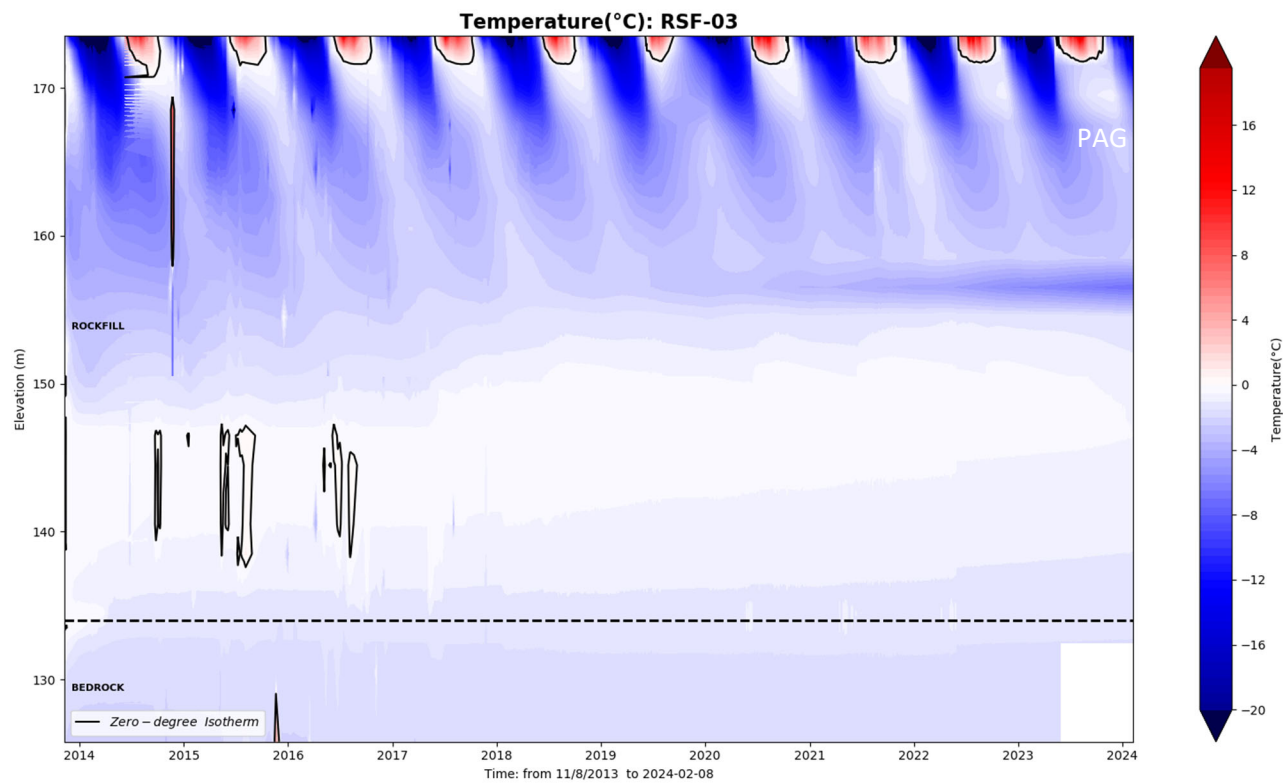


CD-US-0+650

This instrument is along the liner.



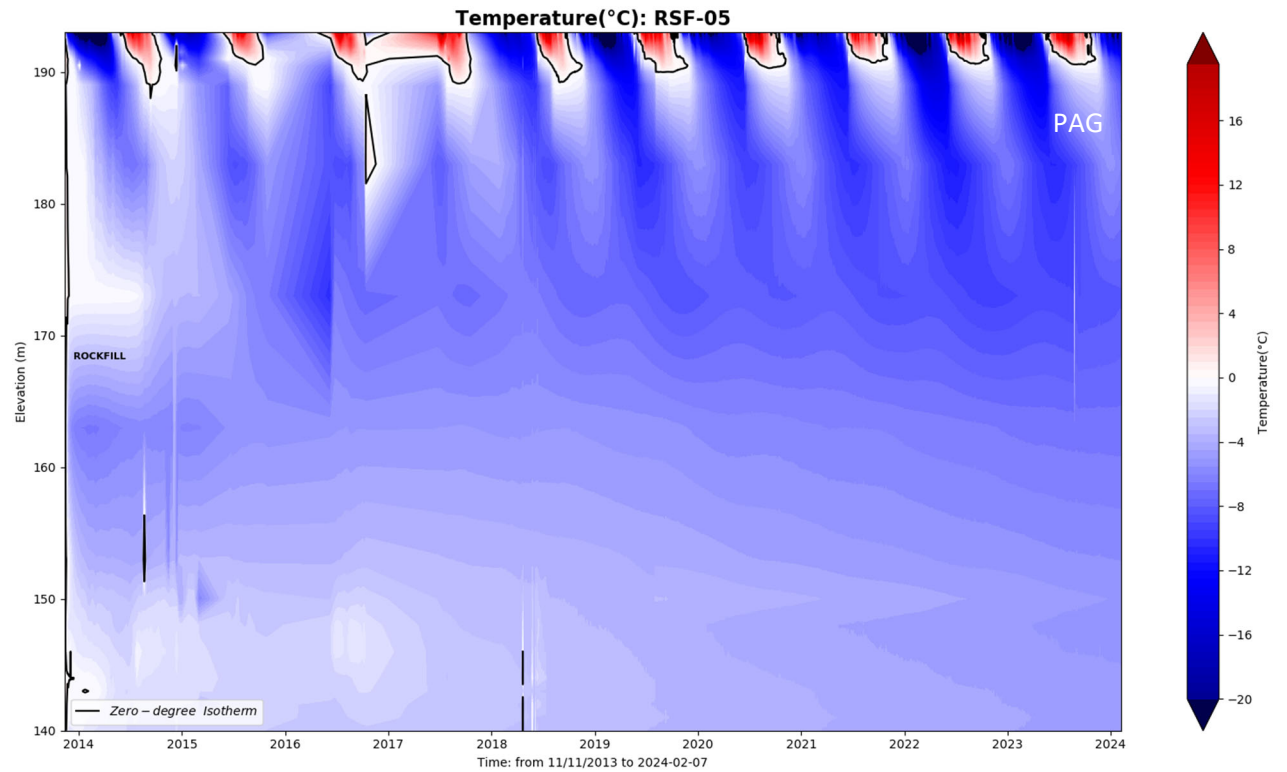
RSF-3



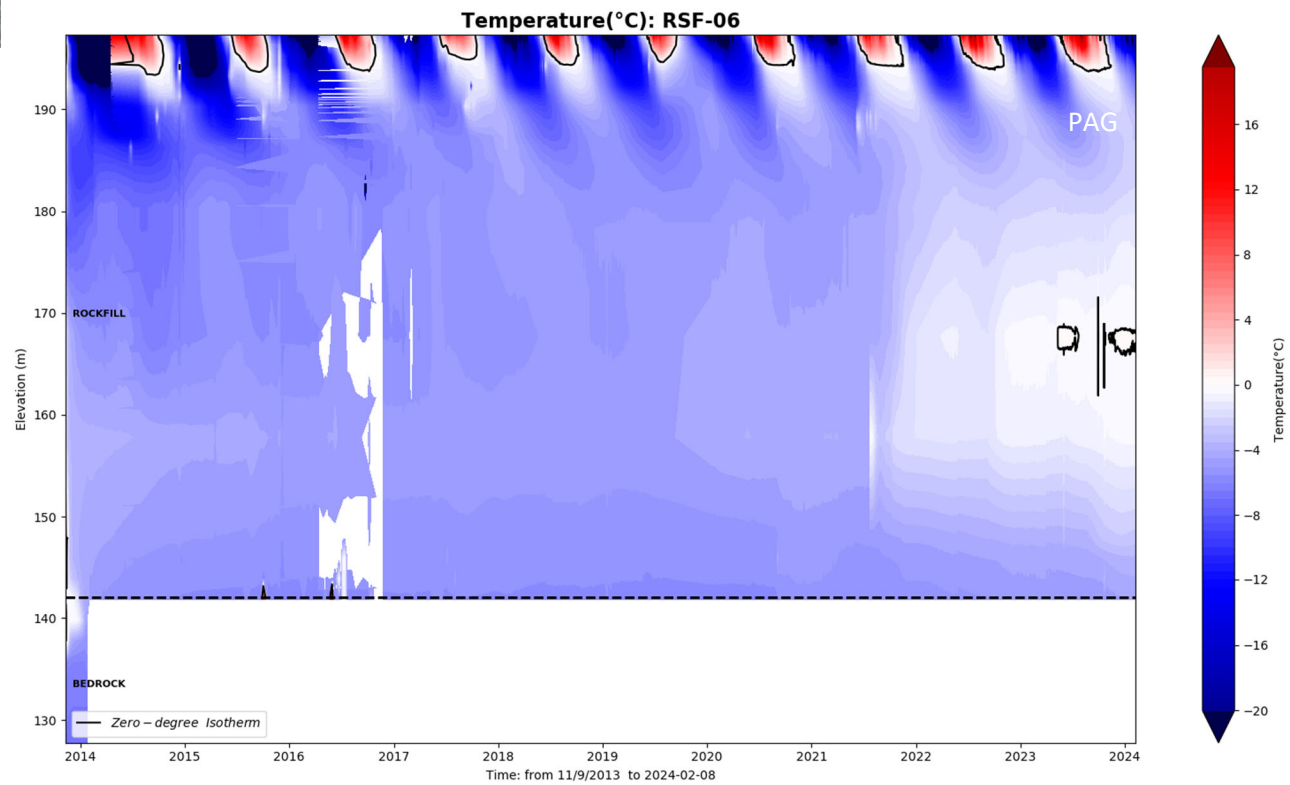
RSF-5



This instrument is broken and not sending data.



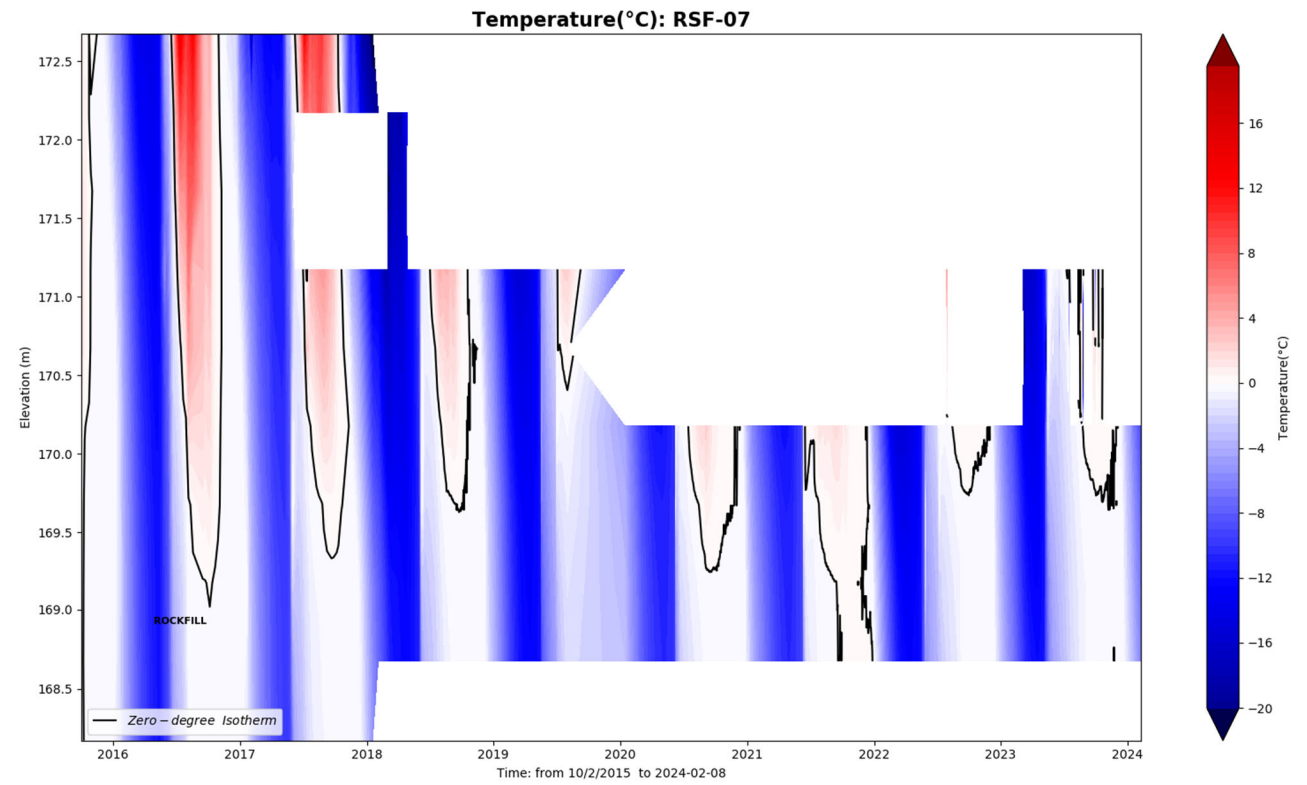
RSF-6



RSF-7



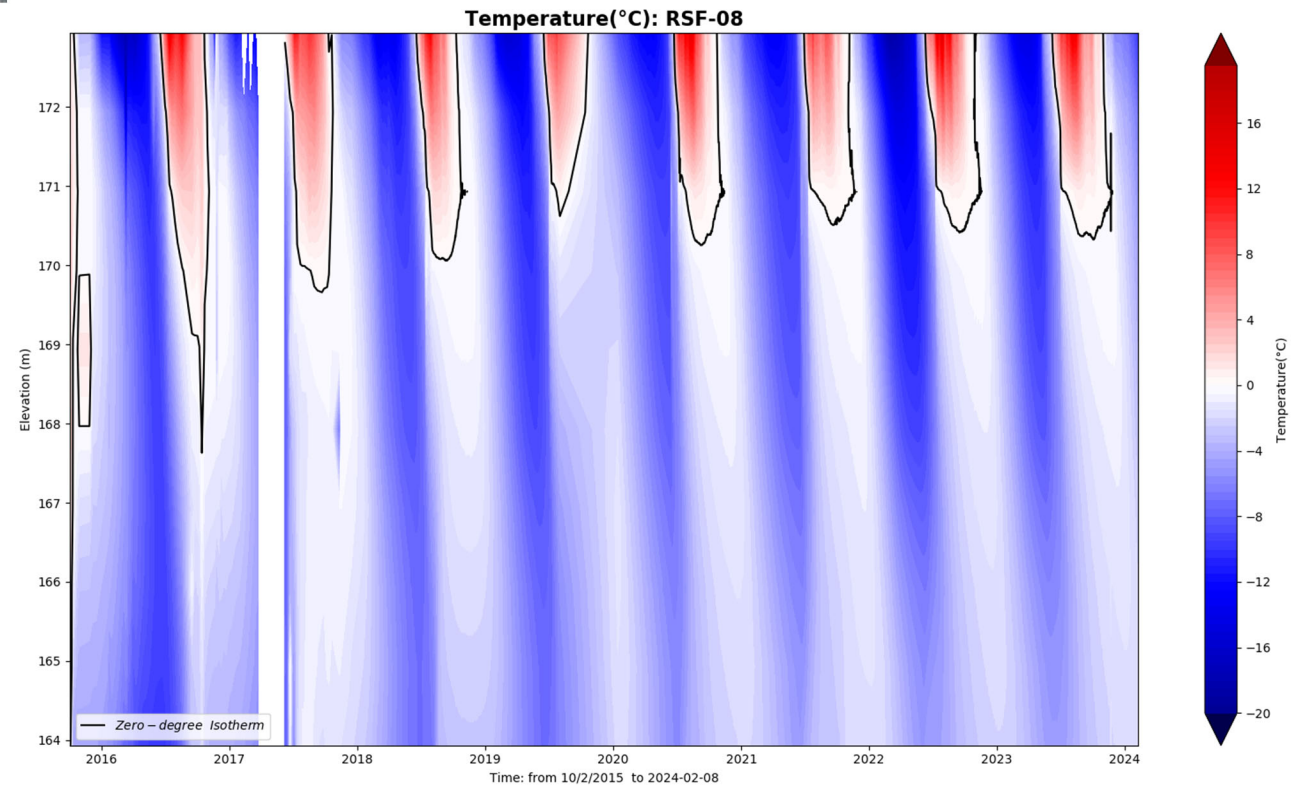
RSF-7 installed at a dip of -55°



RSF-8



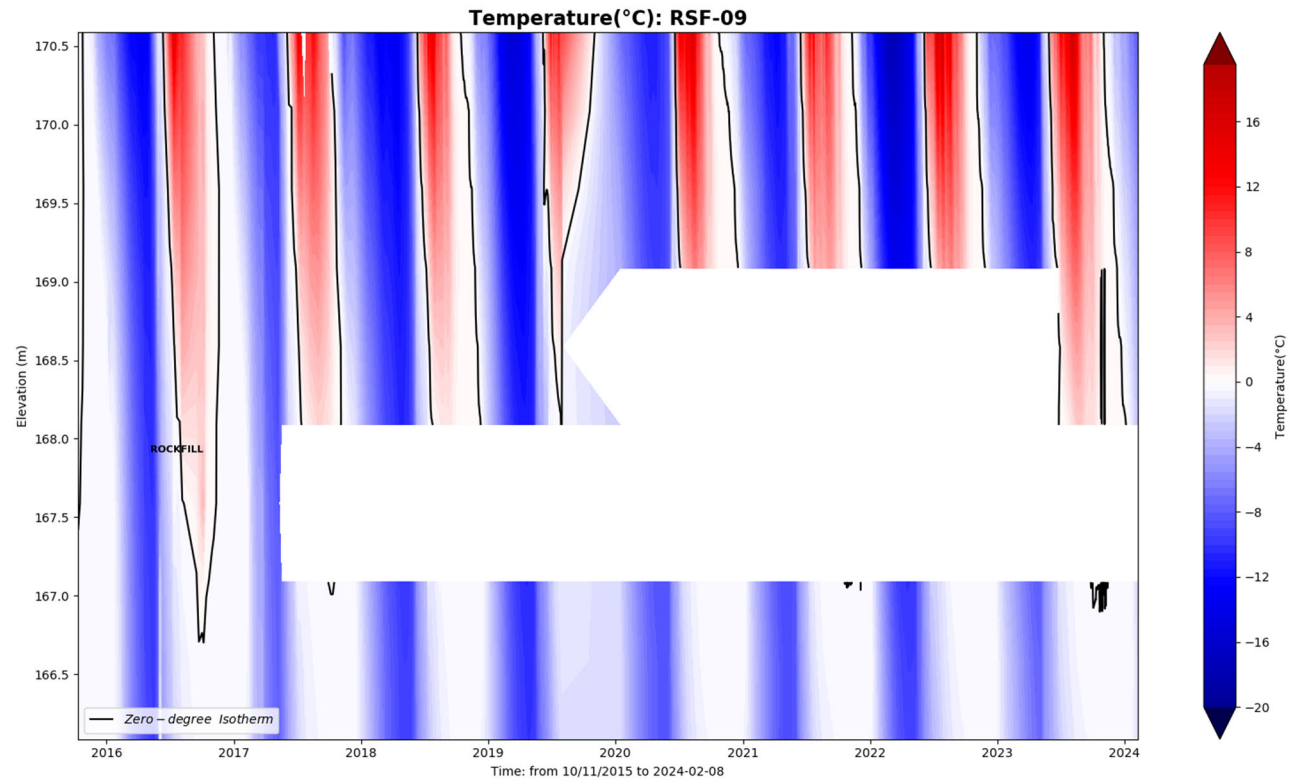
RSF-8 installed at a dip of -70°



RSF-9



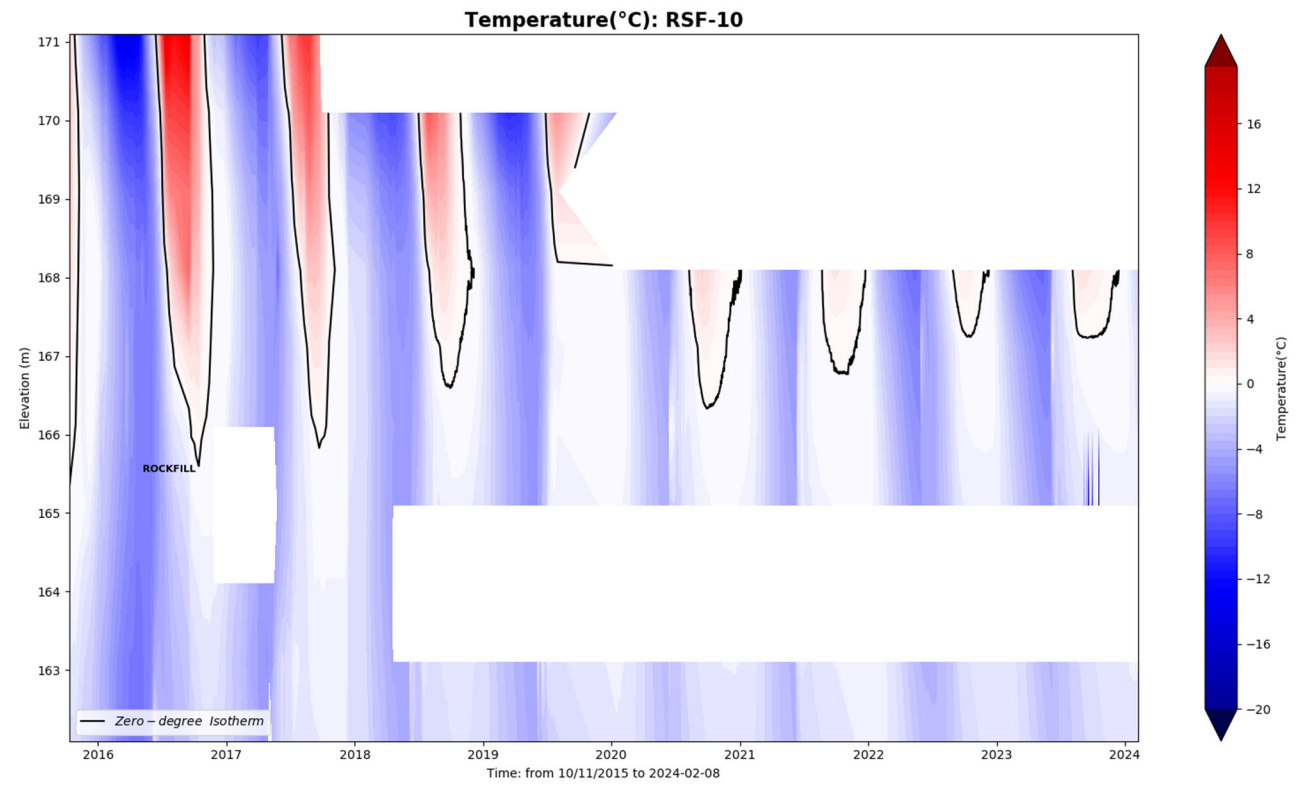
RSF-9 installed at a dip of -55°



RSF-10



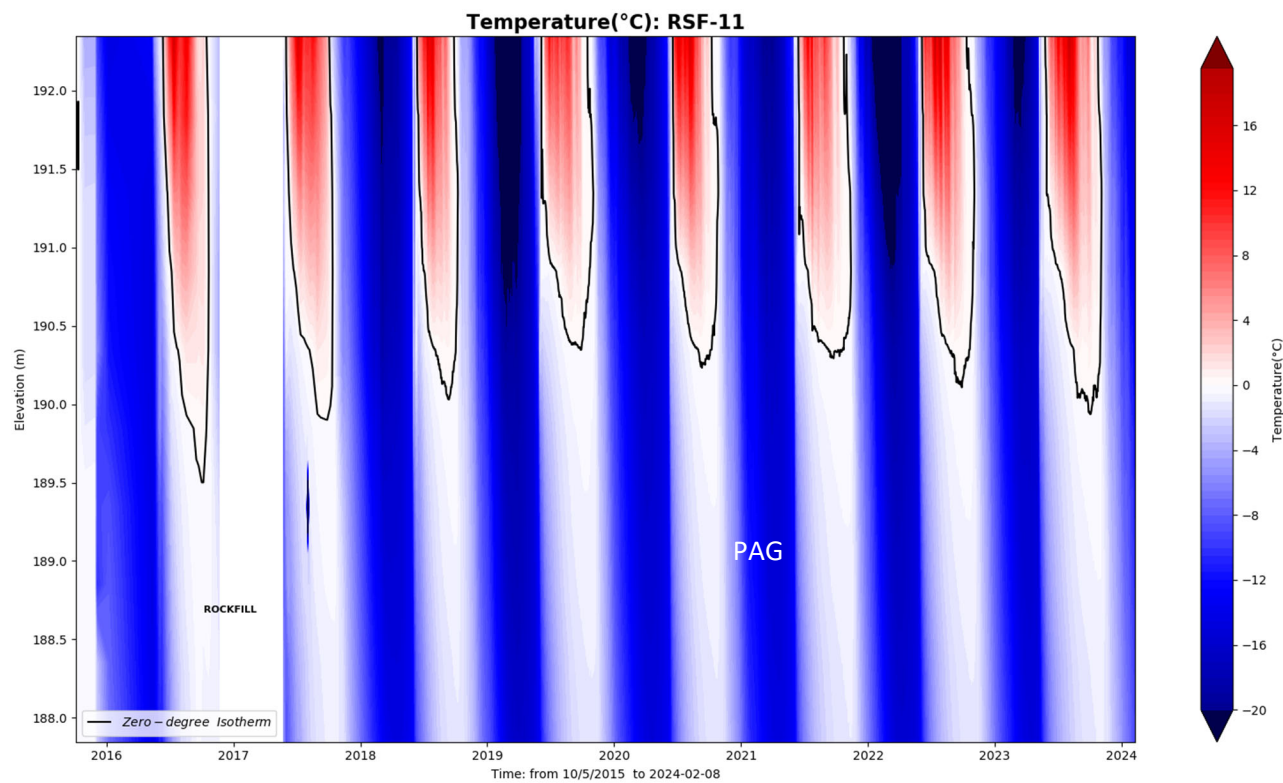
RSF-10 installed at a dip of -70°



RSF-11



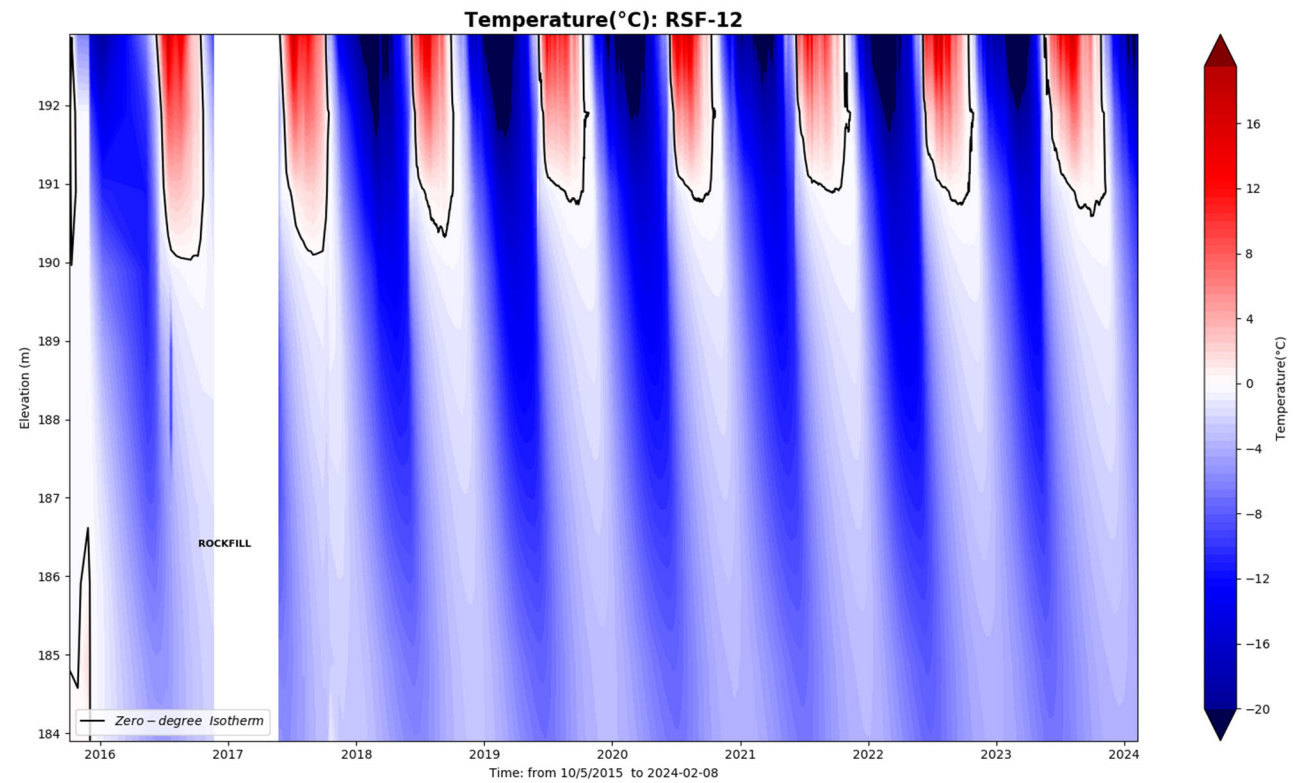
RSF-11 installed at a dip of -55°



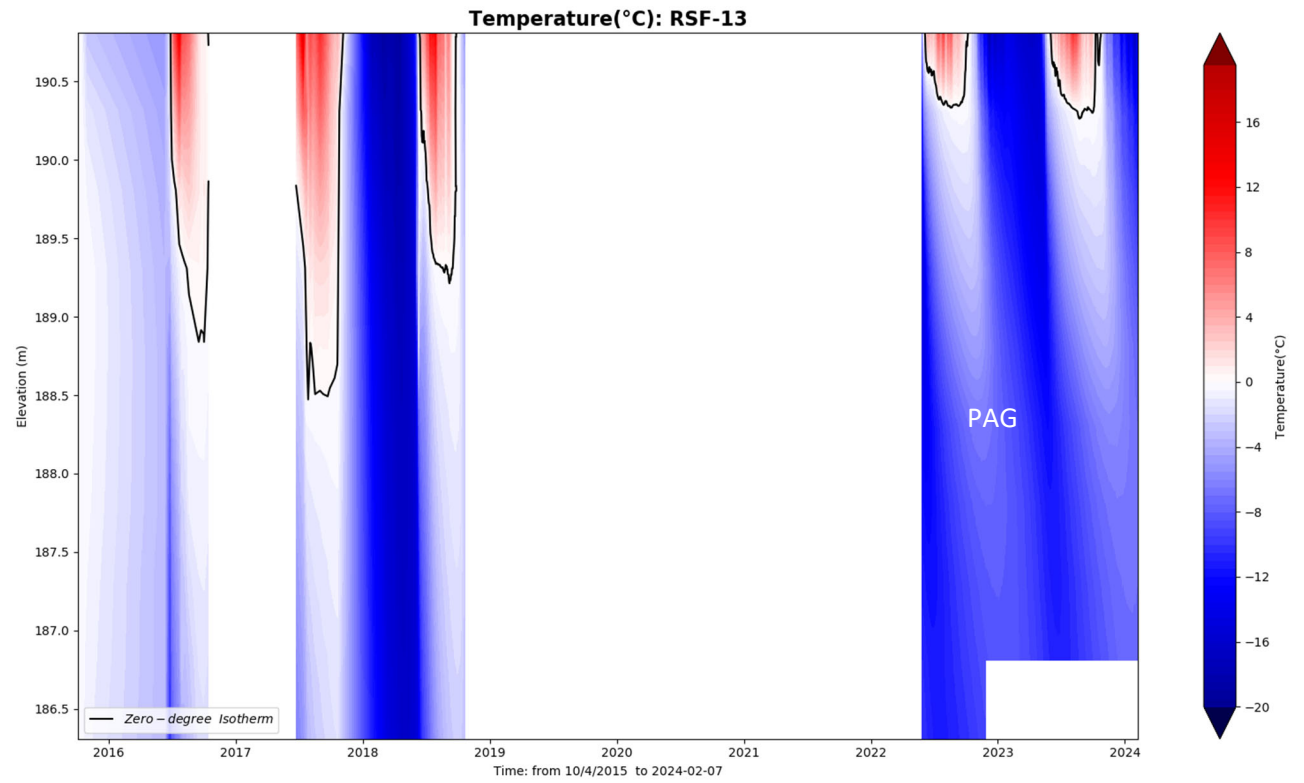
RSF-12



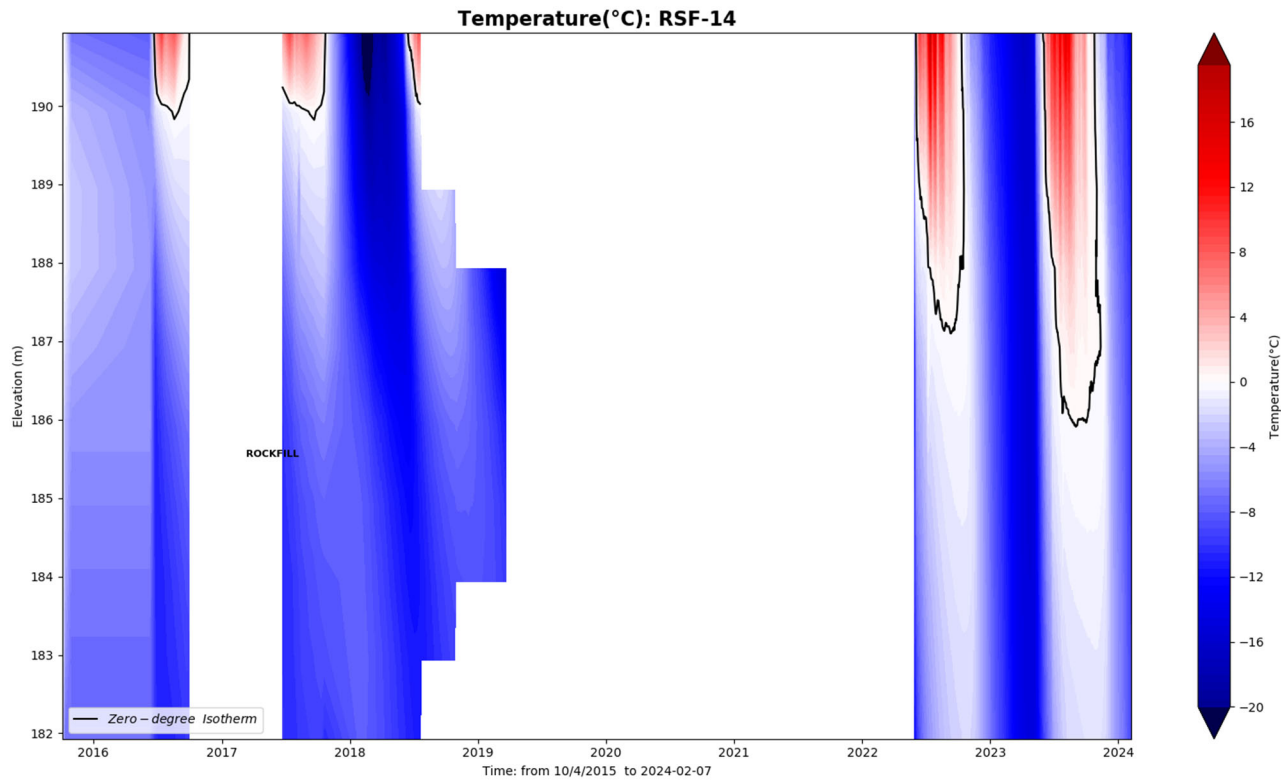
RSF-12 installed at a dip of -70°



RSF-13



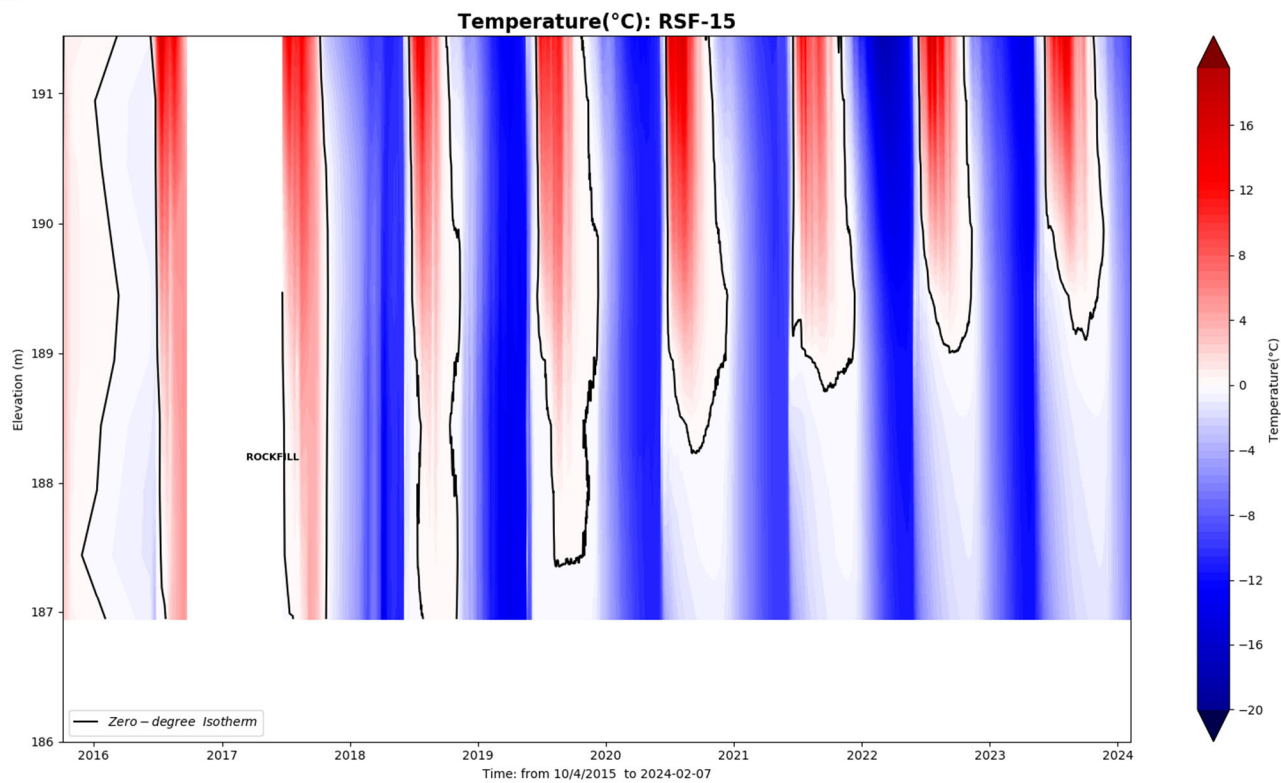
RSF-14



RSF-15



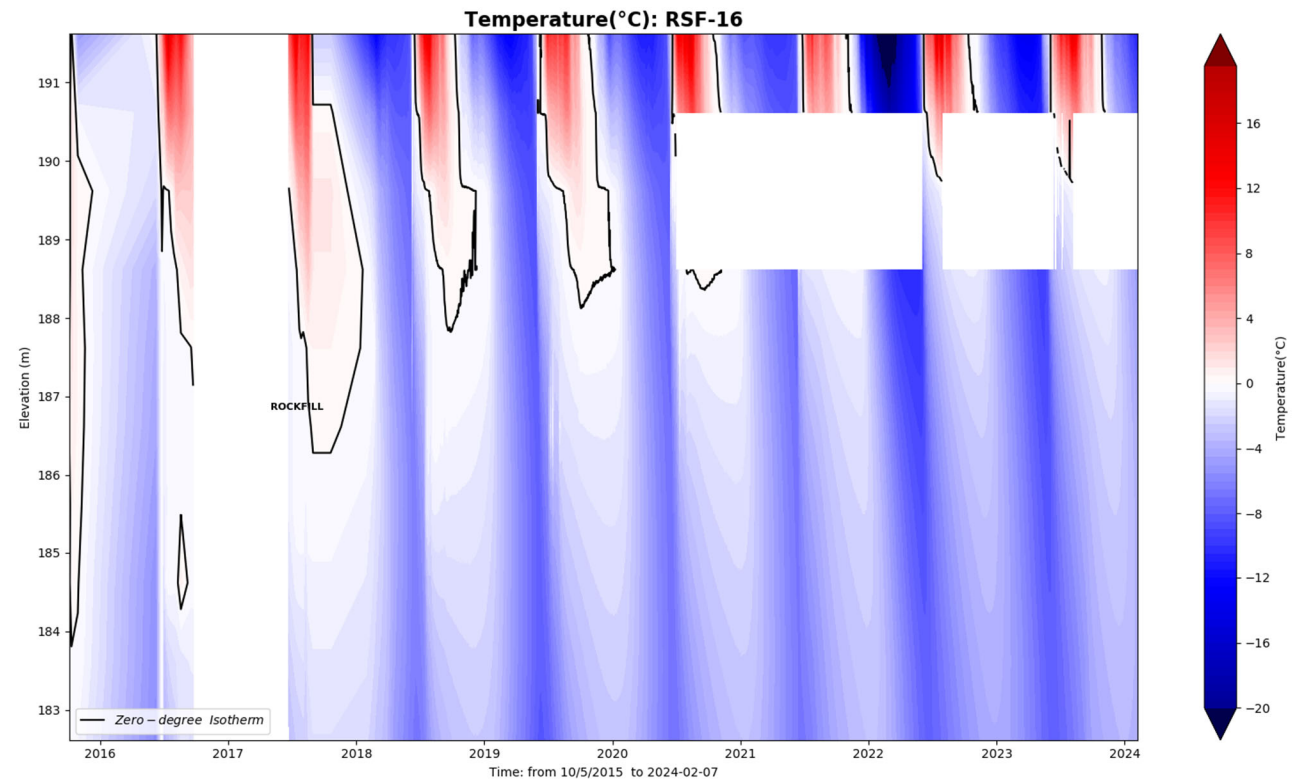
RSF-15 installed at a dip of -55°



RSF-16



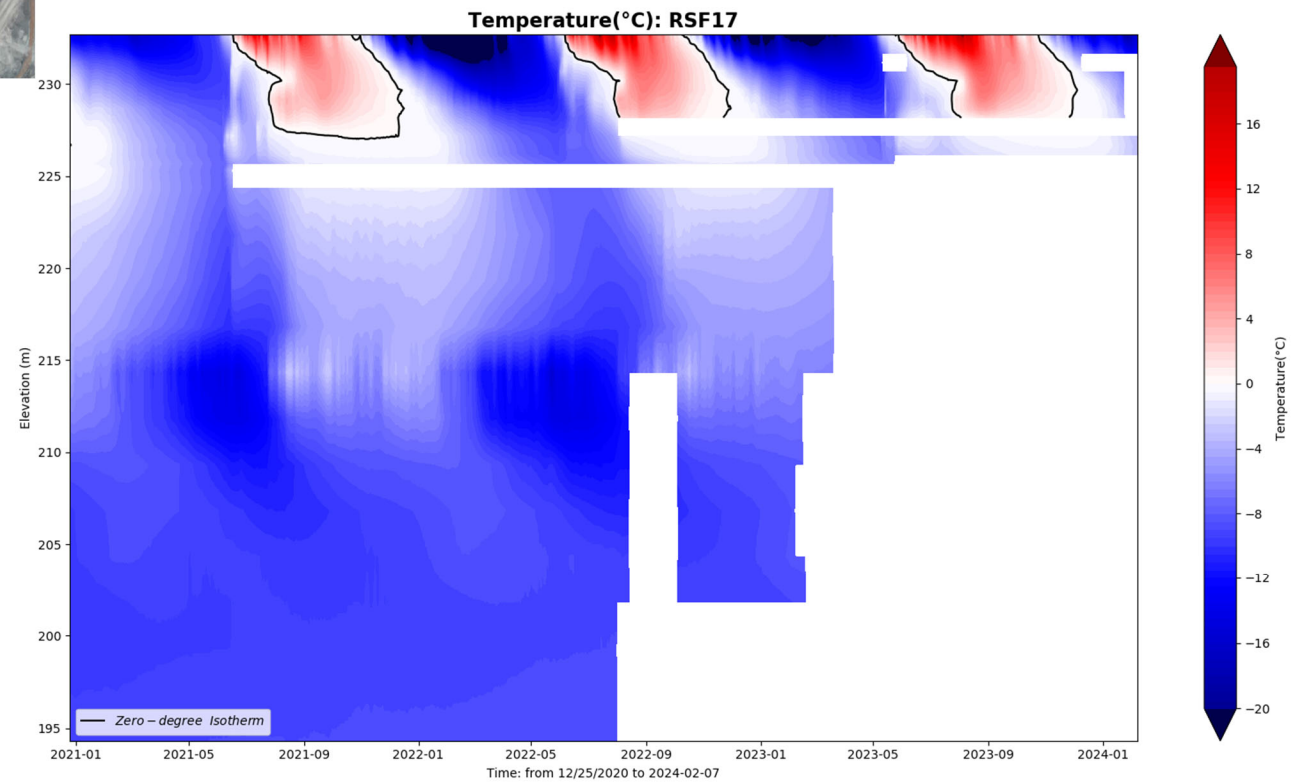
RSF-16 installed at a dip of -70°



RSF-17



RSF-17 installed at a dip of -90°



RSF-18



RSF-18 installed at a dip of -90°

