

# Reimagining datalogger monitoring and computer systems at the Alaska Earthquake Center



Alexandra Farrell

June 2024

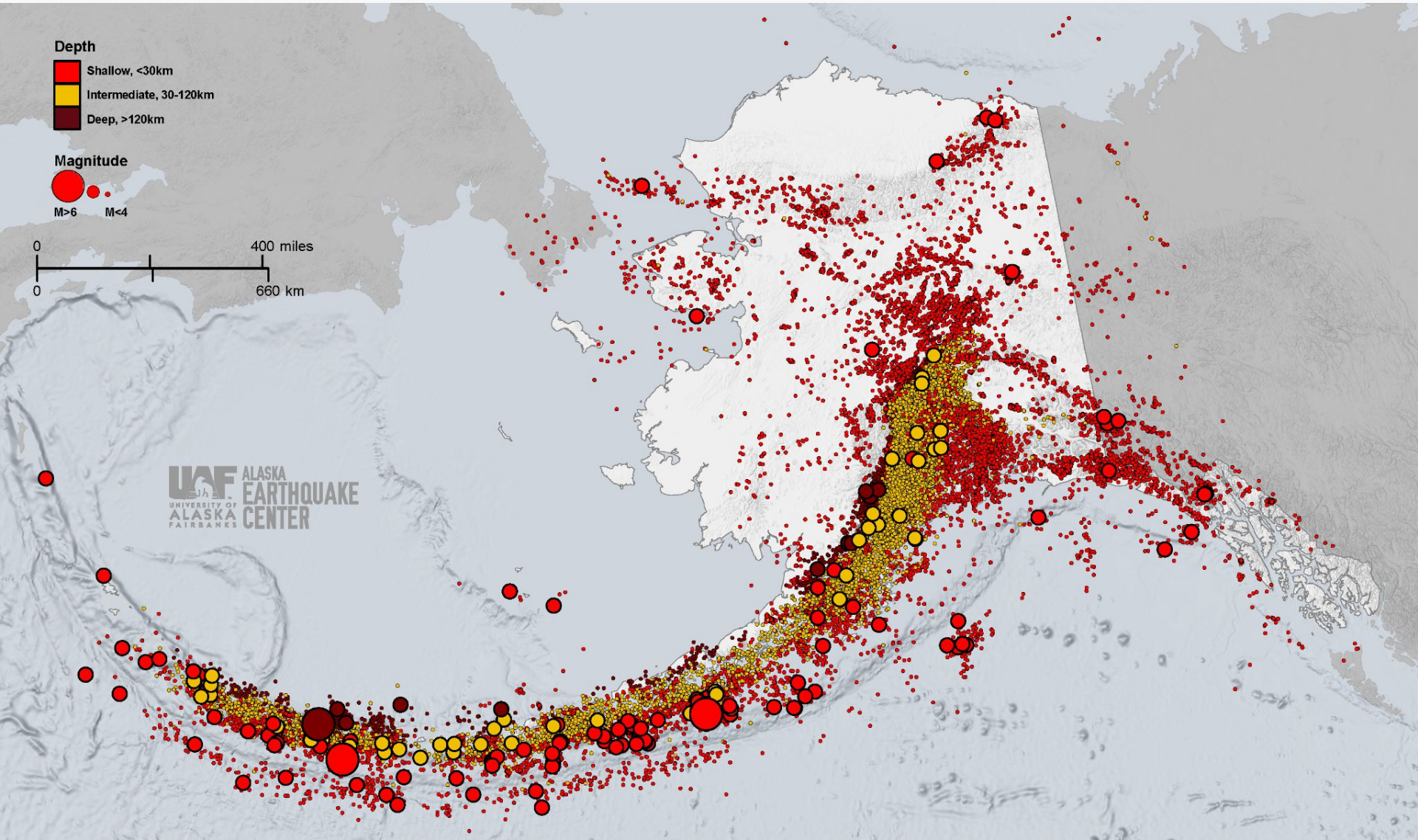
Antelope User Group Meeting

# Alaska Earthquake Center (AEC)





# 2023 Earthquake Summary

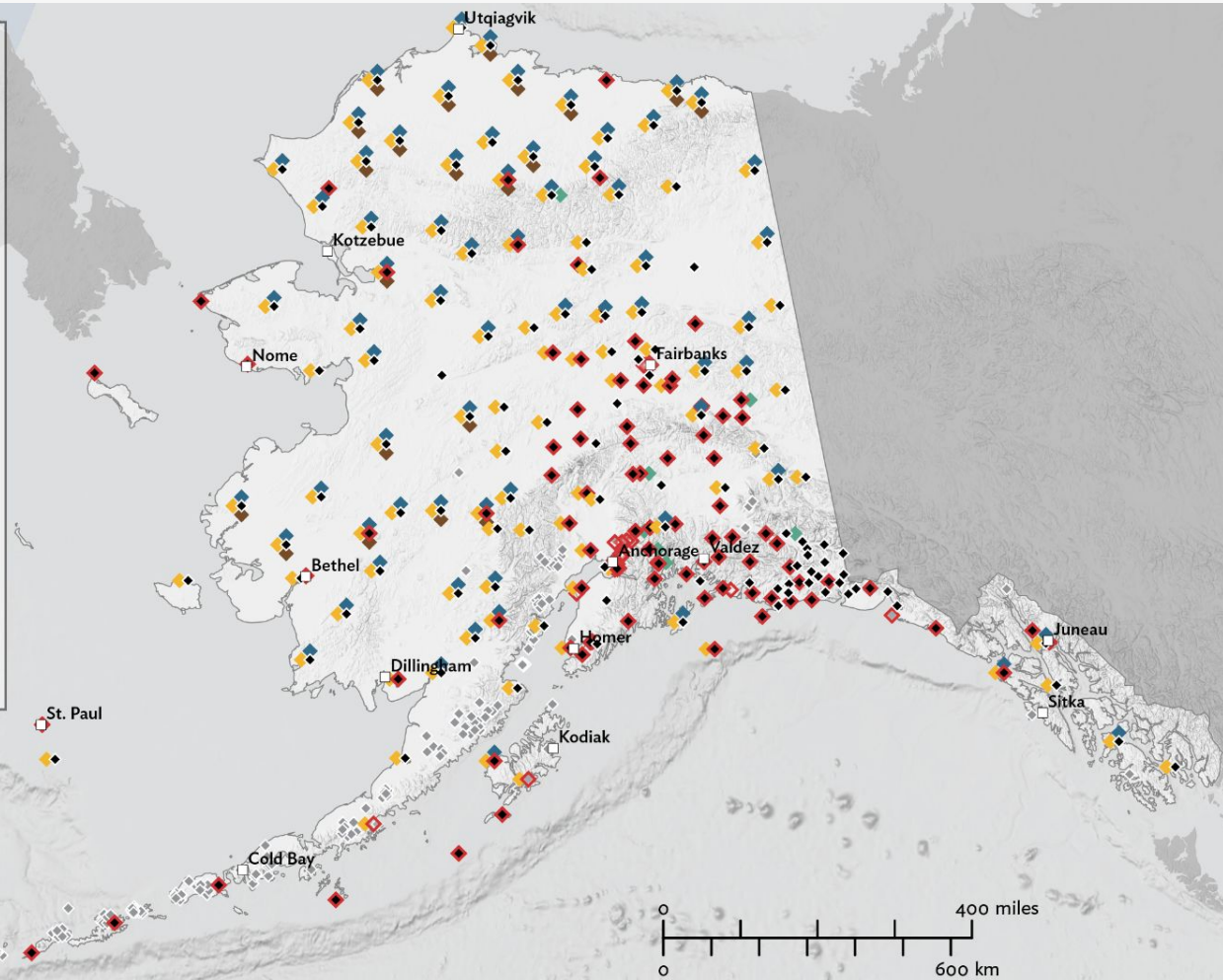


# AEC stations

## station key



- ◆ high-sensitivity **broadband** sensors measure ground motions over a wide range of frequencies
- ◆ **strong-motion** sensors help to quickly infer damage after earthquakes, and are essential to earthquake early warning
- ◆ temperature, humidity, and wind gauges are used in **weather** forecasting, climate assessment, aviation safety, and wildfire mitigation
- ◆ detecting frequencies below what humans can hear, **infrasound** sensors are used to monitor explosions and large ground movements
- ◆ **soil temperature** probes are used to map thawing permafrost, necessary for infrastructure planning
- ◆ the new generation of GPS, **GNSS** instruments are used in earthquake, surveying, weather, space, and defense science
- ◆ **partner**





# Introducing Webdlmon



Web-based Datalogger Monitoring for the Alaska Earthquake Center

Last refresh: 5 seconds ago

# Usage



- Duty: check to see status of station for pipeline alarms
- QC: check to see timing issues, mass positions, latencies, datalogger reboots, gaps, etc.
- Field: check to confirm station status (network connection) and key telemetry/power diagnostics during fieldwork.
- Network monitoring: the starting point to detect network and station problems and is very useful for daily network checks.

# Overview

Web-based Datalogger Monitoring for the Alaska Earthquake Center

Last refresh: 8 seconds ago

Search Station name:

<input checked="" type="checkbox"/> Status	<input checked="" type="checkbox"/> DL Type	<input checked="" type="checkbox"/> Latency	<input checked="" type="checkbox"/> Runtime	<input checked="" type="checkbox"/> Throughput	<input checked="" type="checkbox"/> Data Rate	<input checked="" type="checkbox"/> Buffer	<input checked="" type="checkbox"/> Comm Efficiency	<input checked="" type="checkbox"/> Temp	<input checked="" type="checkbox"/> Voltage	<input checked="" type="checkbox"/> Current	<input checked="" type="checkbox"/> Mass Position 0	<input checked="" type="checkbox"/> Mass Position 1			
<input checked="" type="checkbox"/> Mass Position 2	<input checked="" type="checkbox"/> Mass Position 3	<input checked="" type="checkbox"/> Mass Position 4	<input checked="" type="checkbox"/> Mass Position 5	<input checked="" type="checkbox"/> Clock Latency	<input checked="" type="checkbox"/> GPS Status	<input checked="" type="checkbox"/> Clock Status	<input checked="" type="checkbox"/> Clock Quality	<input checked="" type="checkbox"/> Data Gaps	<input checked="" type="checkbox"/> Reboots	<input checked="" type="checkbox"/> Link Cycles					
DL Name	Status	DL Type	Latency	Runtime	Throughput	Data Rate	Buffer	Comm Efficiency	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3
AK_A19K	offline	q330	6h-22m	6h-20m	0	0	0	100	3	13.35	0	4	-22	14	20
AK_A21K	offline	q330	1Y-9M-6D	1Y-9M-6D	0	0									
AK_A22K	offline	q330	57m-8s	55m-11s	0	8	0	100	18	13.5	0	3	-3	-12	20
AK_ATKA	online	q330	34s	29m-57s	1.041	4307	0	100	11	13.35	0	33	33	33	-7
AK_B18K	offline	q330	5h-52m	5h-50m	0	0	0	98.889	1	13.2	0	-12	5	1	
AK_B20K	online	q330	36s	3h-13m	1.074	4010	0	100	18	13.5	0	-11	8	-4	
AK_B22K	offline	q330	10M-1D	10M-1D	0	0									
AK_BAE	offline	q330	23D-3h	23D-3h	0	16	0	100	6	13.35	0	34	33	33	-1
AK_BAGL	offline	q330	5M-8D	5M-8D	0	0	0	100	0	12.75	0	20	20	20	7
AK_BAL	online	q330	12s	30m-4s	1.107	3402	0	100	9	13.2	0	20	20	20	-1
AK_BARK	offline	q330	5M-8D	5M-8D	0	0	0	81.967	3	11.7	0	20	20	20	9
AK_BARN	online	q330	14s	6m-0s	1.008	2253	0	100	11	13.65	0	20	20	20	5

# Legend

[Jump To Top](#)

## Legend


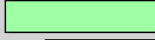






### DL Name

Description: Name of station

### Status

Description: Overall health of data logger

Coloring and Status Descriptions:

- stopped =  - Server stopped (offline)
- yes =  - Currently connected and acquiring data (online)
- waiting =  - Waiting for a datalogger POC (listening)
- hibernating =  - Hibernating (offline)
- sleeping =  - Sleeping after a connection setup failure (offline)
- reg =  - Establishing a connection (offline)
- su =  - Establishing a connection (offline)
- nr =  - NULL datalogger ip-address (offline)

### DL Type


Description: Data logger type

### Latency

Description: Age of last data packet sample recieved.

Units: Day, Hr, Min, Sec

Coloring:

- 0 - 60 =  



# Hide Columns

Web-based Datalogger Monitoring for the Alaska Earthquake Center

Last refresh: 2 seconds ago

Search Station name:


<input checked="" type="checkbox"/> Status	<input checked="" type="checkbox"/> DL Type	<input checked="" type="checkbox"/> Latency	<input checked="" type="checkbox"/> Runtime	<input checked="" type="checkbox"/> Throughput	<input checked="" type="checkbox"/> Data Rate	<input type="checkbox"/> Buffer	<input type="checkbox"/> Comm Efficiency	<input checked="" type="checkbox"/> Temp	<input checked="" type="checkbox"/> Voltage	<input checked="" type="checkbox"/> Current	<input checked="" type="checkbox"/> Mass Position 0	<input checked="" type="checkbox"/> Mass Position 1			
<input checked="" type="checkbox"/> Mass Position 2	<input checked="" type="checkbox"/> Mass Position 3	<input checked="" type="checkbox"/> Mass Position 4	<input checked="" type="checkbox"/> Mass Position 5	<input checked="" type="checkbox"/> Clock Latency	<input checked="" type="checkbox"/> GPS Status	<input checked="" type="checkbox"/> Clock Status	<input checked="" type="checkbox"/> Clock Quality	<input checked="" type="checkbox"/> Data Gaps	<input checked="" type="checkbox"/> Reboots	<input checked="" type="checkbox"/> Link Cycles					
DL Name ▼	Status	DL Type	Latency	Runtime	Throughput	Data Rate	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3	Mass Position 4	Mass Position 5
AK_A19K	offline	q330	6h-22m	6h-20m	0	0	3	13.35	0	4	-22	14	20	21	21
AK_A21K	offline	q330	1Y-9M-6D	1Y-9M-6D	0	0									
AK_A22K	offline	q330	57m-8s	55m-11s	0	8	18	13.5	0	3	-3	-12	20	20	20
AK_ATKA	online	q330	34s	29m-57s	1.041	4307	11	13.35	0	33	33	33	-7	-10	-4
AK_B18K	offline	q330	5h-52m	5h-50m	0	0	1	13.2	0	-12	5	1			
AK_B20K	online	q330	36s	3h-13m	1.074	4010	18	13.5	0	-11	8	-4			
AK_B22K	offline	q330	10M-1D	10M-1D	0	0									
AK_BAE	offline	q330	23D-3h	23D-3h	0	16	6	13.35	0	34	33	33	-1	3	2
AK_BAGL	offline	q330	5M-8D	5M-8D	0	0	0	12.75	0	20	20	20	7	-14	1
AK_BAL	online	q330	12s	30m-4s	1.107	3402	9	13.2	0	20	20	20	-1	1	2
AK_BARK	offline	q330	5M-8D	5M-8D	0	0	3	11.7	0	20	20	20	9	-15	7
AK_BARN	online	q330	14s	6m-0s	1.008	2253	11	13.65	0	20	20	20	5	-5	5

# Station Search

Web-based Datalogger Monitoring for the Alaska Earthquake Center


Last refresh: 18 seconds ago

Search Station name:

<input checked="" type="checkbox"/> Status	<input checked="" type="checkbox"/> DL Type	<input checked="" type="checkbox"/> Latency	<input checked="" type="checkbox"/> Runtime	<input checked="" type="checkbox"/> Throughput	<input checked="" type="checkbox"/> Data Rate	<input checked="" type="checkbox"/> Buffer	<input checked="" type="checkbox"/> Comm Efficiency	<input checked="" type="checkbox"/> Temp	<input checked="" type="checkbox"/> Voltage	<input checked="" type="checkbox"/> Current	<input checked="" type="checkbox"/> Mass Position 0	<input checked="" type="checkbox"/> Mass Position 1				
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DL Name	Status	DL Type 	Latency	Runtime	Throughput	Data Rate	Buffer	Comm Efficiency	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3	Mass Position 4
AK_FA01	online	q330	22s	12m-34s	1.05	6230	0	100	5	11.55	0	41	41	41	20	20
AK_FA02	online	q330	17s	53m-15s	1.041	8254	0	97.949	31	13.5	0	41	41	41		
AK_FA10	online	q330	32s	47m-24s	0.793	6425	0	99.625	41	11.7	0	41	41	41	20	20
AK_FALS	online	q330	19s	21m-38s	0.86	4944	0	100	13	13.2	0	50	51	51	2	2
AK_FA05	online	Etna 2	7s	13D-22h					38	13.163	0					
AK_FA06	online	Etna 2	3s	13D-22h					36	13.224	0					
AK_FA07	online	Etna 2	9s	13D-22h					35	13.253	0					
AK_FA12	online	Etna 2	9s	13D-22h					34	13.136	0					

# Color Blind Friendly Table

Search Station name: 

<input checked="" type="checkbox"/> Status	<input checked="" type="checkbox"/> DL Type	<input checked="" type="checkbox"/> Latency	<input checked="" type="checkbox"/> Runtime	<input checked="" type="checkbox"/> Throughput	<input checked="" type="checkbox"/> Data Rate	<input checked="" type="checkbox"/> Buffer	<input checked="" type="checkbox"/> Comm Efficiency	<input checked="" type="checkbox"/> Temp	<input checked="" type="checkbox"/> Voltage	<input checked="" type="checkbox"/> Current	<input checked="" type="checkbox"/> Mass Position 0	<input checked="" type="checkbox"/> Mass Position 1			
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DL Name 	Status	DL Type	Latency	Runtime	Throughput	Data Rate	Buffer	Comm Efficiency	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3
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AK_A21K	offline	q330	1Y-9M-6D	1Y-9M-6D	0	0									
AK_A22K	offline	q330	58m-8s	56m-11s	0	0	0	100	18	13.5	0	3	-3	-12	20
AK_ATKA	online	q330	31s	30m-57s	1.041	4342	0	100	11	13.35	0	33	33	33	-7
AK_B18K	offline	q330	5h-53m	5h-51m	0	0	0	98.889	1	13.2	0	-12	5	1	
AK_B20K	online	q330	36s	3h-14m	0.942	4208	0	99.254	18	13.65	0	-11	8	-4	
AK_B22K	offline	q330	10M-1D	10M-1D	0	0									
AK_BAE	offline	q330	23D-3h	23D-3h	0	0	0	100	6	13.35	0	34	33	33	-1





# Color Blind Friendly Legend

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## Legend









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### DL Type

Description: Data logger type

### Latency

Description: Age of last data packet sample recieved.

Units: Day, Hr, Min, Sec

Coloring:

- 0 - 60 = 

# Sort by Column



DL Name	Status	DL Type ▼	Latency	Runtime	Throughput	Data Rate	Buffer	Comm Efficiency
AK_CDVT	online	Basalt	5s	3D-12h				
AK_DAM2	online	Basalt	29s	13D-22h				
AK_K204	online	Basalt	30s	13D-22h				
AK_K205	online	Basalt	23s	13D-22h				
AK_K208	online	Basalt	16s	1M-12D				
AK_K210	online	Basalt	1m-16s	13D-22h				
AK_K211	online	Basalt	2s	20D-9h				

# Reverse Sort by Column

☒ Status ☒ DL Type ☒ Latency ☒ Runtime ☒ Throughput ☒ Data Rate ☒ Buffer ☒ Comm Efficiency ☒ Temp ☒ Voltage

☒ Mass Position 2 ☒ Mass Position 3 ☒ Mass Position 4 ☒ Mass Position 5 ☒ Clock Latency ☒ GPS Status ☒ Clock Status

DL Name .....	Status .....	DL Type ..... ▲	Latency .....	Runtime .....	Throughput .....	Data Rate .....	Buffer .....	Comm Efficiency .....	Temp .....
AK_K209	online	Rock	42s	2Y-0m-6D					31
AK_K213	online	Rock	18s	11M-24D					33
AK_K215	online	Rock	5s	1M-12D					29
AK_K217	online	Rock	2s	2Y-0m-1D					27
AK_K218	online	Rock	29s	13D-20h					26
AK-ANM	online	Q8	12s	2M-25D					22
AK-CCB	online	Q8	43s	11M-7D					42



# Headers Pinned

DL Name ▼	Data Rate	Buffer	Comm Efficiency	Temp	Voltage	Current	Mass Position 0	Mass Position 1	Mass Position 2	Mass Position 3	Mass Position 4	Mass Position 5	Clock Latency	GPS Status
AK_K209				31	15.43	0								
AK_K20K	3379	0	98.519	29	12.75	0	2	2	-1				0s	
AK_K210				26	15.517	0								
AK_K211				25	15.507	0							0s	
AK_K212				25	15.528	0							0s	
AK_K213				33	15.44	0								
AK_K214				36	15.277	0							7s	
AK_K215				29	15.5	0								
AK_K217				27	15.44	0								
AK_K218				26	15.49	0								
AK_K221				35	14.099	0							7s	
AK_K222				21	13.124	0							6s	
AK_K223				35	13.314	0							5s	
AK_K24K	5229	0	100	29	13.05	0	-14	-7	4				0s	

# Information Pop-up

Throughput ▼	Data Rate	Buffer	Comm Efficiency
Throughput as ratio of seconds of data to real- time clock			

# Map

Jump To Legend

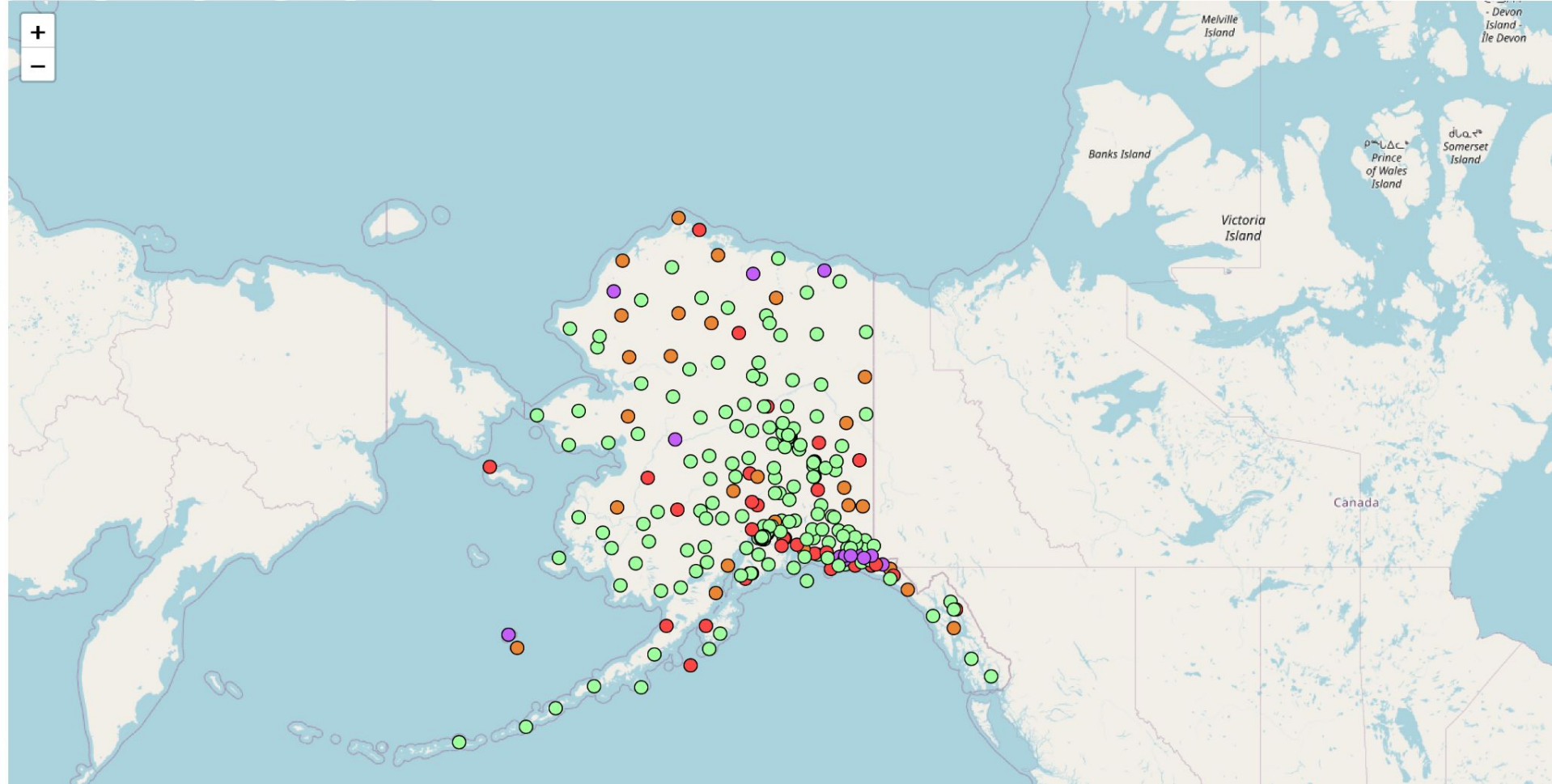
[View Map](#)



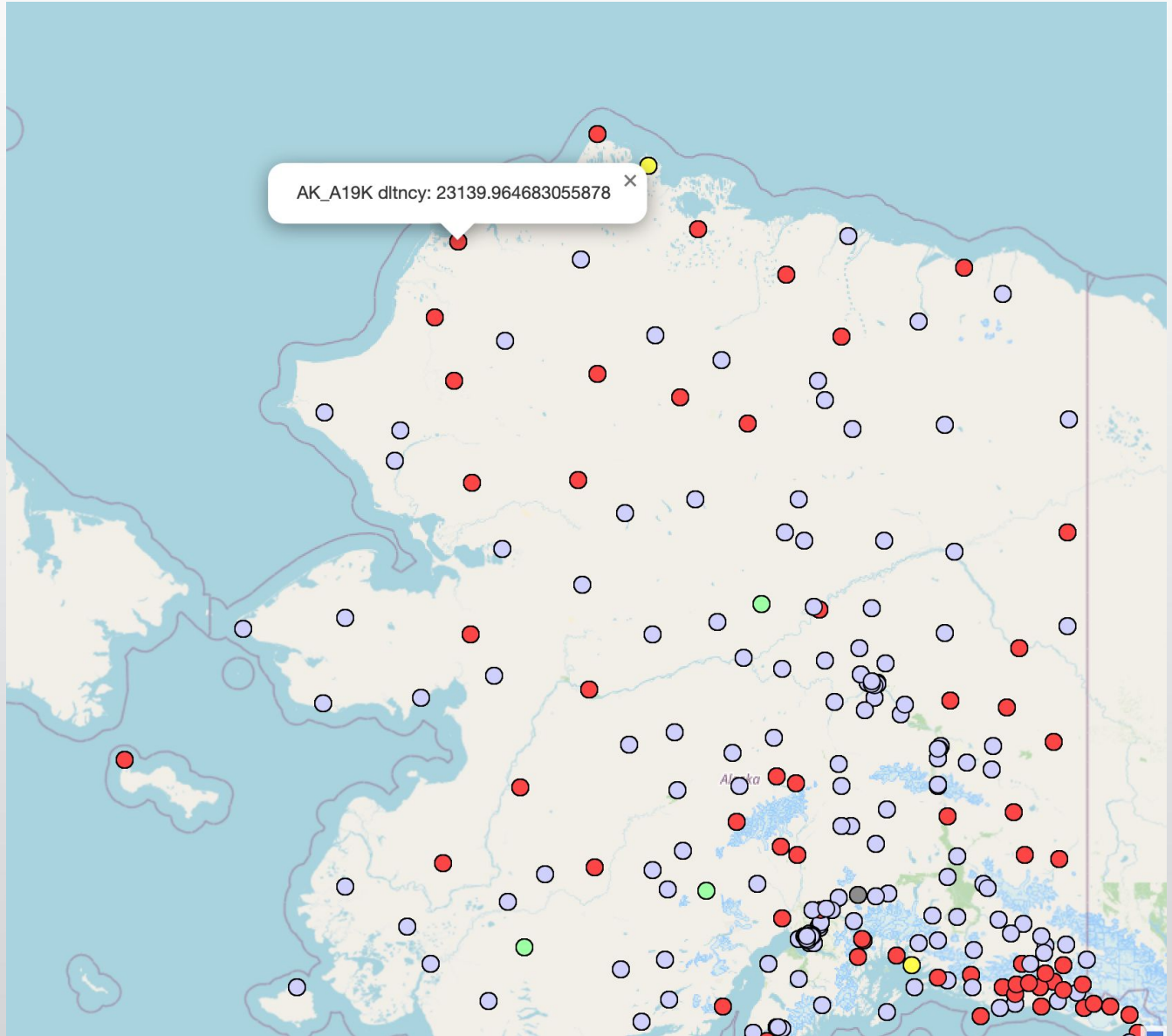
# Map View

[Main Webdlmon Page](#)

Status Latency Runtime Throughput Data Rate Buffer Comm Efficiency Temperature Voltage Current Mass Pos. 0 Mass Pos. 1 Mass Pos. 2 Mass Pos. 3 Mass Pos. 4 Mass Pos. 5 Clock Latency GPS Status  
Clock Status Clock Quality Data Gaps Reboots Link Cycles



# Basic Information on Click





Backend	follow-up changes to previous	3 weeks ago
Frontend	follow up to the follow up	3 weeks ago
.gitignore	remove .env from source control	4 months ago

- DOM (document object module) - representation of the HTML
- React.js can refresh certain parts of the DOM without refreshing the whole DOM or page






# Workflow

- Python script running as rtexec process captures SOH packets from our primary data ORB
  - `packet_types = ('./pf/st', 'AK_GRE.*_D0/SEED')`
- Writes data to MySQL database
  - database holds current data, not record through time
- Website backend queries MySQL database and puts data into a JSON file
  - also sends an epoch time of creation to the frontend
- Website frontend handles user requests and displays the data
  - takes epoch from backend and determines how old that epoch is in seconds
  - also does some math for latency when no new data has been received
  - refreshes every cell in table



# Map Codebase



 getColor.js	brought things up to speed with main webdlmon	3 weeks ago
 index.html	improved code style and added an auto-update at 5sec ...	2 months ago
 map.js	brought things up to speed with main webdlmon	3 weeks ago
 style.css	adding files - site nearly complete	2 months ago
 webdlmon.json	adding files - site nearly complete	2 months ago

# Challenges



- Standardizing for all datalogger types in use
  - which metrics to use
  - unit conversions for values
- Packet ingestion control
  - for Centaur packets
- Formatting tweaks
  - allow usability for all users as well as mobile platforms
  - time/date format for readability



Thank you!

**Questions and Thoughts?**