Alaska Earthquake Center
Quarterly Technical Report
January-March 2021

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Contents

1. Introduction

This is the first in a series of technical quarterly reports from the Alaska Earthquake Center (AEC). It includes detailed summaries and updates on Alaska seismicity, the AEC seismic network and stations, field work, our social media presence, and lists publications and presentations by AEC staff. Multiple AEC staff members contributed to this report. It is issued in the following month after the completion of each quarter Q1: January-March, Q2: April-June, Q3: July-September, and Q4: October-December.

2. Seismicity

Between January 1 and March 31, 2021 we reported 11,104 seismic events in the state and the neighbouring regions (Figure 2.1), with depths ranging between 0 and 239 km and magnitudes between -0.6 and 6.1. The largest earthquake of Mw=6.1 occurred on January 3 at 12:38:49 UTC in the Andreanof Islands region of Alaska. It was a subduction zone interface earthquake. Five earthquakes had magnitudes between 5.0 and 5.6, all located in the Alaska Peninsula and along the Aleutian arc. The largest earthquake in mainland Alaska was a M5.3 that occurred on February 27 at 18:59:25 UTC (9:59 am AKST) and was located 13 km NNW of Anchorage at 46 km depth.

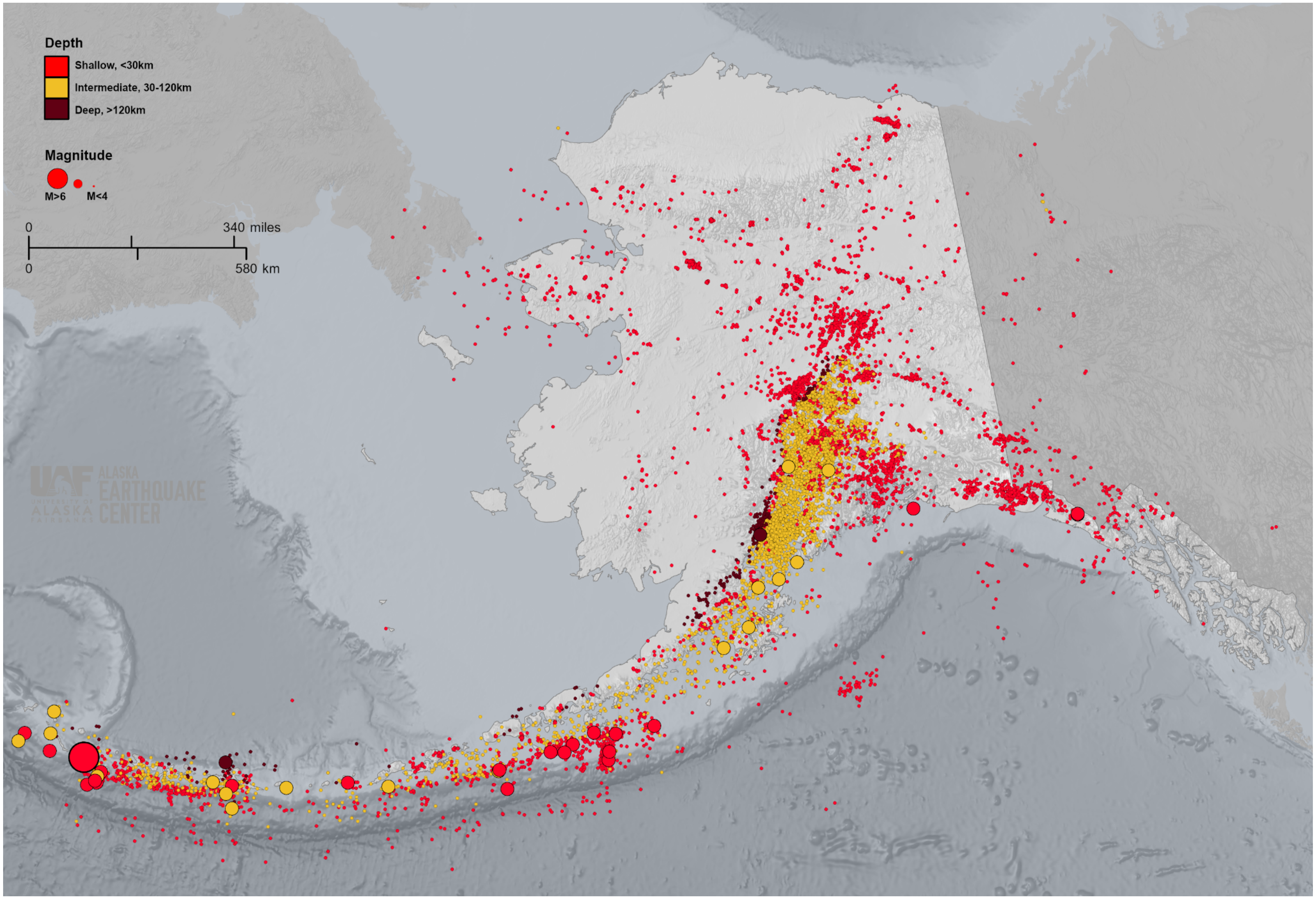
AEC data analysts also picked and catalogued 354,058 seismic phases, 237,720 of which were P-phase and 116,338 S-phase arrival picks (Figure 2.2). Fewer phase arrivals per event were catalogued for the Aleutian earthquake due to sparser station coverage compared to mainland Alaska.

We reported 336 seismic sources caused by something other than regional tectonic earthquakes. 91 of these were suspected quarry blasts, the majority of which were located in the vicinity of Fort Knox and Healy mines in Interior Alaska (magnitudes M=0.8-2.1). 170 of the reported events were ice quakes, primarily located in the Prince WIlliam Sound, Icy Bay, and Yakutat Bay areas (magnitudes M=0.9-2.1). 66 events were characterized as volcanic seismic events (magnitudes M=-0.6-2.6).

49 earthquakes were reported as felt (magnitudes M=2.2-6.1), 4 of which were located in Southeast Alaska, 4 in the Interior, 3 in the Aleutian Islands, 3 in the Kodiak Island region, and the remainder in the Cook Inlet and Southcentral region of Alaska. The largest number of DYFI (Did You Feel It) responses, 2,900, came from the M5.3 earthquake near Anchorage on February 27 (https://earthquake.usgs.gov/earthquakes/eventpage/ak0212o88mof/dyfi/intensity).

Overall, we reported about 123 events per day, or one event every 11 minutes on average. The seismicity rate continued at a steady pace with no notable increases or decreases (Figures 2.3 and 2.4). We continued recording aftershock activity for the following sequences: 2020 M7.8 Simeonof, 2018 M7.1 Anchorage, 2018 M6.4 Kaktovik, 2018 M7.9 Offshore Kodiak, and Purcell Mountain Swarm (Table 1).

Figure 2.1. *Earthquake map for Alaska and neighbouring regions January-March, 2021.*



The Simeonof Earthquake continues to produce the most active ongoing aftershock sequence with 1,300 reported aftershocks between magnitude 1.2 and 5.3, continuing the 2020 trend. The M7.6 aftershock cluster continues to be more active than the larger M7.8 patch (Figures 2.5 and 2.6). The 2018 M7.1 Anchorage earthquake aftershock sequence and the Purcell Mountains swarm produced nearly equal contributions of events at 190 and 187, respectively. All listed sequences, however, continue at notably decreased rates compared to 2020 (Ruppert and Gardine, 2021).

A magnitude 4.3 earthquake on March 26 near Cleveland Volcano generated a vigorous aftershock sequence with 30 aftershocks reported between magnitudes 2.1 and 3.3. Due to lack of station coverage in the area, aftershocks with a magnitude less than about 2 can not be reliably located (Figure 2.7). Cleveland Volcano has been in a state of unrest for most of the past decade (https://www.avo.alaska.edu/activity/Cleveland.php). No increase in eruptive activity, however, has been observed following this earthquake.

Table 1. *Notable Alaska seismic sequences in January-March, 2021 (listed in order of activity level). The M7.8 Simeonof Earthquake occurred on July 22, followed by a M7.6 aftershock on October 19. The M7.6 earthquake generated its own aftershock sequence.*

Earthquake	Number of aftershocks	Magnitude range	Magnitude of completeness (Mc)	Number of events per week
2020 M7.8 Simeonof	1,300 (850 in the M7.6 zone)	1.2-5.3	2.3	101
2018 M7.1 Anchorage	190	0.8-5.3	1.2	15
Purcell Mountains Swarm	187	0.7-2.8	1.0	15
2018 M6.4 Kaktovik	121	0.6-3.4	1.1	9
2018 M7.9 Offshore Kodiak	48	2.6-3.8	3.1	4

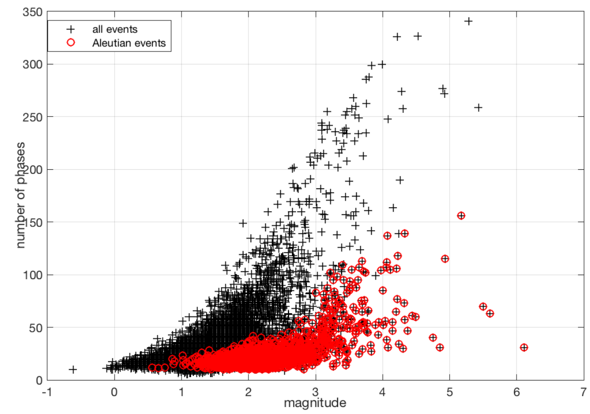


Figure 2.2. *Phase picks depending on magnitude and region for January-March, 2021.*

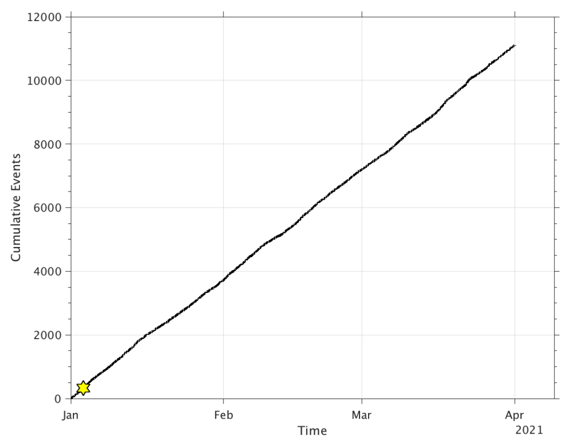


Figure 2.3. *Cumulative number of seismic events in the Alaska catalog.*

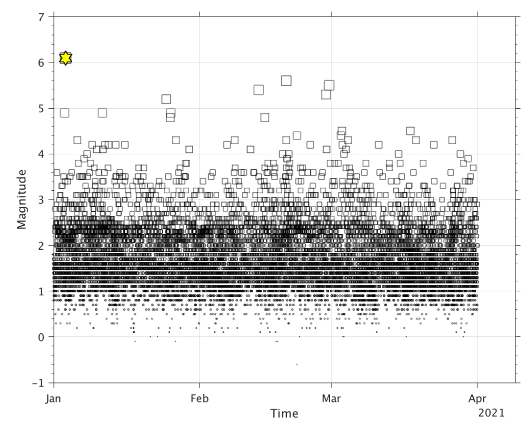


Figure 2.4. *Time-magnitude plot of seismic events in the Alaska catalog.*

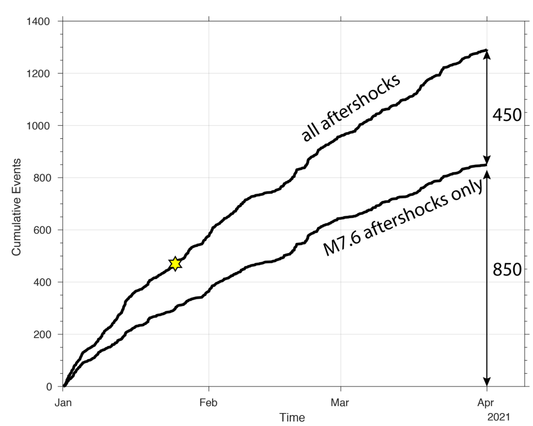


Figure 2.5. *Cumulative number of the 2020 Simeonof Earthquake aftershocks.*

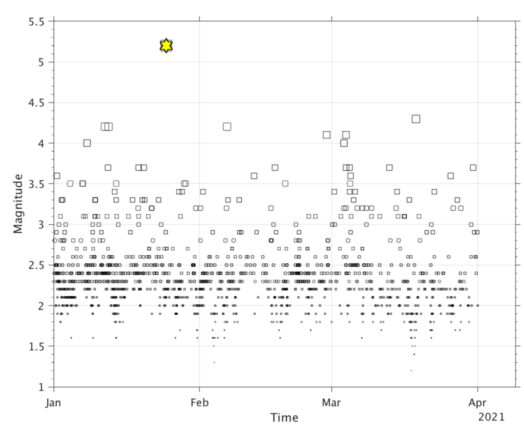


Figure 2.6. *Time-magnitude plot of the 2020 Simeonof Earthquake aftershocks.*

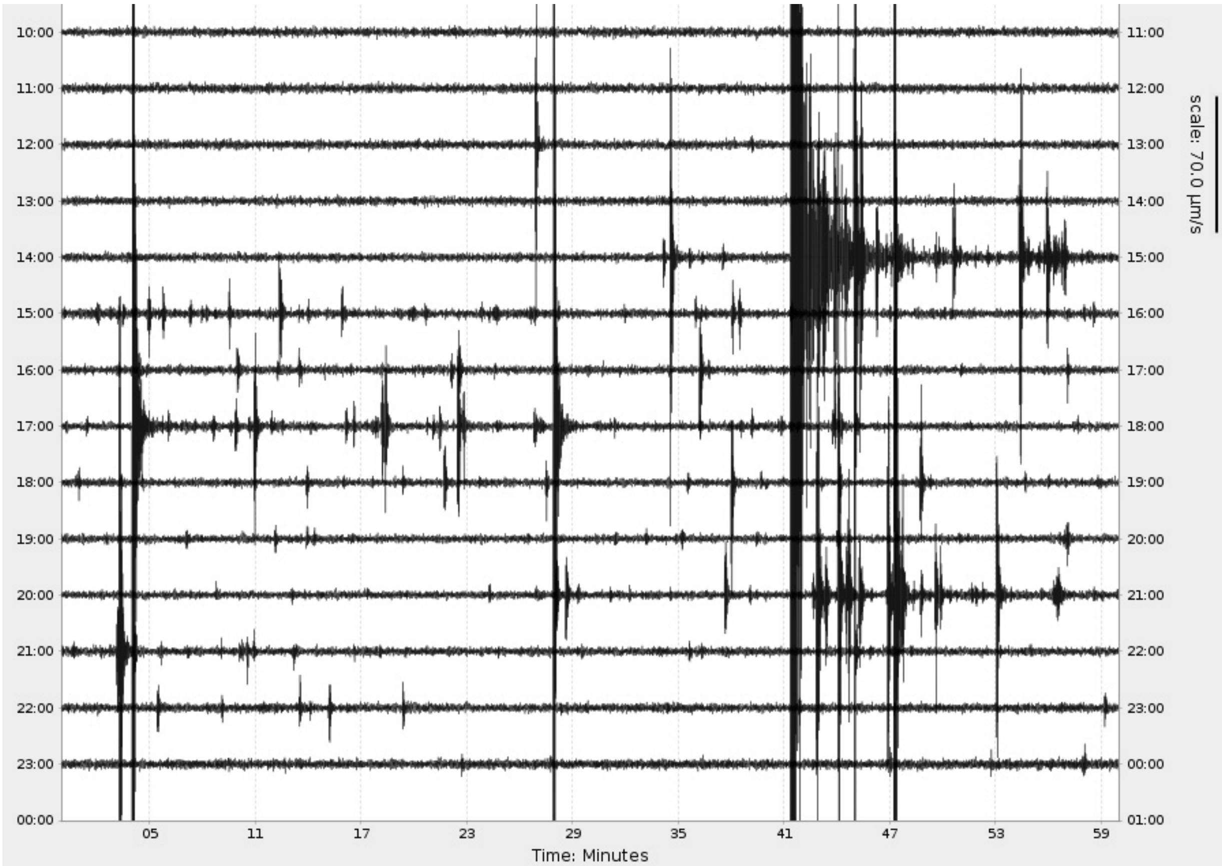


***Figure 2.7**. Seismic record of aftershock sequence of the M4.3 earthquake near Cleveland Volcano on March 26, 2021. Only M2.2 or greater aftershocks (the largest signals on the plot) can be reliably located.*

3. Field network

As of March 31, 2021, AEC maintains and acquires data from 255 seismic sites of the AK seismic network. The sites can be broken into the following groups based on their locations and sensor types (Figure 3.1):

- 211 free field broadband stations, 80 of which have co-located strong motion sensors, 107 of which have infrasound data streams, and 69 of which have meteorological sensor packages;
- 25 strong motion sites in greater Anchorage and Mat-Su Valley region (6 of these sites were installed during the reporting period);
- 9 strong motion sites in Fairbanks;
- 7 strong motion sensor sites located in coastal communities from Chignik to Yakutat;
- 1 structural array located in the Engineering Learning and Innovation Facility on University of Alaska Fairbanks campus;
- 2 Netquake sites in Fairbanks that record only triggered data (these are not included in the data return rates).

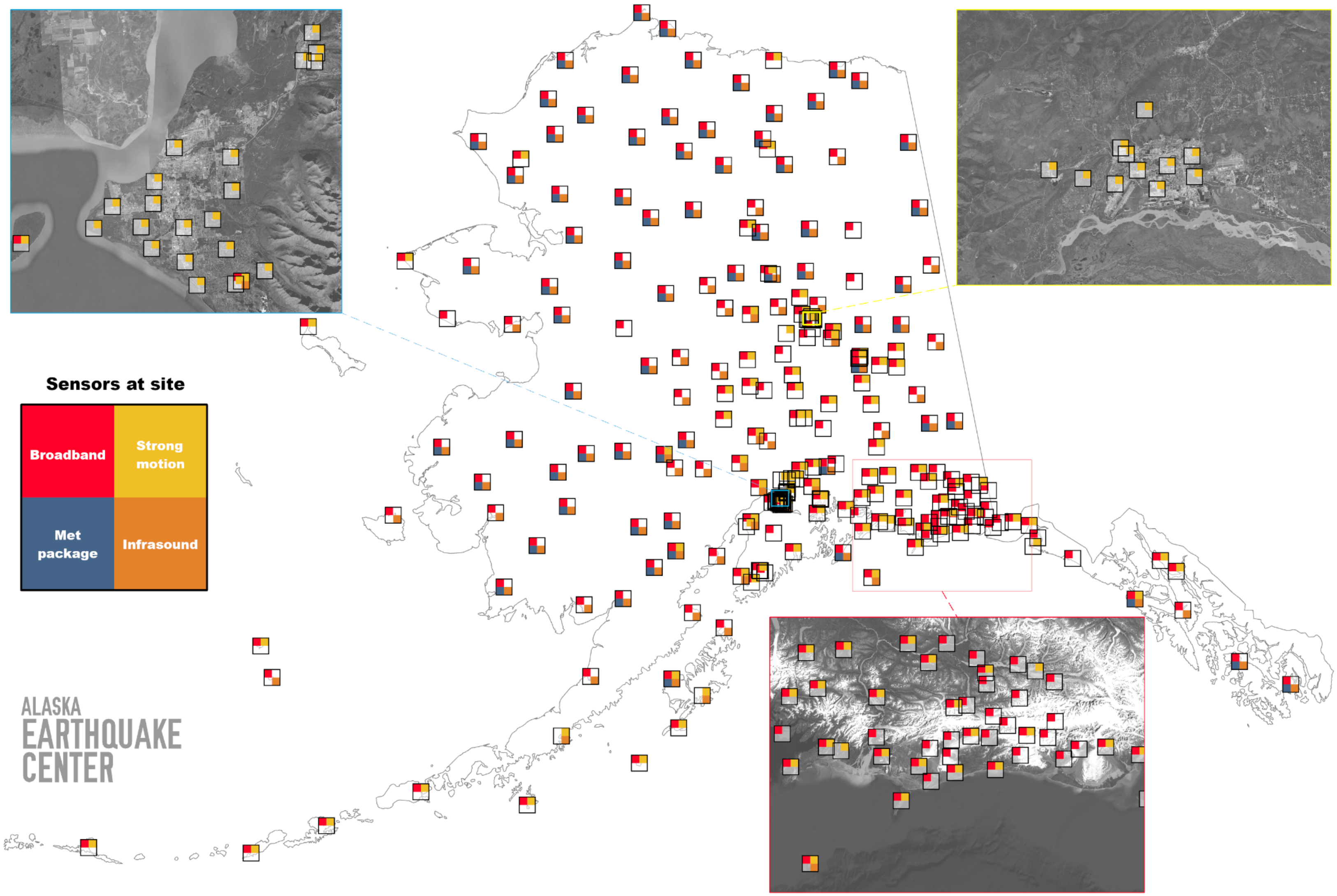


Figure 3.1. *AK field network.*

Over the period between January 1 and March 31 the network had an average data return rate of 82.7%, ranging from 78.6% to 88.7% (Figures 3.2 and 3.3). A multi-month outage of the Bering Glacier data hub that is carrying 13 sites contributed to the decrease in data recovery, along with depleted power systems at northern sites that do not get enough solar charging in winter months to sustain real-time data recovery. A gradual increase from 80.6% in January to 84.9% in March came from Bering VSAT in early February and gradual recovery of power systems at some stations due to more sunlight and return of solar charging.

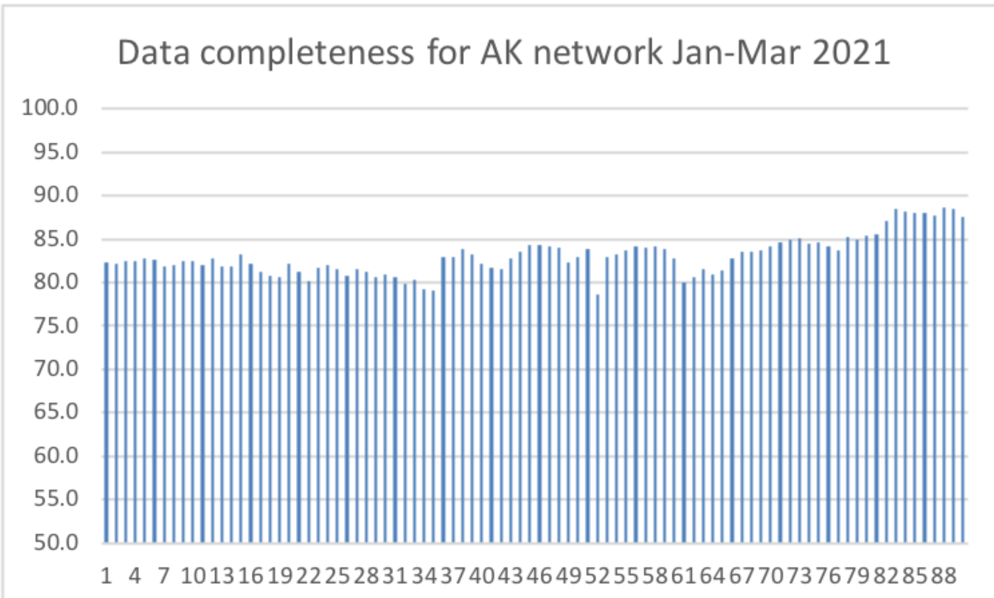


***Figure 3.2**. Daily data completeness in percent for AK network January-March 2021.*

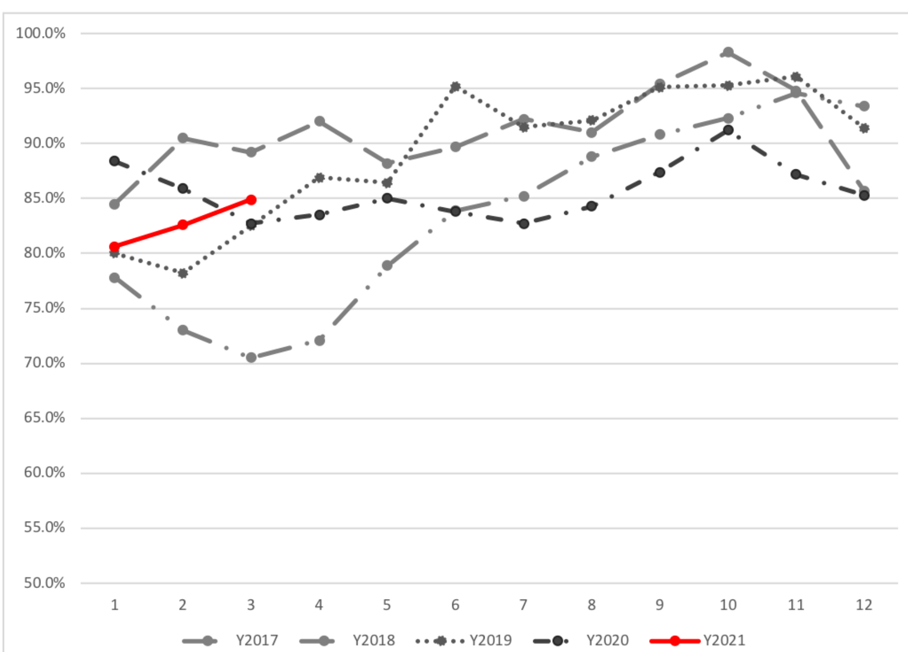


***Figure 3.3**. Average monthly data completeness in percent for AK network 2017-2021.*

4. Data Quality assurance

Data Quality Control (QC) efforts at the center consist of data integrity (up-time, completeness, latencies) and quality (signal quality/noise performance). We define 'QC' broadly as quantitative data that helps assess the performance of our stations. This includes data on the overall health of the station (data completeness, clock quality, latency, etc.) as well as data specific to individual channels (broadband, strong-motion, weather, infrasound, etc.). QC metrics are values derived from the data and state of health channels (SOH), as well as from the IRIS MUSTANG website (http://services.iris.edu/mustang/measurements/1/). Standardized QC reports are produced weekly and include percent availability, gaps, and amplitude-related metrics (dead and pegged channel, spikes, high and low amplitudes compared to the global New High and New Low Noise Models, flat amplitudes for strong motion sensors, and dc offset).

Each piece of our QC information has multiple end-users. Maintaining a comprehensive set of QC products allows us to feed these end-uses while minimizing the need to perform one-off QC requests. Internal end-users include the field team to help steer repairs and upgrades, analyst team to identify stations that should not be used for routine earthquake analysis, as well as project reports specific to certain stations (TsuNet, Greely, Pipeline, Donlin, etc.). We also communicate performance issues to the research community and partner organizations (Alaska Climate Research Center and the Wilson Alaska Technical Center).

During January-March, 2021 we documented multiple long (weeks to months) and short (days) term station outages and problems with data gaps. Outages in the northern parts of Alaska were mostly due to power issues related to the lack of solar charging from limited sunlight in winter months and snow cover. Large outages in southern Alaska were the result of telemetry issues at receiver sites. Bering Glacier VSAT site had equipment issues that were fixed with a site visit in February. Overall, about ¾ of stations had an overall data availability of 90% or better.

- Stations with the lowest data availability January-March, 2021:
  - 0%: BRSE, BWN, DAM1, E22K, E25K, FALS, FID, H23K, ISLE, K15K, K216, KTH, L26K, NICH, R18K, SWD, YAKA
  - 1-50%: A19K, A22K, B20K, BAE, COLD, D17K, E18K, E21K, G27K, HARP, NIKH, TOLK
- The following stations were identified as having data quality issues related to malfunction of sensors or dataloggers:
  - Broadband sensors: J26L, L22K, M11K, P08K, PS01, PS06, TOLK, WRH
  - Strong motion sensors: L22K, PS06
- 2 sites were identified as having bad timing (no reliable GPS clock):
  - strong motion site K223 in Anchorage and NetQuake site TAPE in Fairbanks.

5. Real-time earthquake detection system

The Earthquake Center is the authoritative source of earthquake information in Alaska. Our real-time automated earthquake detection system is tuned to rapidly determine locations and magnitudes of seismic events in the state and disseminate this information to State and Federal agencies, scientists, and the general public via website and other data feeds. The real-time earthquake detection system at AEC is based on the Antelope software package from BRTT, Inc.

First, waveforms are being continuously scanned by the *orbdetect* module to identify seismic arrivals. When a group of concurrent arrivals is identified, *orbassoc* module searches over several pre-calculated three-dimensional grids to find the best fit for the set of arrivals. Each successful association is relocated by *orbgenloc* module. Once the event is located, its magnitude is calculated through *orbevproc* module. Automatic and reviewed locations and magnitudes along with the set of associated arrivals and other information are written into the real-time earthquake database (CSS3.0) by *orb2dbt* module. The real-time earthquake locations and magnitudes are determined within 2-5 minutes of the event occurrence, depending on the event location and size.

During the January-March 2021 time period we reported 7,250 automated events in Alaska and neighboring regions. Starting with January 2021 we started producing monthly reports on performance of the real-time detection system. We document numbers of detected events (Figure 5.1), percent of bogus events that get deleted by the duty seismologist, percent of events with automatic magnitudes computed, location errors, detection latencies (Figures 5.2 and 5.3), and overall magnitude of completeness. We compare some metrics to ANSS (Advanced National Seismic System) performance standards. For example, 2 minutes latency post time for hypocenters in High-Risk areas. This performance evaluation project is still in its initial testing stages; we expect it to evolve in future quarterly reports. See Table 2 for detailed information on some of the current metrics.

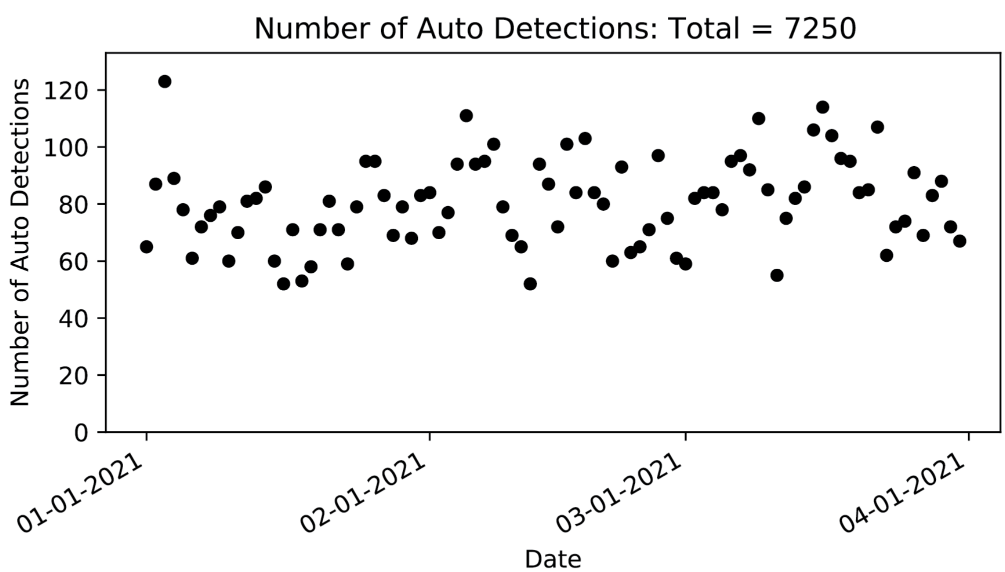


Figure 5.1. *Number of automatic event detections for each day.*

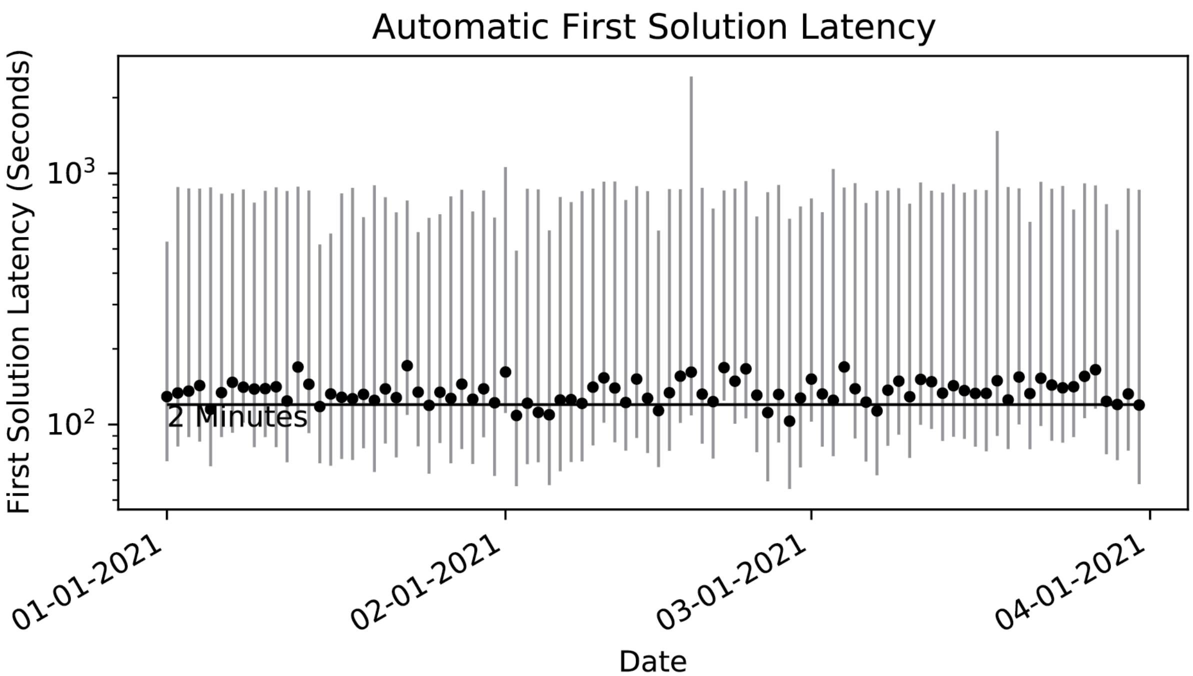


Figure 5.2. *Average daily latency (dots) and range (lines) of first automatic solution for each event.*

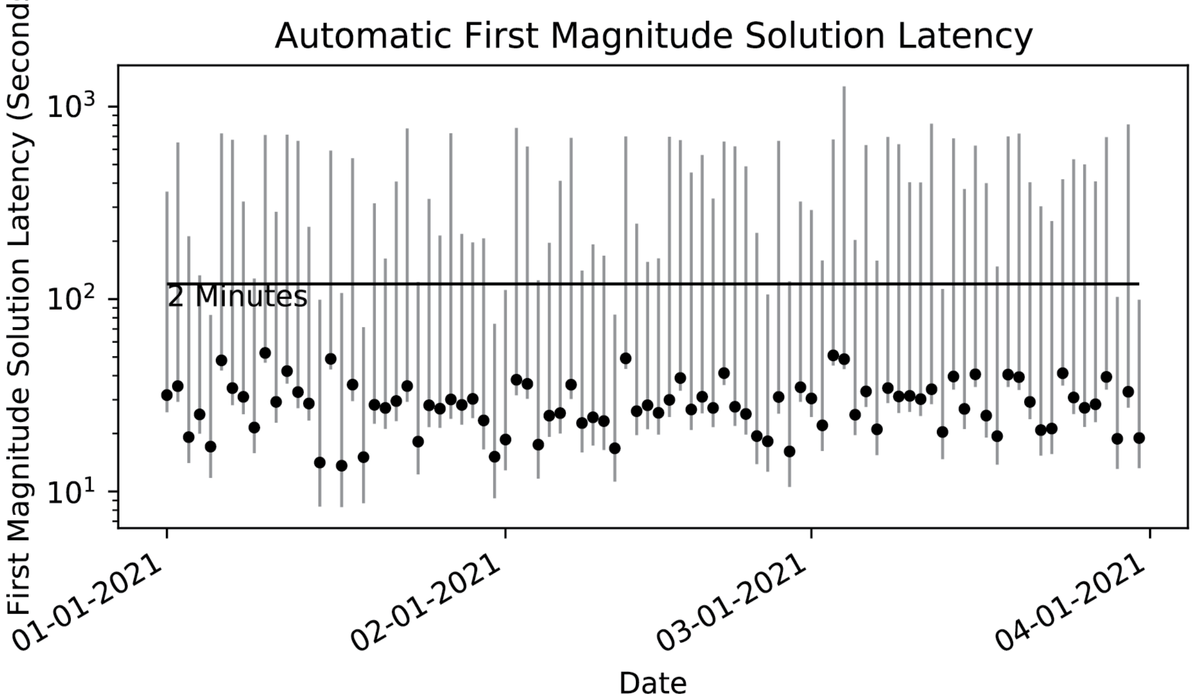


Figure 5.3. *Average daily latency (dots) and range (lines) of first automatic magnitude for each event after the event detection.*

Table 2. *Real time earthquake detection system performance.*

Metric	January	February	March
Number of automatic event detections	2,336	2,281	2,633
First origin latency below ANSS 2 min standard	65%	69%	68%
Number of automatic events with magnitudes	1,833	1,814	2,082
Percent origins with magnitudes	78%	79%	79%
First magnitude latency below ANSS 2 min standard	45%	49%	49%
Magnitude latency from origin post time below ANSS 2 min standard	98%	98%	96%
Events deleted by duty seismologist	5%	5%	7%
Magnitude of completeness	1.8	1.9	1.8
Number of earthquake alarms	9	12	4

There were 25 earthquake alarms during this reporting period. Our goal is to have duty seismologist-reviewed solutions for alarm events within 20 minutes. Only 2 earthquakes were reviewed with slightly longer delays (Figure 5.4).

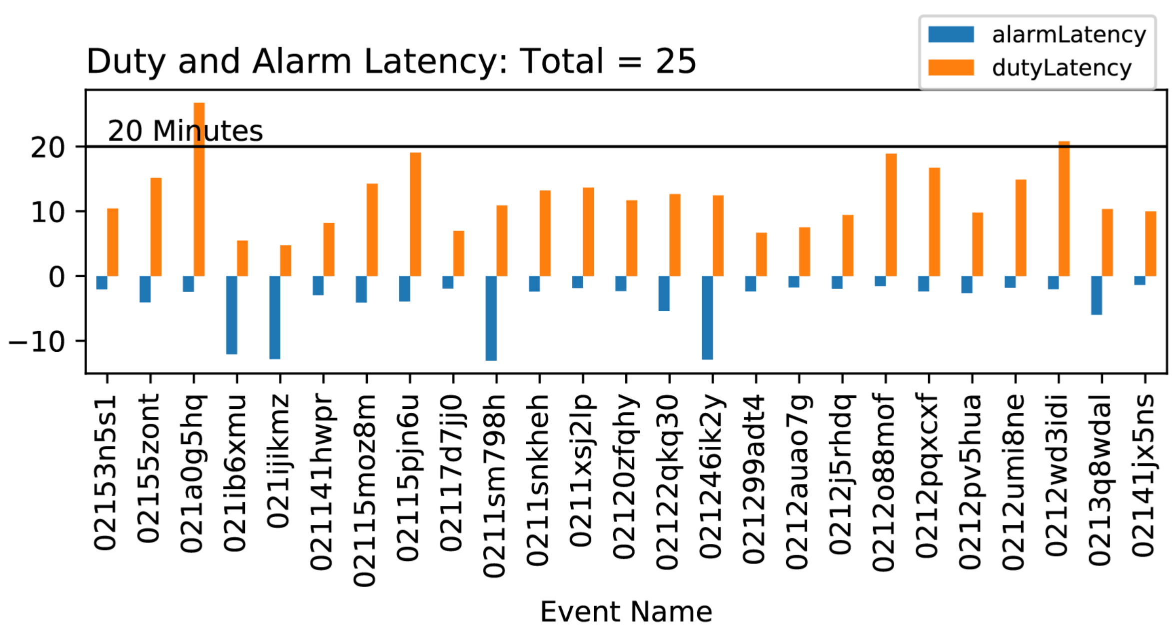


Figure 5.4*. Earthquake alarm and duty review latency from alarm time (bottom of the blue bar is origin time, top of the orange bar is duty review post time).*

6. Computer systems

6.1 Computer resources

The Earthquake Center operates a computing cluster hosting an enterprise-grade virtual environment for nearly all operational needs. During this quarter, no major hardware upgrades were performed.

Current status is as follows:

Number of hosts	Total CPUs	Total CPU (GHz)	Total RAM (GB)	Total vSAN storage (TB)
4	96	258.62	1022.49	41.92

Resource utilization is as follows:

Virtual Systems				Operating System	
Production	Staging	Development	Users	CentOS	Windows
23	0	18	7	44	4

6.2 Waveform storage

The Earthquake Center maintains a permanent archive of all available seismic data in the state in miniSEED format. Continuous waveforms have been stored since 1997, and segmented data is available from 1988-2012. Currently, AEC has 54.5 TB in continuous waveform data and 1.1 TB of segmented data. During the quarter, we acquired and archived 1.06 TB of new data (Figure 6.2.1).

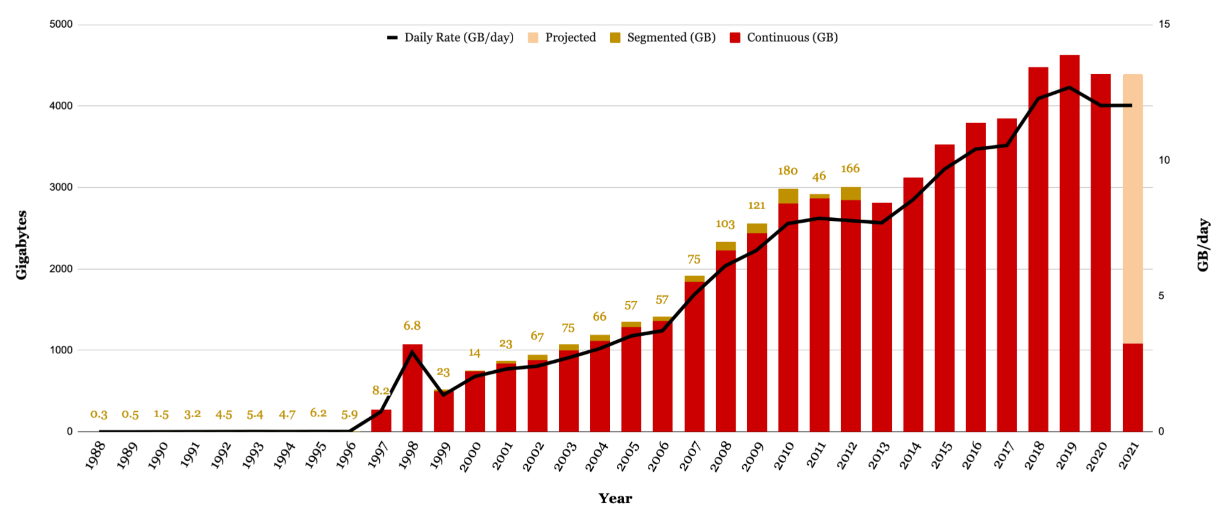


Figure 6.2.1. *Digital waveform archival storage for continuous and segmented data*

6.3 Metadata

AEC maintains metadata in css3.0 format for internal use, and provides dataless SEED volumes to IRIS for public distribution. During this quarter, the following station entries were modified:

- Stations added: ER01, ER02, ER03, ER04, MS01, MS02, MS03, NIKI
- Stations modified: None
- Stations removed: None

6.4 Software development

During this time, no major software upgrades were performed. Total code commits under the following scopes of work were:

Antelope	Website	Station health	Other
155	4	24	11

The major development project during this quarter was work on redesigning the catalog data workflow from the real-time system through final archival. Goals of this project include ensuring that analysts always have the most up-to-date information available when processing, ensuring that any catalog products remain in sync, and making the "best" catalog data access clear for internal and external users. During this quarter, the project team completed the first 6 sprints.

7. Fieldwork

During the reporting period Earthquake Center staff installed six new strong-motion sensor stations in Eagle River and the Mat-Su Valley, adopted an existing strong-motion station in Nikiski, and visited Bering Glacier Camp to resolve a data outage. One of our technicians also spent one day troubleshooting strong-motion outages in Anchorage. Staff spent 15 person-days in the field and used a helicopter for one day.

The new strong-motion stations that we established in Eagle River and Mat-Su are ER01, ER03, ER04, MS01, MS02, and MS03. These join ER02, installed in 2020. These seven new sites are located at local schools, churches, and fire stations. These sites were installed and will be operated in cooperation with UAA.

The Nikiski strong-motion site, NIKI, was previously operated by the Alaska Gasline Development Corporation (AGDC). Our staff visited the site in January with an AGDC escort in order to install a sensor and communication equipment. We then began data acquisition and adopted the site into our network.

Bering Glacier Camp (BGLC) is an important data hub on the coast of the Gulf of Alaska that we lost contact with in late 2020. Our staff visited BGLC via helicopter in February and were able to resolve the data outage by replacing a router and switch. On their return flight to Girdwood they performed a visual inspection of three sites in Barry Arm.

8. Social media and outreach

The Alaska Earthquake Center maintains a vibrant and dynamic social media presence on Facebook and Twitter. Since its initiation in 2013, we have amassed nearly 40 thousand followers across the two platforms. Our social media posting strategy takes a multifaceted approach to public engagement. Social media is one of the primary ways that earthquake information is shared and that remains our primary focus. We also seek to highlight the human element of the center. We do not produce autogenerated posts. We aim to have 50% of our posts be related to recent earthquakes. The remaining 50% is divided between topics that highlight the various aspects of the center itself. We also acknowledge that we can fill a vital role in helping to amplify the messaging of our partner agencies.

8.1. Website

During the first quarter of 2021, we had more than 260,000 users visit our website. This amounted to more than 320,000 sessions (number of times users entered our website) and more than 535,000 pageviews (number of individual web pages visited). Figure 8.1.1 shows the daily distribution of users, pageviews, and sessions.

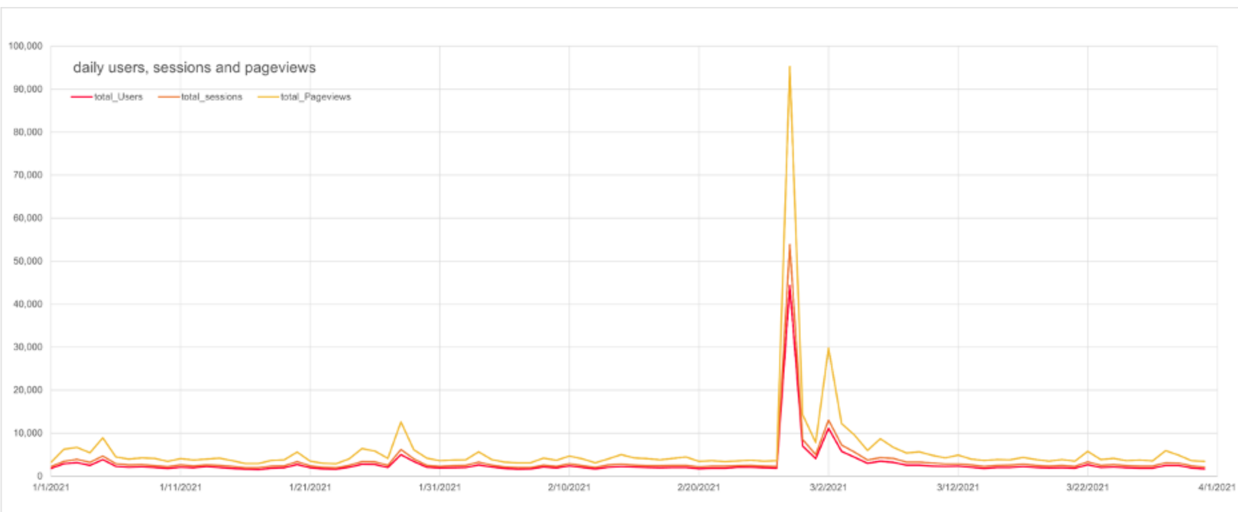
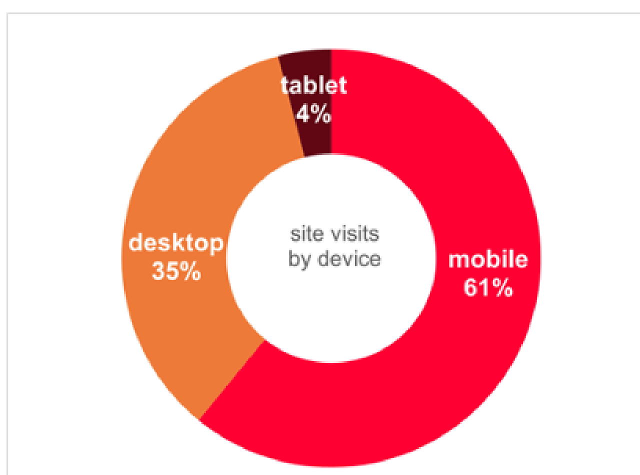


Figure 8.1.1. *Total number of website users, sessions, and pageviews per day.*

Figure 8.1.2*. Percentage of website sessions for the three major device types, mobile (e.g., phones), tablets, and desktop computers.*



Our web traffic is rarely quiet. On our "slowest" day between January 1-March 31, we still had more than 1,500 users on our site. The recent earthquake map page and recent earthquake list (a page for lower bandwidth users) accounted for a combined 90% of pageviews during the reporting period. These two pages typically account for approximately 75% of site visitors. The large spike seen on February 27 in the figure above is directly linked to the M5.5 Anchorage aftershock that was felt widely through Southcentral Alaska. Earthquakes felt in Southcentral often result in a large influx of users to our site.

In recent years we have made our website and content more mobile friendly, based on trends seen in device usage. More people visit our site on mobile devices as seen in Figure 8.1.2. Tablets and mobile devices such as phones accounted for 65% of website sessions. These numbers have only increased with time.

8.2. Twitter

Our Twitter presence has been strong since our account was established and grows every year. We have become a trusted source for Alaskans and reporters looking for rapid earthquake information, and in recent years, for explanations and context for current and historical events. In the first quarter of 2021, we gained approximately 550 new followers bringing our total following to 20,700. Because of the nature of Twitter, we often post frequent or threaded content to convey our messages. Figure 8.2.1 shows the distribution of post types for the 85 tweets made this quarter. Approximately 49% of our posts are related to reviewed events (41% plus 8% Anchorage aftershock specific posts). Other posts consisted of curated content and seismicity reports representing 31% and 12% of posts, respectively. The remaining 8% of posts were comprised of general interest, amplified messages and replies to comments, questions, and @s (when someone puts our Twitter handle in their post).

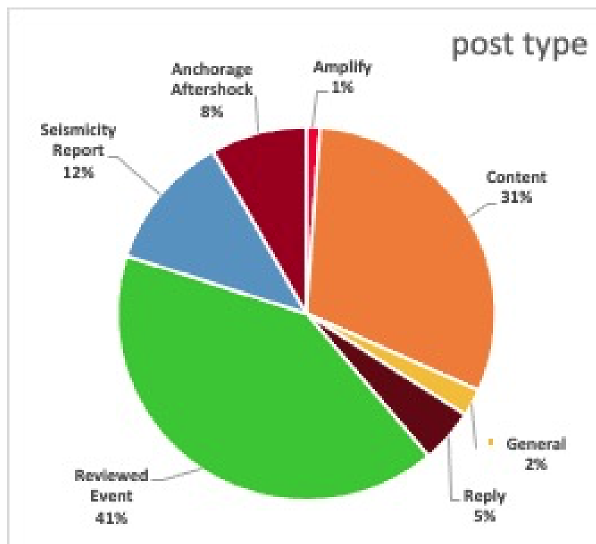


Figure 8.2.1. *Post type distribution for Tweets in the first quarter of 2021.*

Figure 8.2.2 shows the number of posts made per day and the number of impressions per day. Impressions represent the number of times our tweet is shown on a screen. The number of impressions does not scale directly with the number of posts based on the Twitter algorithm, as evidenced by the days with impressions and no posts. This is used to determine how often our followers view our posts. February 27 stands out with the highest number of impressions despite other days having more than 5 posts. Earthquakes that are felt in

Southcentral Alaska (our most populated region) statistically have higher impressions and engagements.

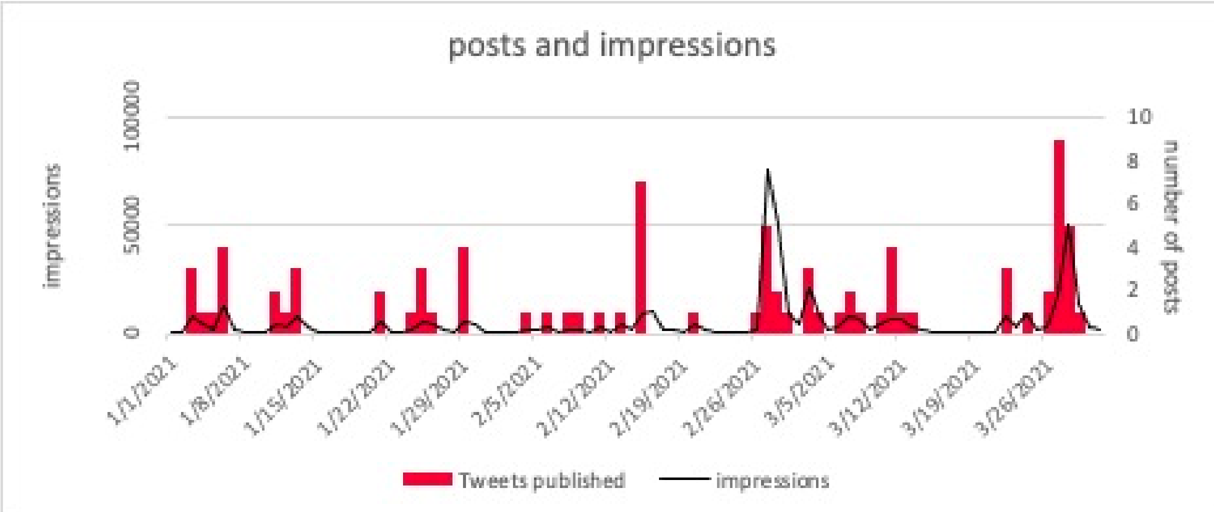


***Figure 8.2.2**. Number of posts per day (right axis, red bars) compared to the number of impressions received per day (left axis, black line).*

Looking at our engagement with time, we maintain a steady engagement rate averaging 2% (compared to the median engagement rate for education industries of .05%). Our engagement rate is never zero; even on days when we do not make posts people are still choosing to engage with our content (see Figure 8.2.2 for post frequency and Figure 8.2.3 for engagement rates). The engagement rate for February 27 reached nearly 10% with the rate remaining elevated for a few days following.

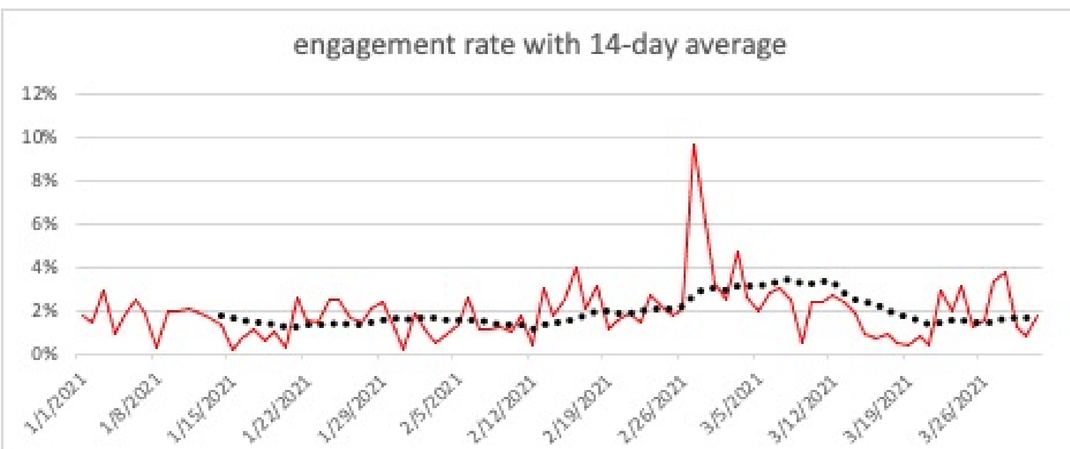


***Figure 8.2.3.** Twitter engagement rates with time (red line) and 14-day moving average (black dotted line).*

As mentioned above we aim to diversify our post types. By evaluating our impressions and engagement based on post type we can assess the success of the various types. Figure 8.2.4 demonstrates that earthquakes felt in Southcentral Alaska (e.g., 2018 M7.1 Anchorage aftershocks) account for 28% of impressions, however, they garnered 54% of engagement. This is a trend seen consistently with time.

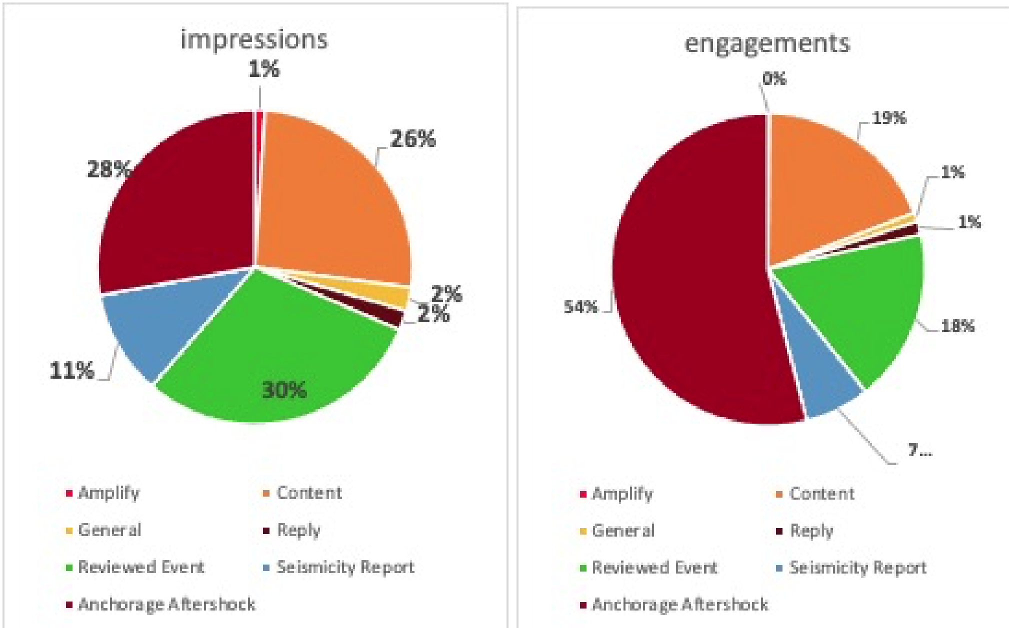


***Figure 8.2.4**. Percentages of impressions and engagements based on Tweet type.*

When the impressions and engagements attributed to the Anchorage aftershock are removed, the type-percentages for impressions and engagements directly correlate. Reviewed events accounted for 41% of impressions and 39% of engagement. Curated content pieces accounted for 36% of impressions and received 41% engagement. See Figure 8.2.5 for the distribution of the remaining content types.

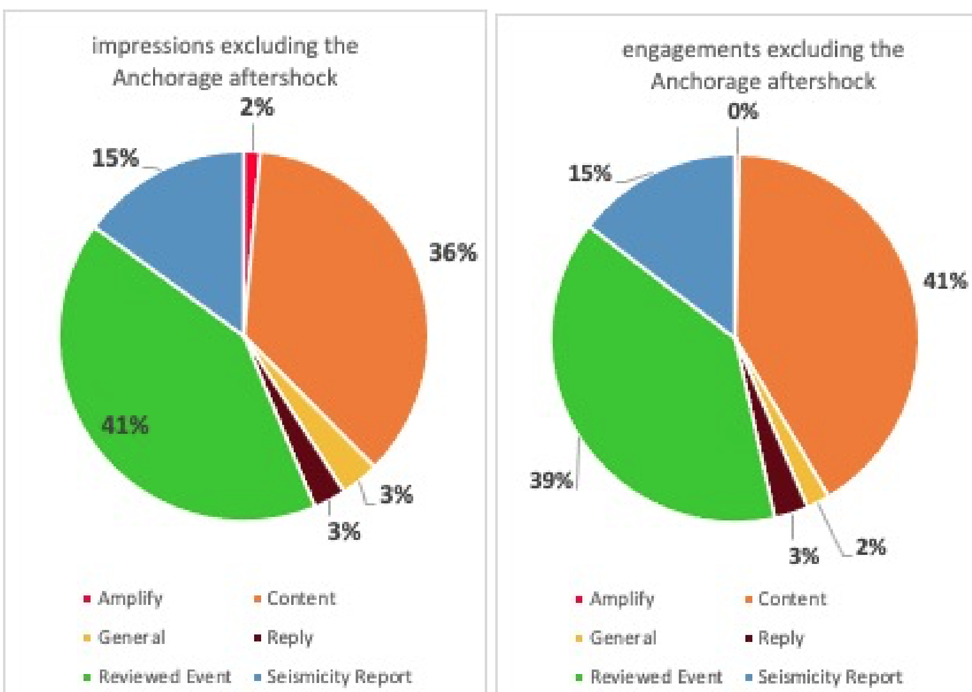


***Figure 8.2.5**. Percentages of impressions and engagements based on Tweet type, excluding those attributed to the Anchorage aftershock on February 27.*

8.3. Facebook (Page)

Our Facebook Page is new as of December 2020. We are still assessing the best way to approach utilizing the page. Currently, we are posting reviewed event information to the page and not to the Facebook Group unless it is a significant event (see Section 8.4). We are also only posting weekly seismicity reports to the page. This is the primary difference between our posting strategies for our Facebook Page and Group.

During the first quarter of 2021, we attracted 1,700 new followers, bringing our current page following to 2,700. The Anchorage aftershock, felt on February 27, attracted 1,200 of our 1,700 new followers during the week following the earthquake. In an effort to transition followers who are exclusively looking for recent earthquake information from the group to the page, we share information to the group with the page as the author and not specific admins. This has shown to be a successful way to expand our audience while we have their attention.

The distribution of post type is shown in Figure 8.3.1. Reviewed events accounted for 63% of the 70 posts made in the first quarter (57% reviewed events and 6% Anchorage aftershock specific). Curated content and weekly seismicity reports accounted for 19% and 14% of posts, respectively.

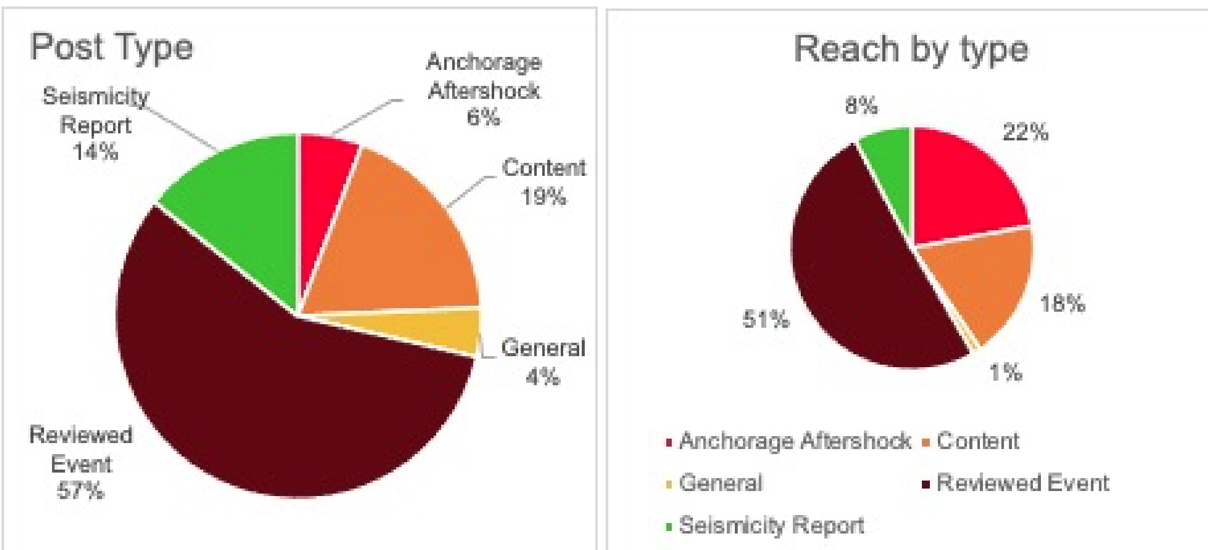


Figure 8.3.1*. Distribution of Facebook Page posts by type (left) and audience reach by type (right)*

Despite 57% of posts being about reviewed earthquakes, only 51% of our page reach (the number of people who actually see our content) is related to those posts. A significant percentage of our reach, 22%, is directly attributed to 6% of our posts during this quarter. This is consistent with what we see from Twitter.

We maintain an average 5% engagement rate based on reach (number of people who see our content) and impressions (how often our content appears on a screen). Engagement rates are generally higher based on reach than impressions because the same user may have the post appear multiple times in their feed. There is little overall difference between the engagement rates for reach and impressions in our analysis, on average 5.5% and 5.3% respectively (Figure 8.3.2).

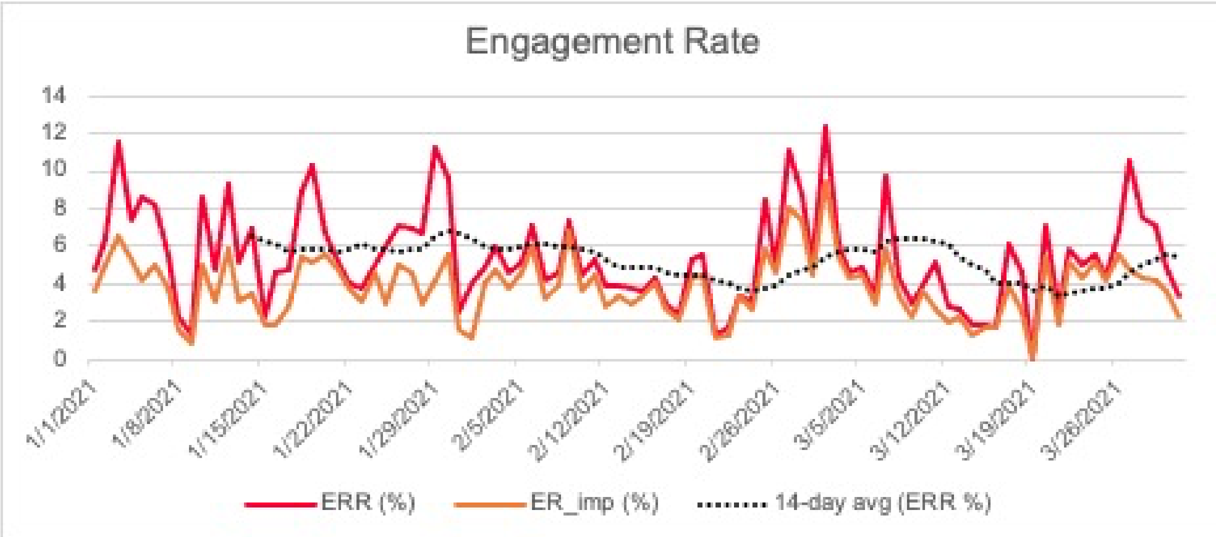
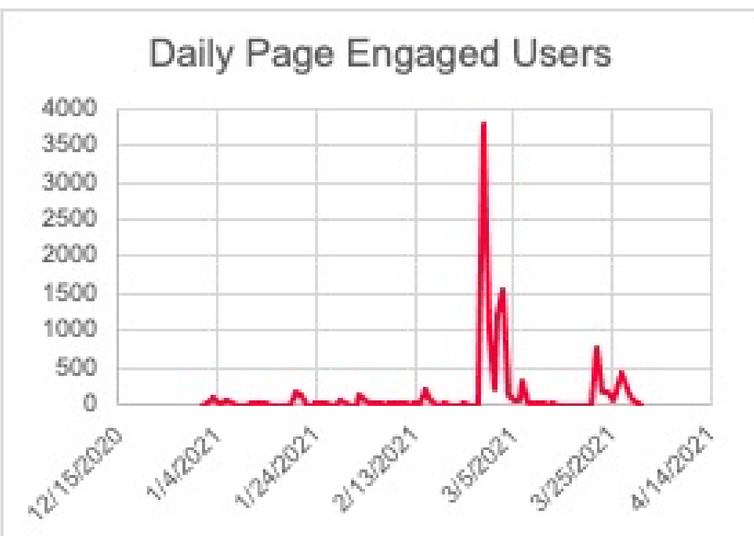


Figure 8.3.2. *Daily engagement rate based on reach (ERR) and impressions (ER_imp) plotted with a moving 14-day average of ERR.*

Our largest percentage of users engaged with posts related to the Anchorage aftershock, 39% of total engaged users. Their engagement was also limited to the week following February 27 (Figure 8.3.3). During that time period, overall reach and impressions were also high, resulting in an average engagement rate between 5-6%.



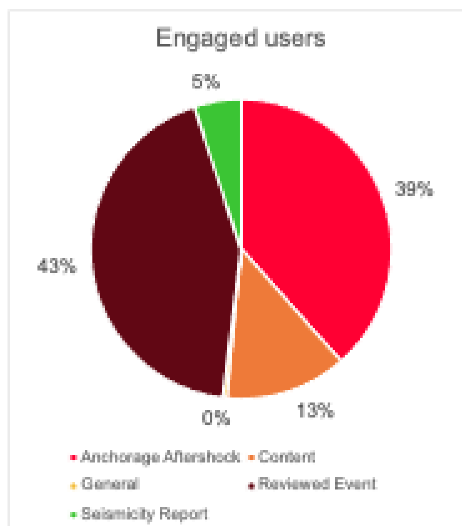


Figure 8.3.3*. Daily engaged users of our Facebook Page (left) with percentages of users by post type.*

8.4. Facebook (Group)

Analytics for Facebook Groups are more difficult to quantify. Groups are set up differently than pages, and engagement, impressions, and reach are calculated differently. Therefore, while some metrics are related, they are not directly comparable.

Currently we have 17,200 group members, with 1,000 new members during the reporting period. As mentioned above the Group is designed to be a discussion forum and not a repository for reviewed event posting. Occasionally, we do post significant events to the group in the hopes of facilitating discussion, but we generally share it from the page with the page as the author and not an individual admin.

Figure 8.4.1 shows the daily count of active members with a number of posts per day. On February 26 following the Anchorage aftershock, our active members topped out at nearly 10,000. We maintain an average engagement rate between 4-6%.

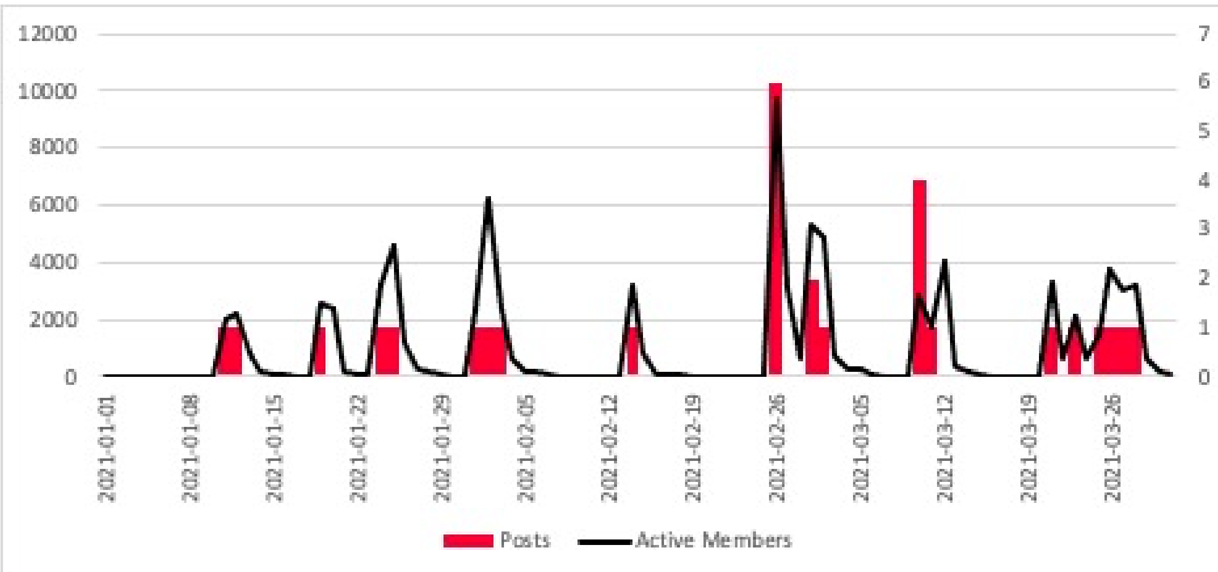


Figure 8.4.1. *Plot of active members (left axis) and number of posts (right axis) with time.*

During the first quarter of 2021, there were 29 posts to the group: 18 by AEC admins and 11 by other group members. The 11 member posts were earthquake felt reports (Figure 8.4.2). We moderate member posts, however, we do not include them in our analyses beyond count when they are felt reporting. Members are encouraged to submit *"Did You Feel It?"* reports.

What is clear in the first quarter of 2021 is that earthquakes felt in Southcentral Alaska dominated our engagement. On the day of the Anchorage aftershock our engagement rate reached 30% in the group and is a trend seen above on our other social media outlets. Plots in Figure 8.4.3 show the distribution of our engagement as reactions, comments, and shares.

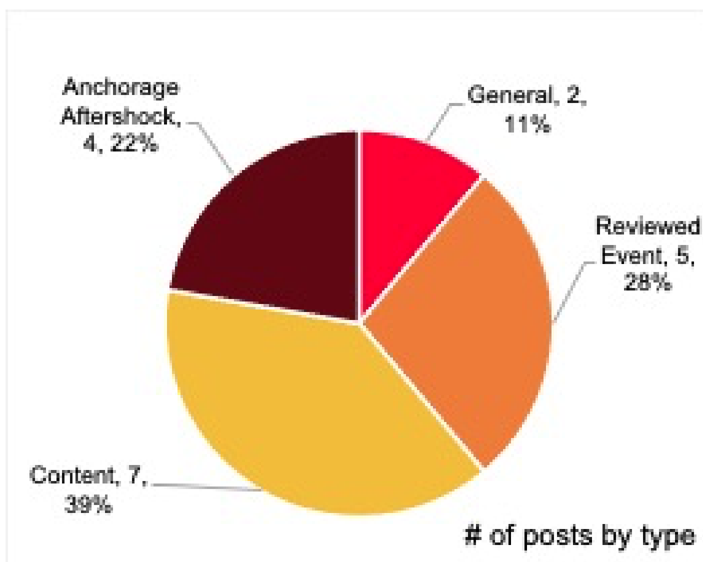


Figure 8.4.2*. Distribution of post type for the Facebook Group.*

Unsurprisingly, the Anchorage aftershock dominated all forms of engagement in the group. Reactions (likes, dislikes, etc.) to the Anchorage aftershock, however, constituted a lower percentage compared to other types of engagement. Other reviewed events and curated content posts garnered larger percentages of reactions than other types of engagement, i.e., they are more likely to be reacted to than commented on or shared.

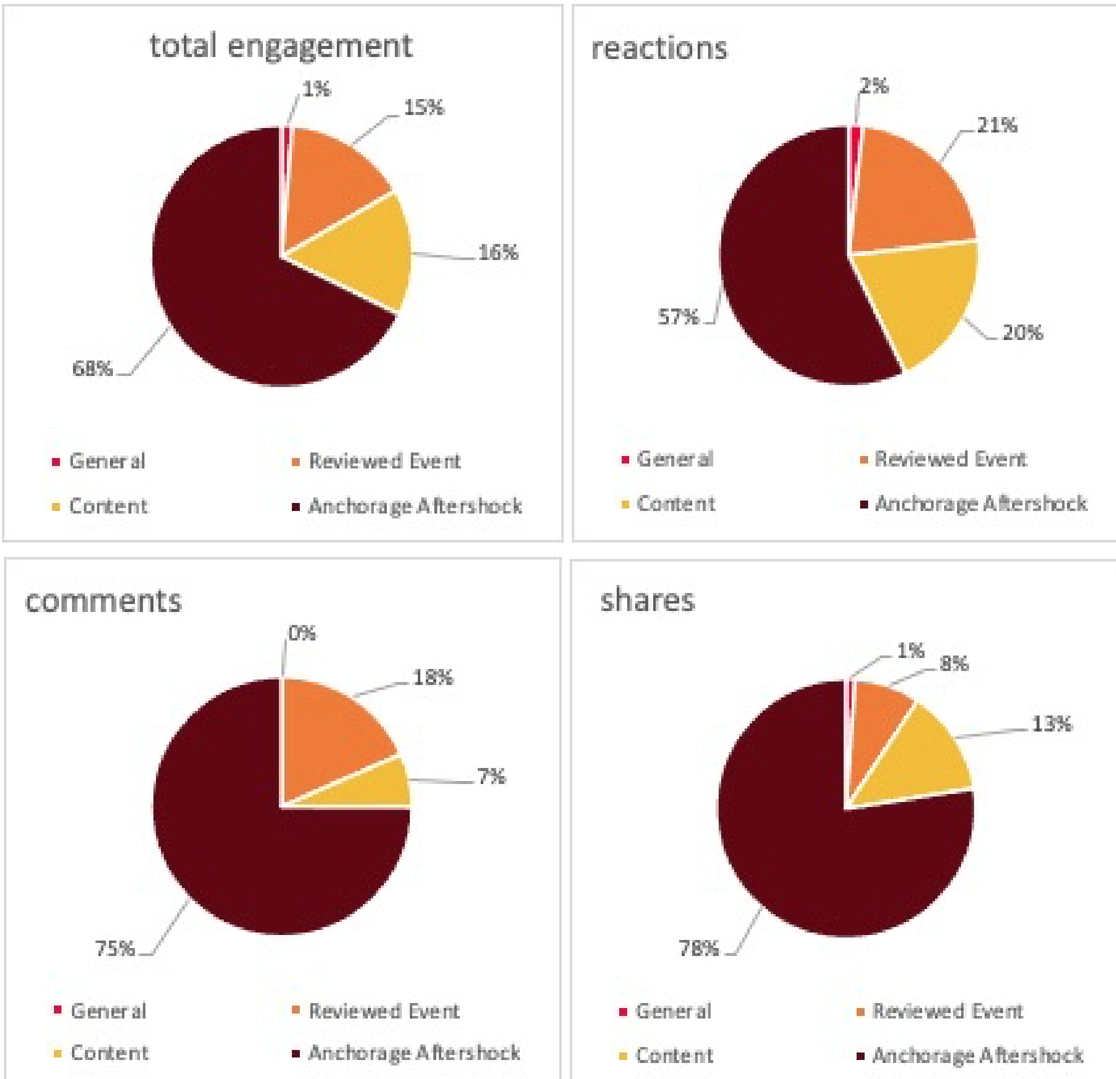


Figure 8.4.3. *The distribution of our engagement as reactions, comments, and shares based on post type for the Facebook Group.*

9. Publications and presentations

Names in **bold** are Earthquake Center staff.

9.1. Publications

Celebi, M., and **Ruppert, N.A.** (Feb. 2021)**.** Response of an asymmetrical five-story building in Fairbanks, Alaska during the November 30, 2018 M7.1 Anchorage, Alaska earthquake, ScholarWorks@UA, 15pp, http://hdl.handle.net/11122/11851**.**

Grassi, B., and **Gardine, L.** (Feb. 2021). *Know Your Tsunami Hazard in Unalaska*. Alaska Earthquake Center, University of Alaska Fairbanks. (brochure)

Grassi, B., and **Gardine, L.** (Feb. 2021). *Know Your Tsunami Hazard in Valdez*. Alaska Earthquake Center, University of Alaska Fairbanks. (brochure)

Grassi, B., West, M., and **Gardine, L.** (Mar. 2021). *Alaska Earthquake Center: A 2020 Perspective*. Alaska Earthquake Center, University of Alaska Fairbanks. 24pp, http://hdl.handle.net/11122/11913.

Ruppert, N.A., and **Gardine, L.** (Feb 2021), 2020 Alaska Seismicity summary, ScholarWorks@UA, 16pp, http://hdl.handle.net/11122/11865.

9.2. Public Presentations

Date	Presenter	Venue	Title	Virtual/In person
1/21	**Michael West**	Alaska Geological Society	End of the Shumagin Gap?	virtual
1/25	**Michael West**	2021 Alaska EarthScope and Beyond weekly seminar	Seismic studies in Alaska before and after EarthScope	virtual
2/26	**Michael West**	UAF Civil Engineering 438 "Design of Engineered Systems II" guest lecture	Earthquake considerations for building in Alaska: A case study of the 2018 M7.1 Anchorage earthquake	virtual
3/5	**Michael West**	Monthly ANSS teleconference	Barry Arm and coastal landslide hazards	virtual
3/27	**Lea Gardine**	Band of Brothers Wasilla earthquake preparedness workshop	Earthquakes in Southcentral Alaska: reflecting on 1964 and 2018	virtual

9.3. Brown Bag Talks

Brown bag talks are informal opportunities for faculty, staff, students, and guest speakers to present their research.

Date	Presenter	Title	Virtual/In person
1/28	Louise Maubant, Massachusetts Institute of Technology (postdoctoral fellow)	Slow slip events and lateral variations of the interseismic coupling: The case of the Mexican subduction seen by remote sensing	virtual
2/4	Liam Tooney, University of Alaska Fairbanks (PhD student)	Reconstructing massive avalanches at Iliamna Volcano using seismic and acoustic signals	virtual
3/31	**Michael West**	Barry Arm: Coming to terms with coastal landslides	virtual

10. References

Ruppert, N.A., and Gardine, L. (2021). 2020 Alaska seismicity summary, ScholarWorks@UA, 16pp, http://hdl.handle.net/11122/11865.

Appendix A: Data availability for broadband stations from AK network.

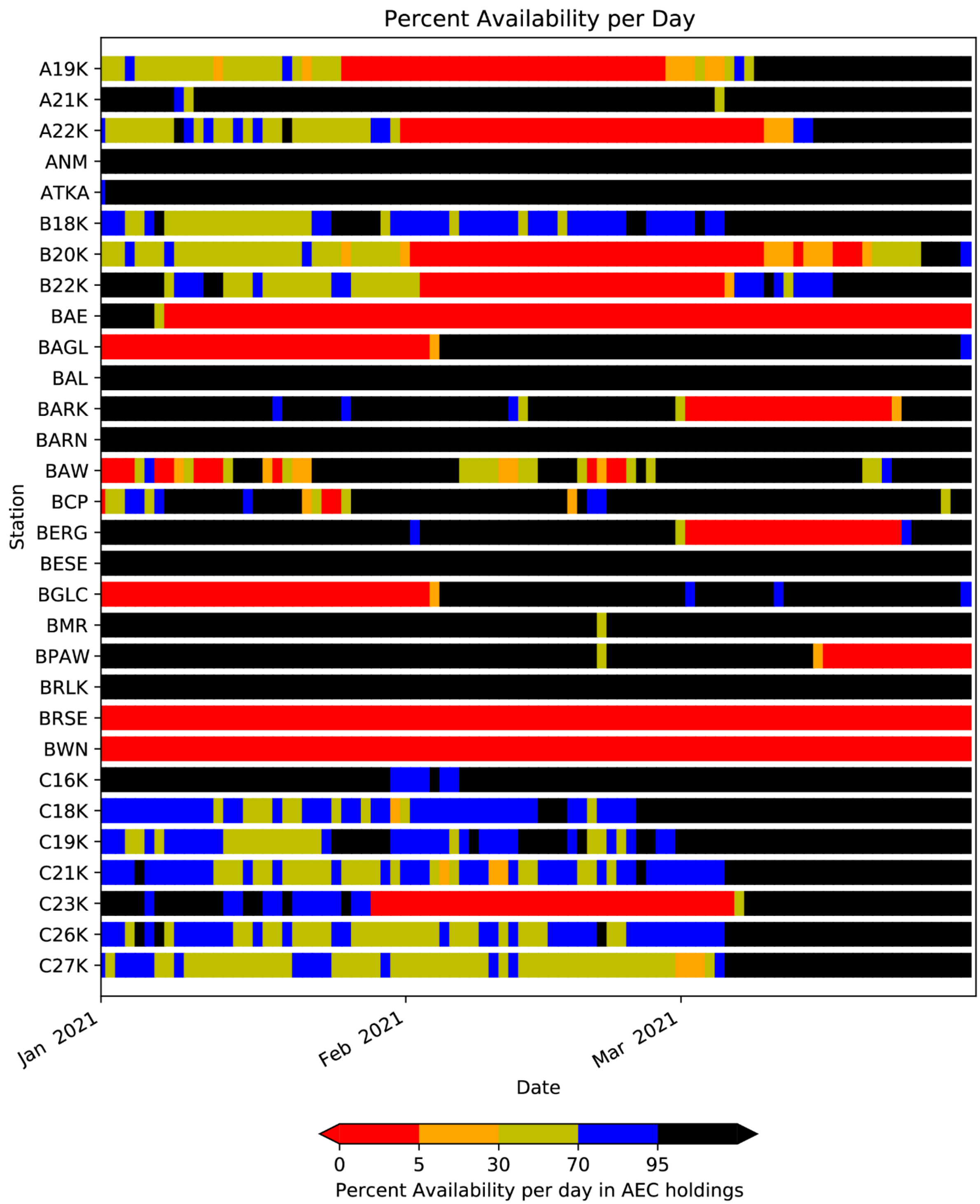


***Figure A1**. Data availability for stations A19K-C27K (listed alphabetically).*

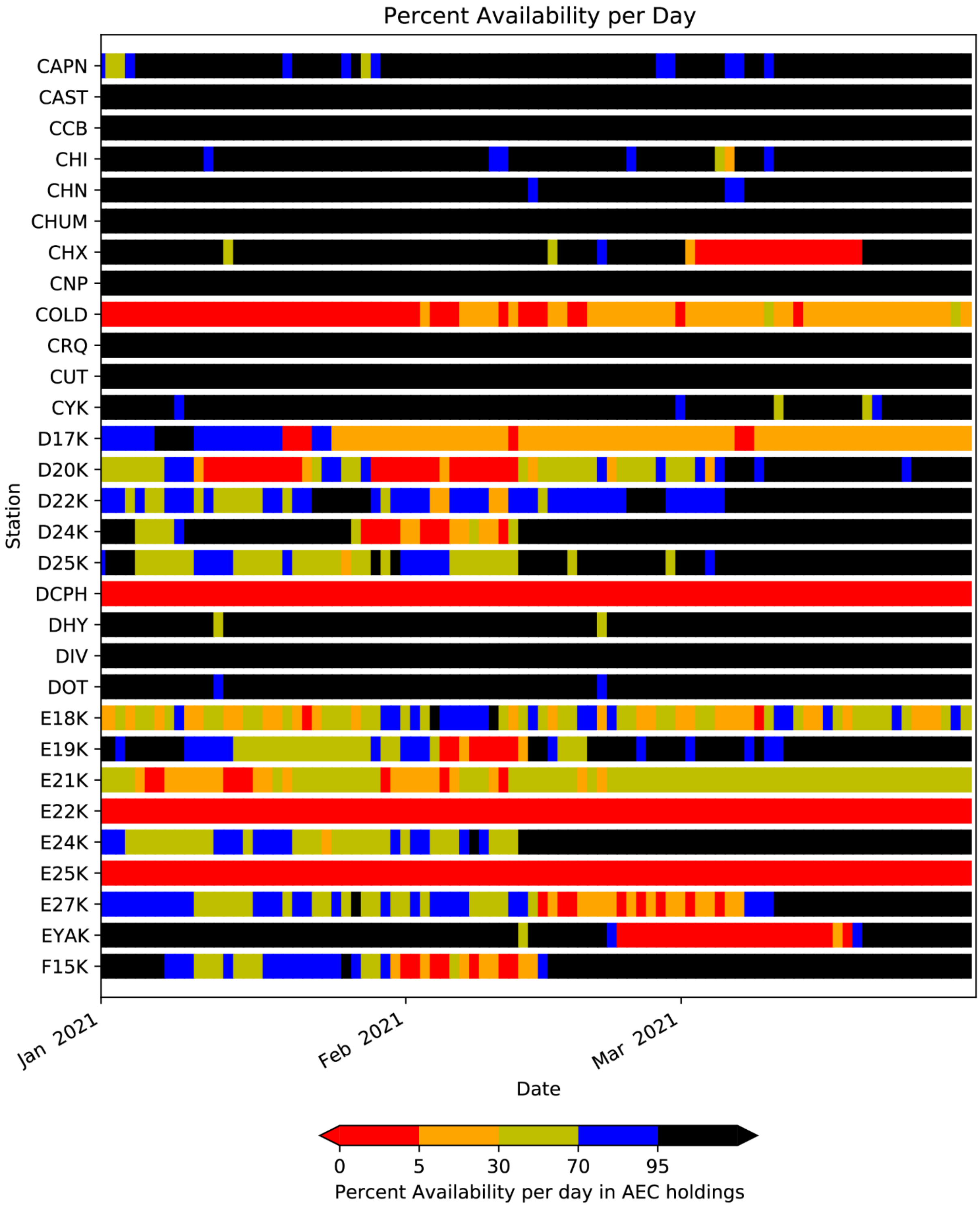


***Figure A2**. Data availability for stations CAPN-F15K (listed alphabetically).*

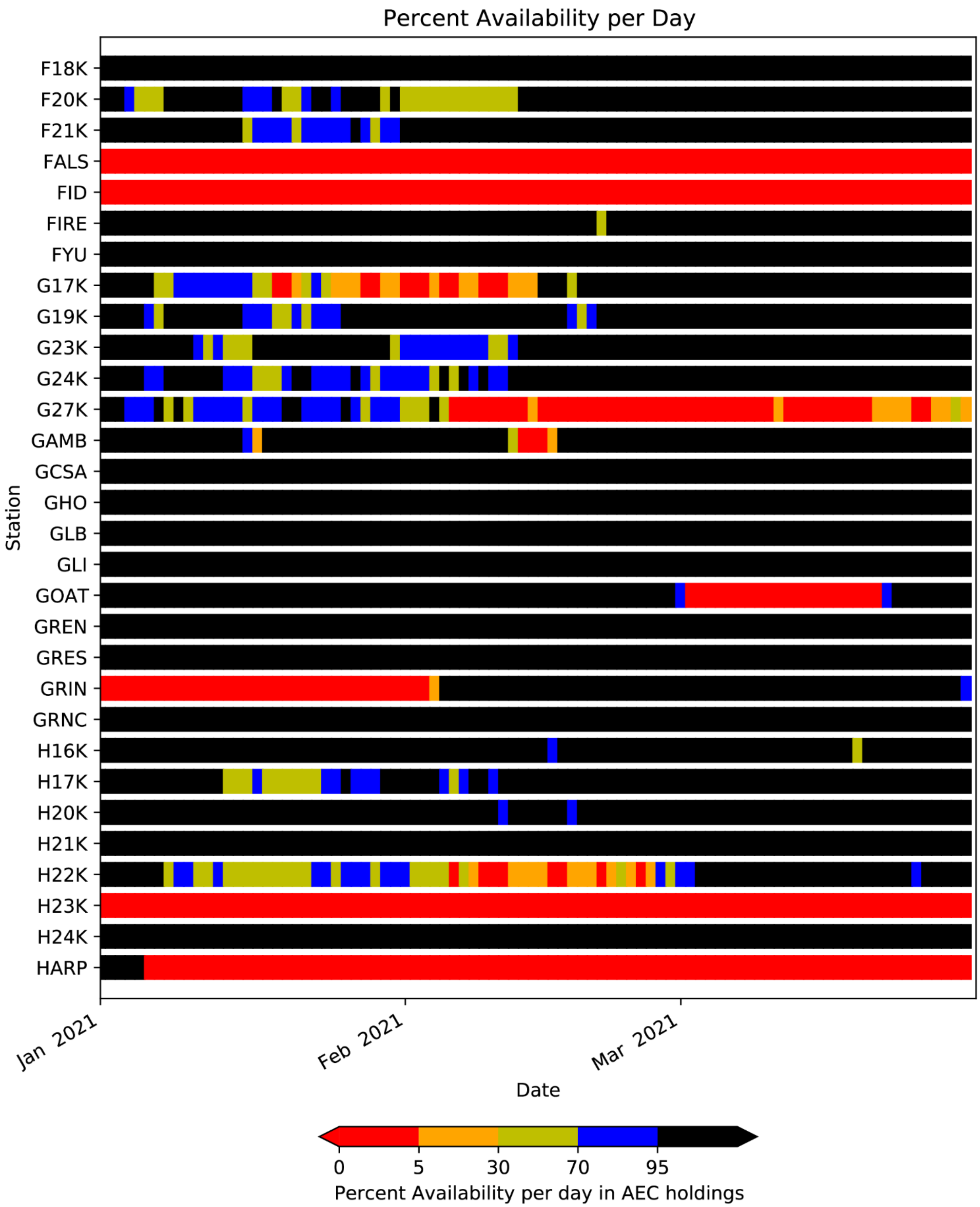


***Figure A3**. Data availability for stations F18K-HARP (listed alphabetically).*

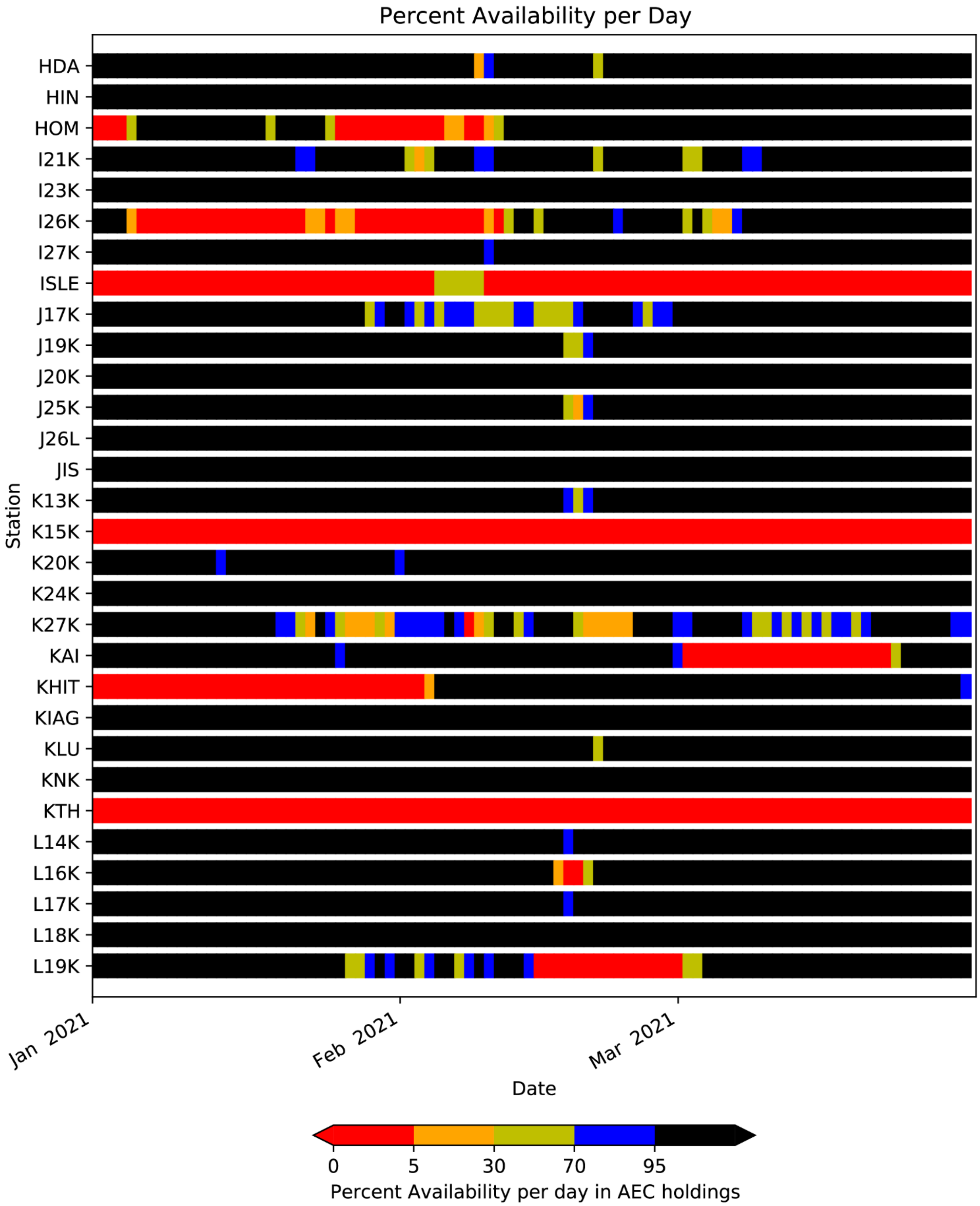


Figure A4. *Data availability for stations HDA-L19K (listed alphabetically).*

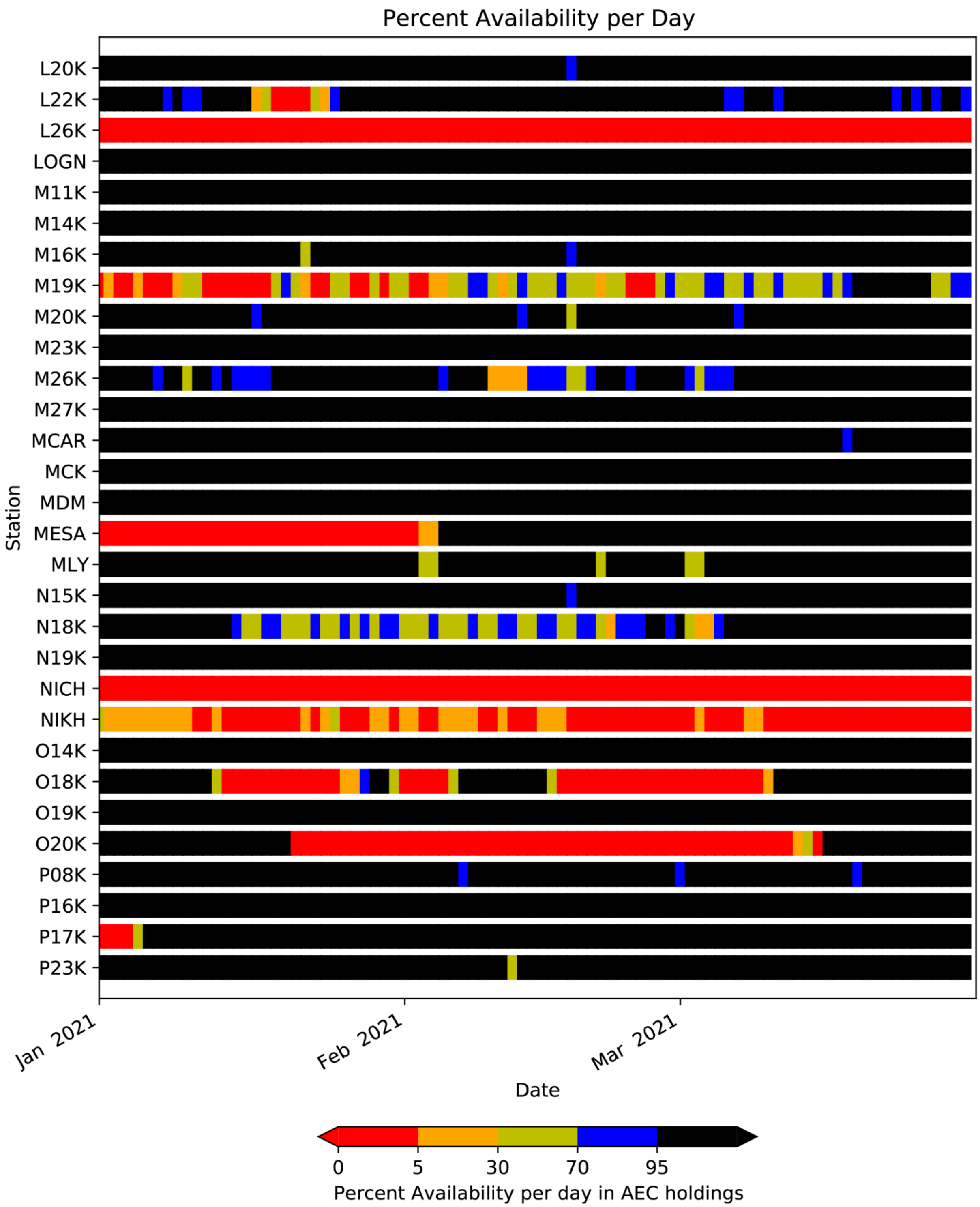


Figure A5. *Data availability for stations L20K-P23K (listed alphabetically).*

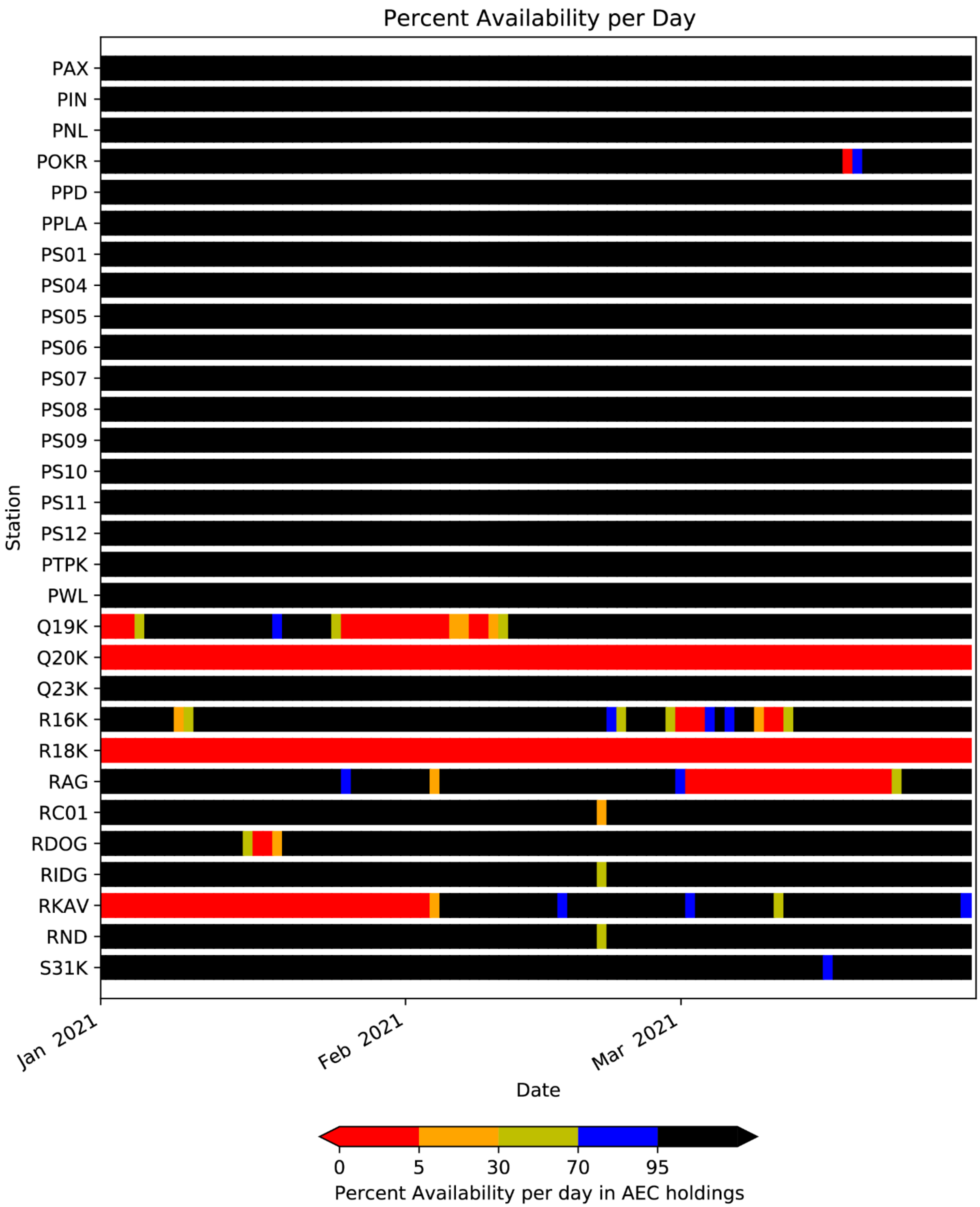


Figure A6. *Data availability for stations PAX-S31K (listed alphabetically).*

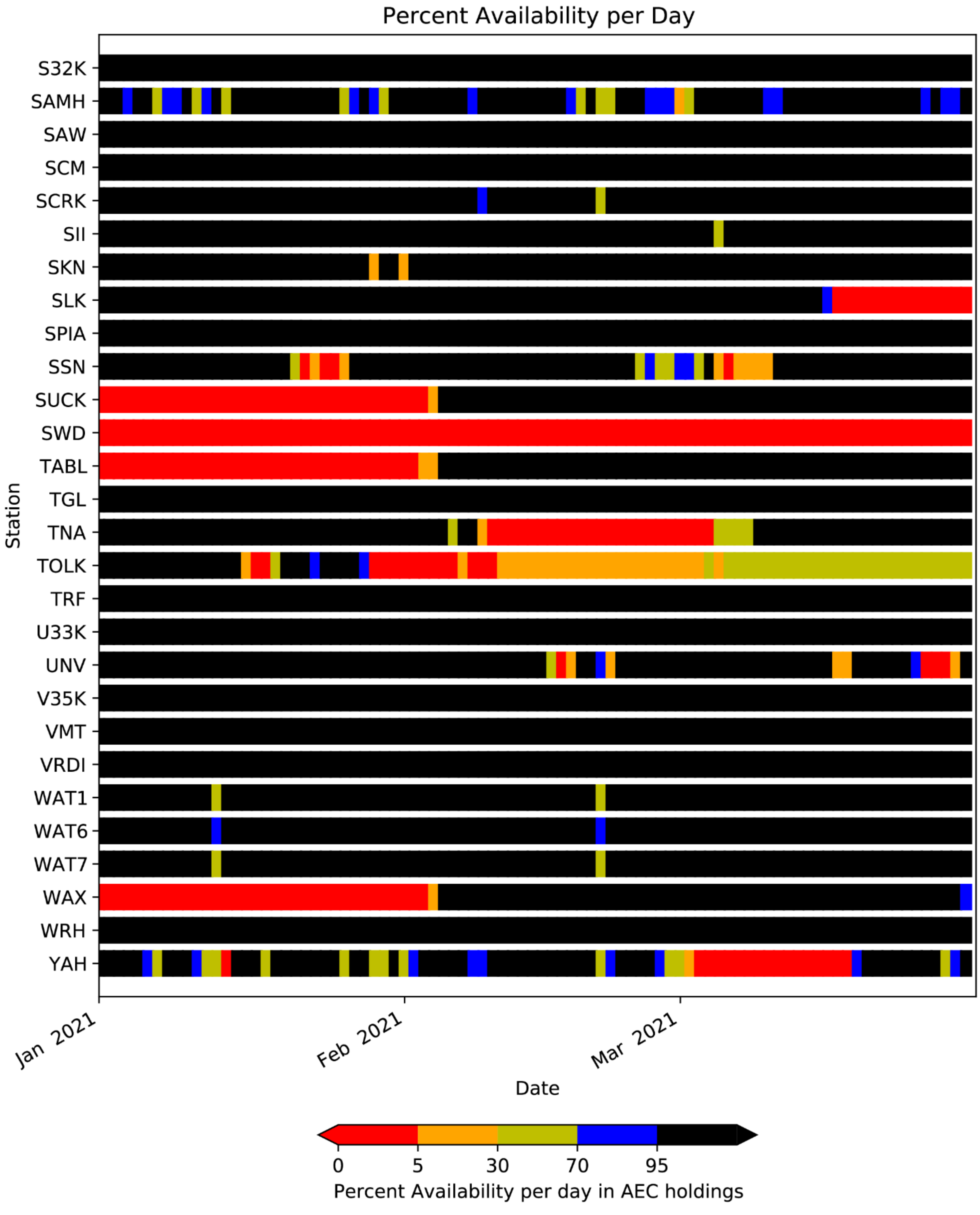


Figure A7. *Data availability for stations S32K-YAH (listed alphabetically).*

Appendix B: Gaps for broadband stations from AK network.

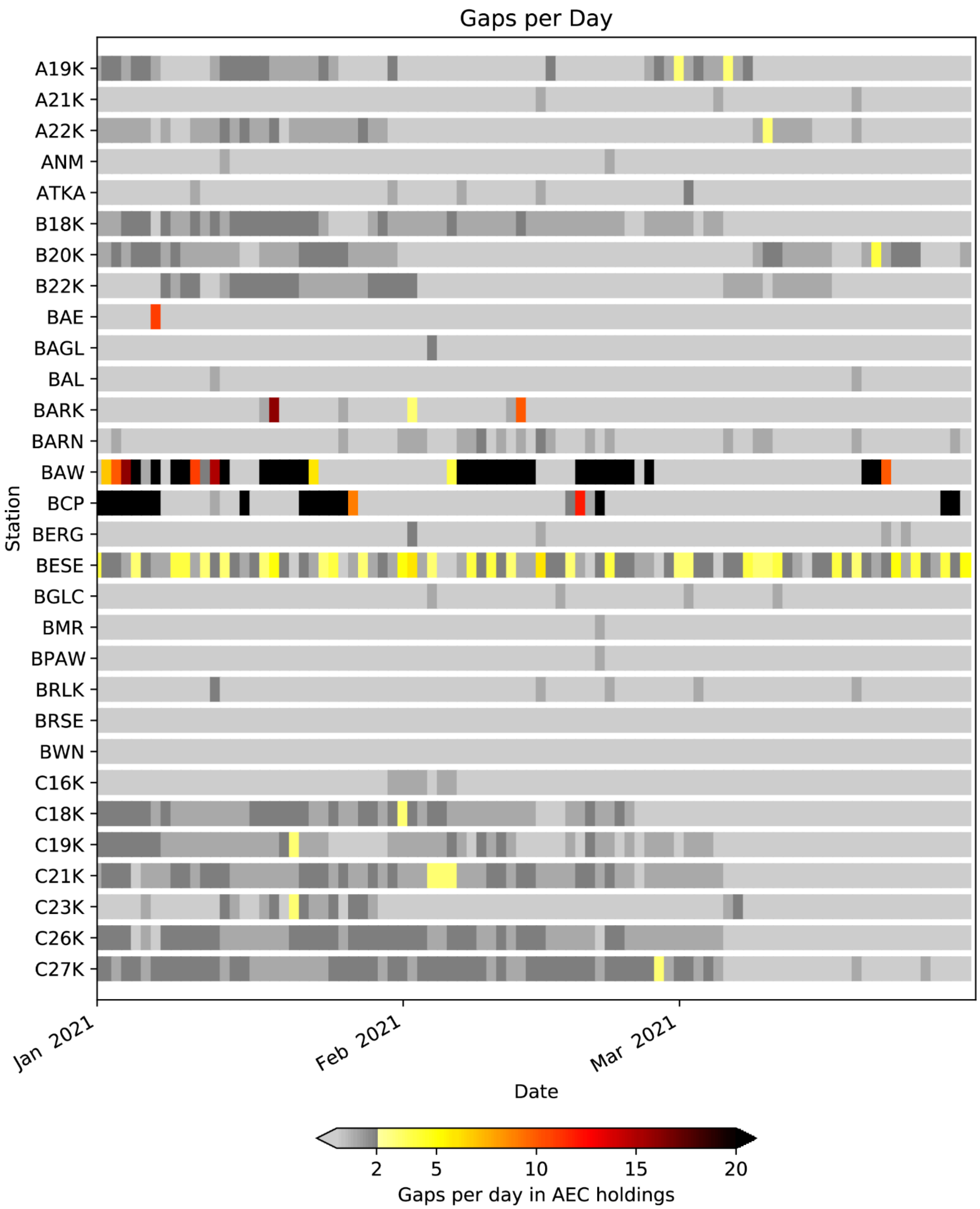


***Figure B1**. Number of gaps per day[1] for stations A19K-C27K (listed alphabetically).*

[1] Stations with 0% data availabilityare denoted in the same color as stations with 0 gaps.

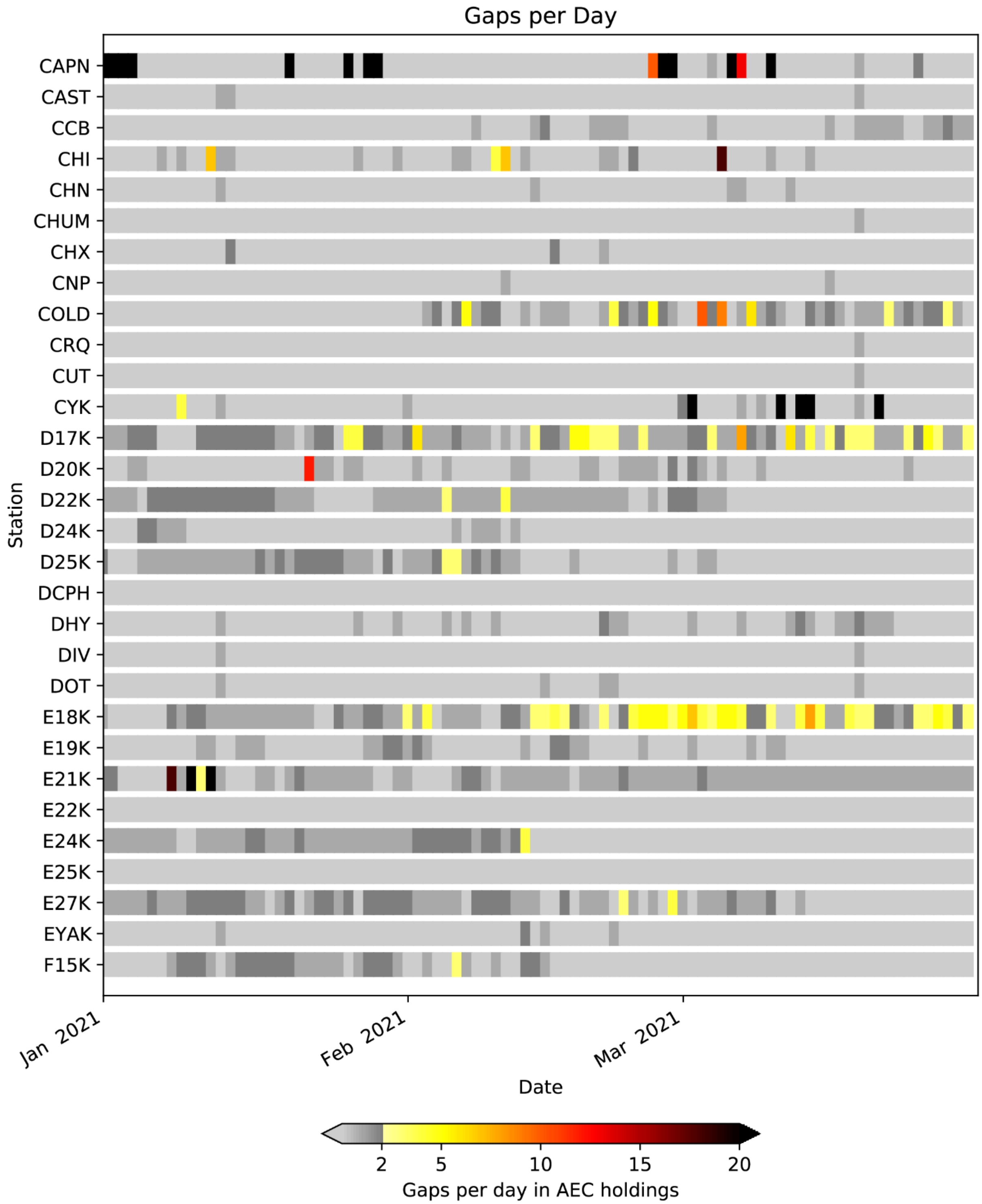


***Figure B2**. Number of gaps per day for stations CAPN-F15K (listed alphabetically).*

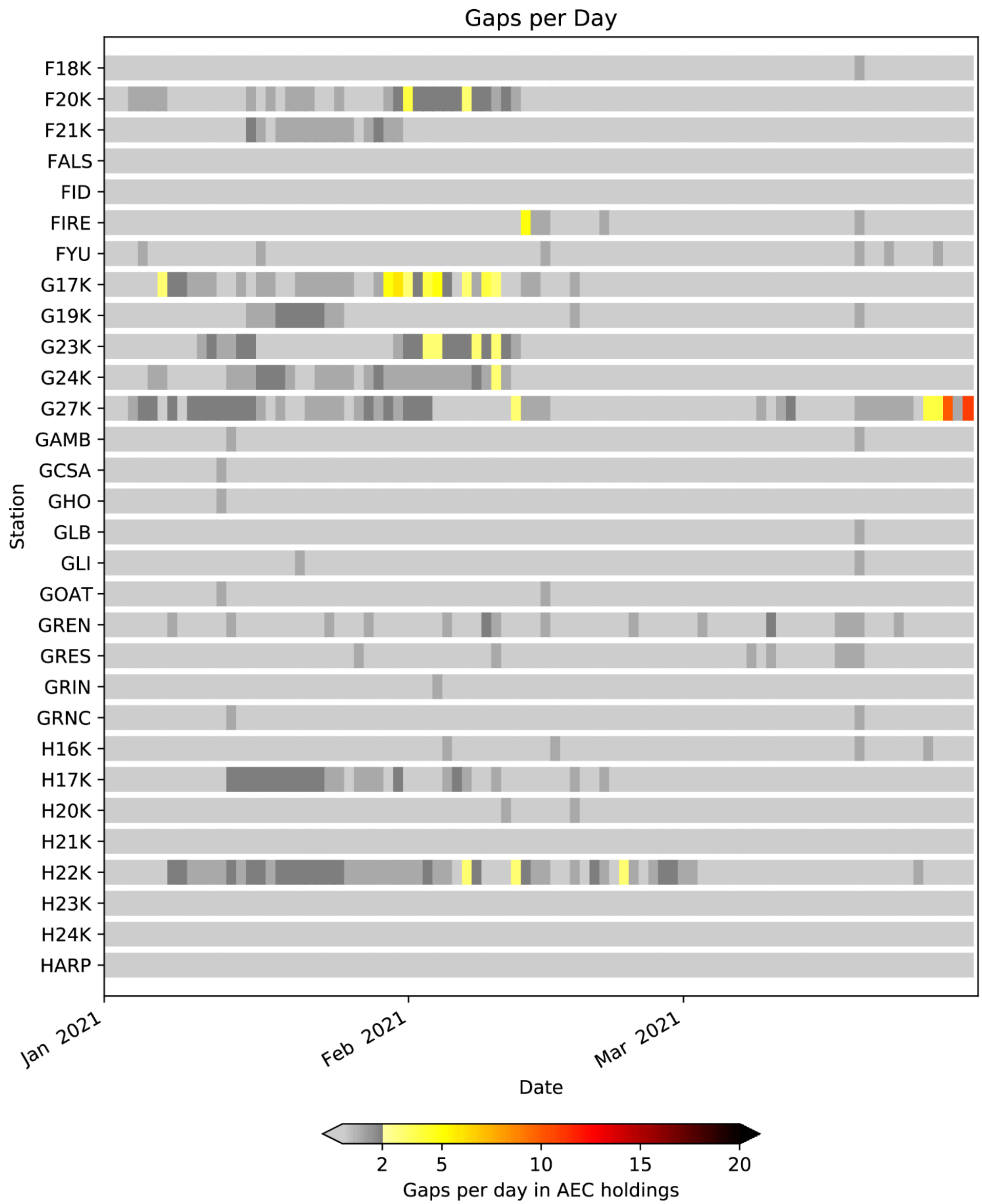


***Figure B3**. Number of gaps per day for stations F18K-HARP (listed alphabetically).*

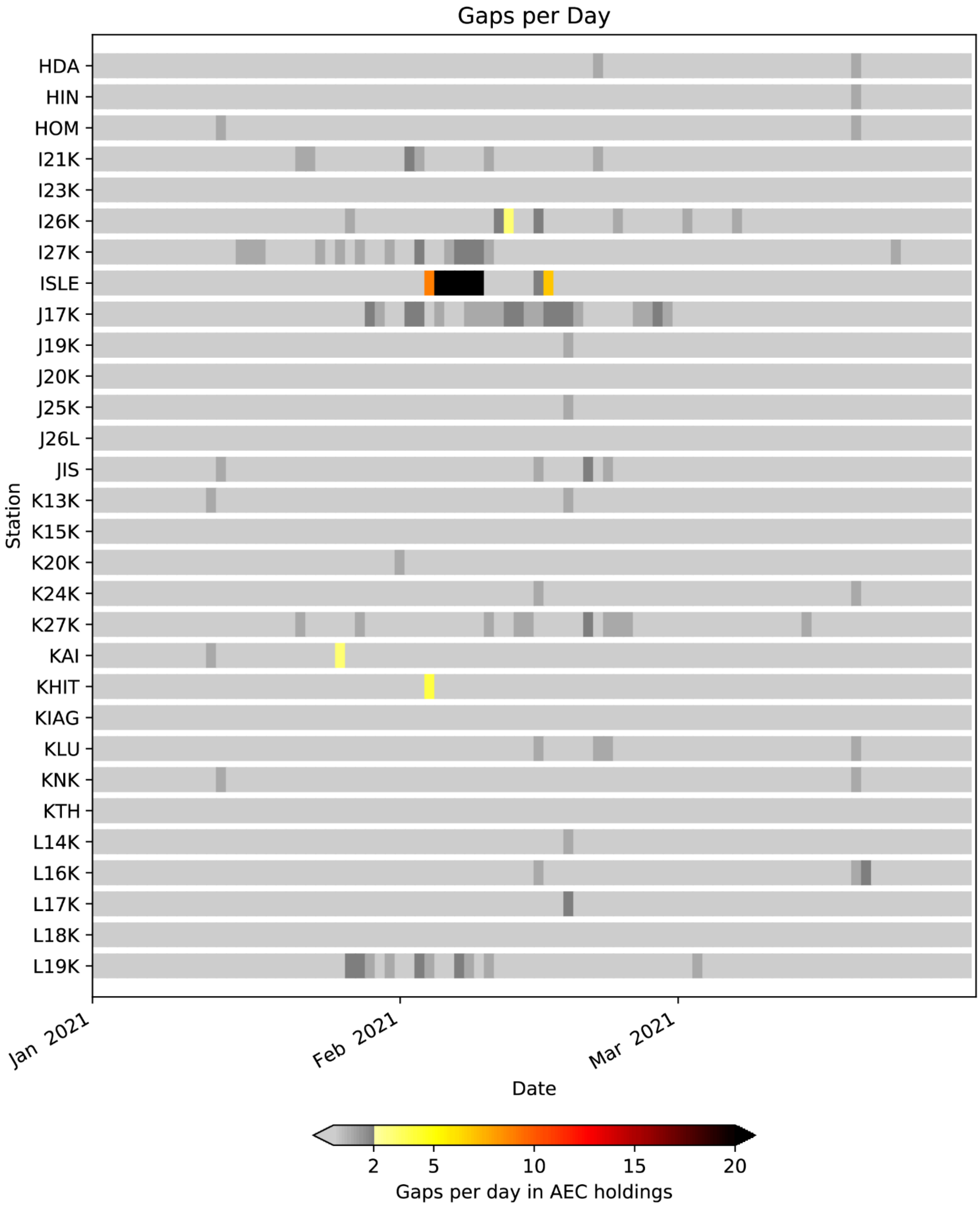


***Figure B4**. Number of gaps per day for stations HDA-L19K (listed alphabetically).*

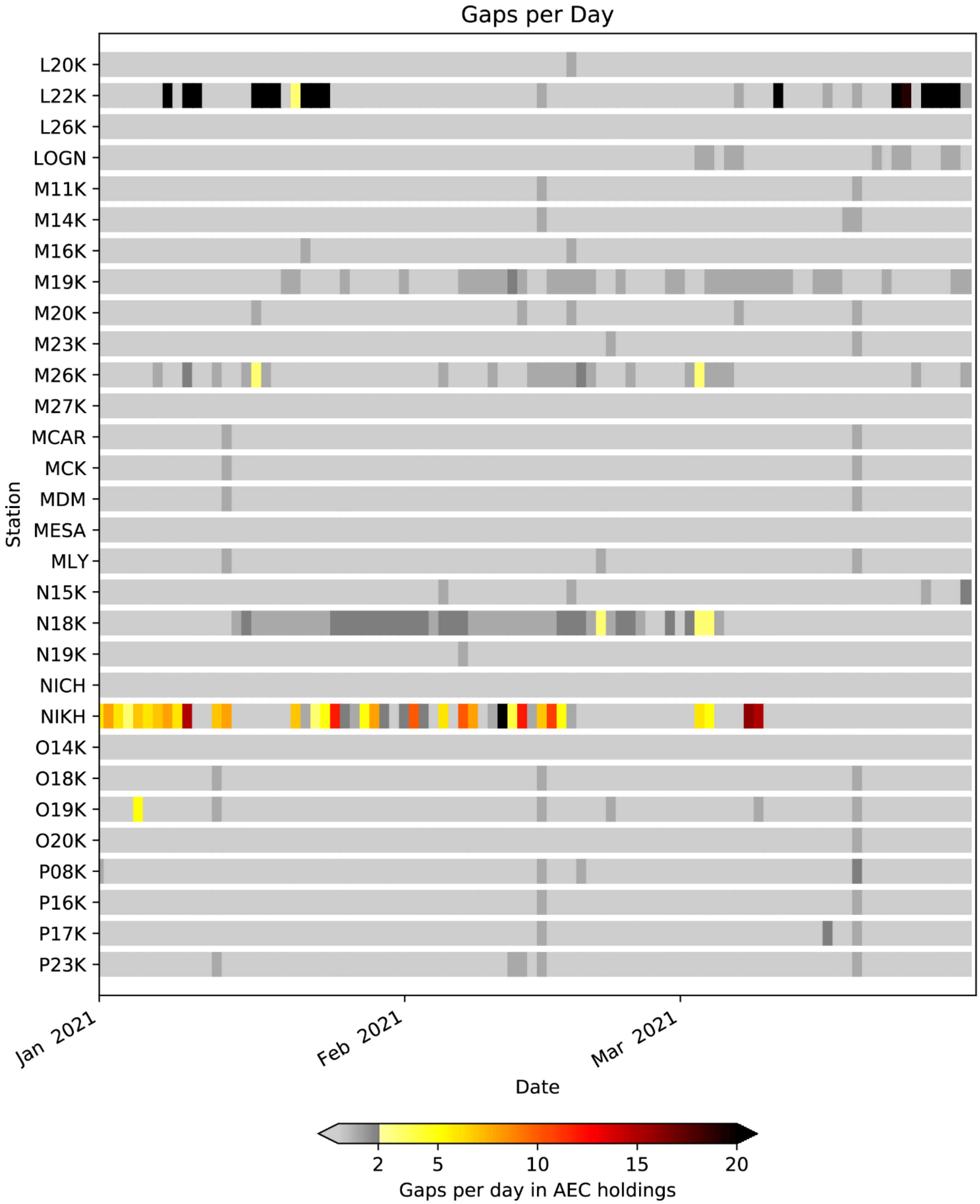


***Figure B5**. Number of gaps per day for stations L20K-P23K (listed alphabetically).*

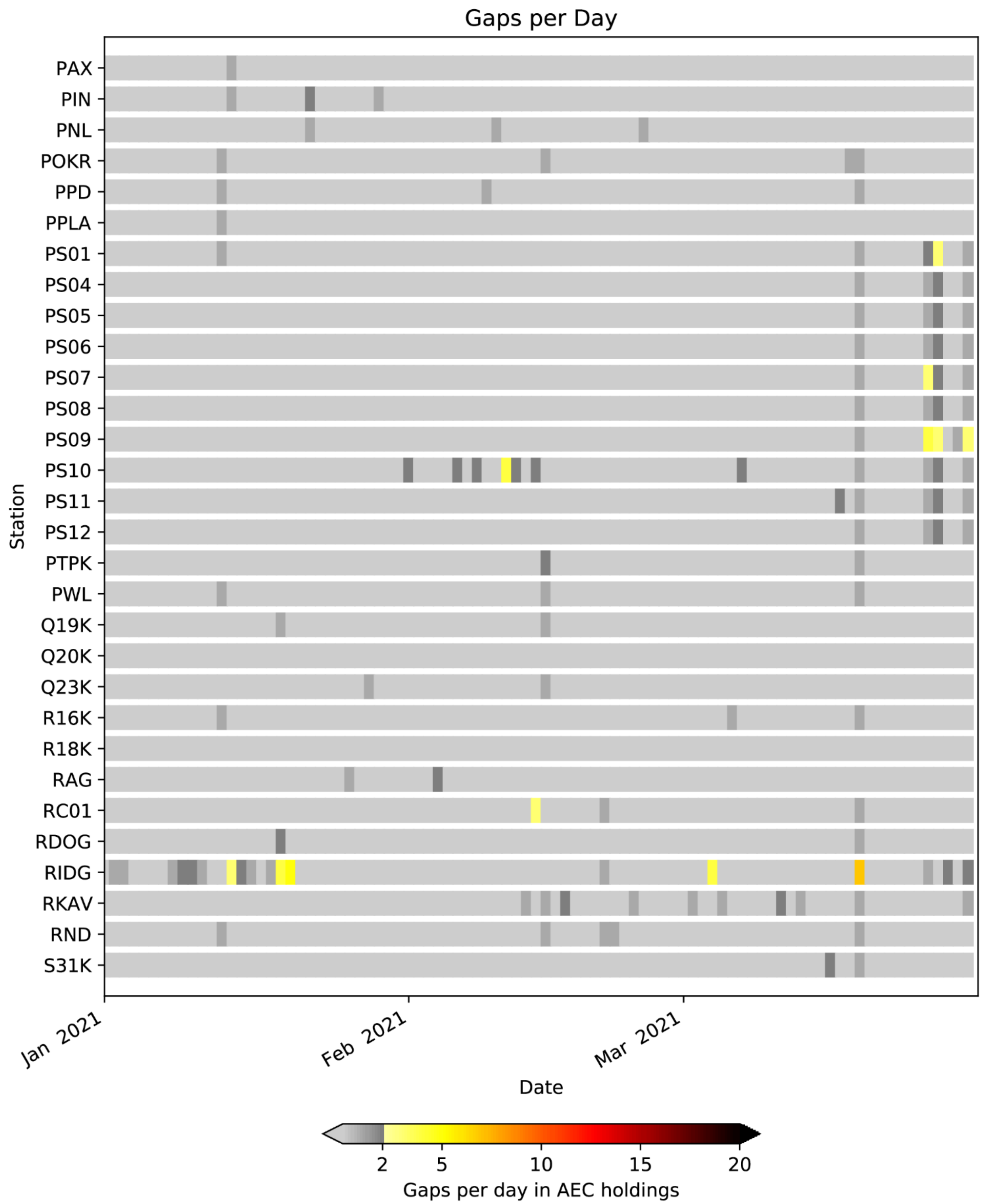


Figure B6. *Number of gaps per day for stations PAX-S31K (listed alphabetically).*

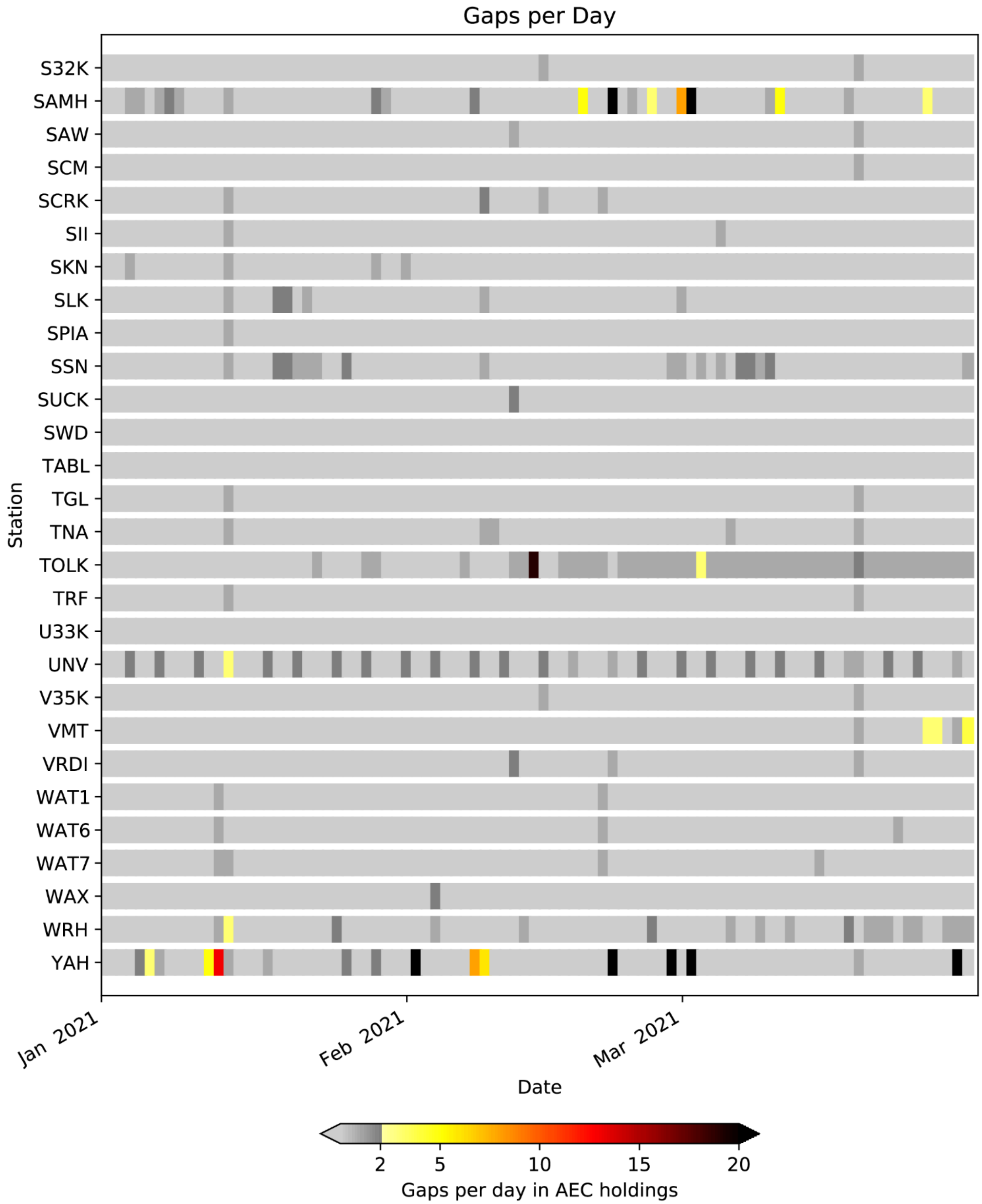


Figure B7. *Number of gaps per day for stations S32K-YAH (listed alphabetically).*