



reimagining how the Alaska Earthquake Center catalog is generated (part 1)

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Antelope User Group Meeting





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Director of
Operations

administration



Ron Wilkes
Seismic Data
Analyst



Ayumi Bakken
Seismic Data
Analyst



Shah Khan
Seismic Data
Analyst

analysis

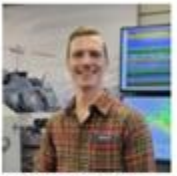


Gabriel Low
K-12 Outreach
Specialist

communication



Sam Jeffries
Field Technician



Michael Place
Field Engineer



Mathilde Wimez
Field Technician



Joanne Heslop
Field Engineer

(not pictured)
Daniel Diaz
Field Engineer

field



Oliver Wood
Web Administrator

(not pictured)
Luke Underwood
Developer



**Alexandra
Farrell**
Developer

(not pictured)
Nick Alexeev
Developer

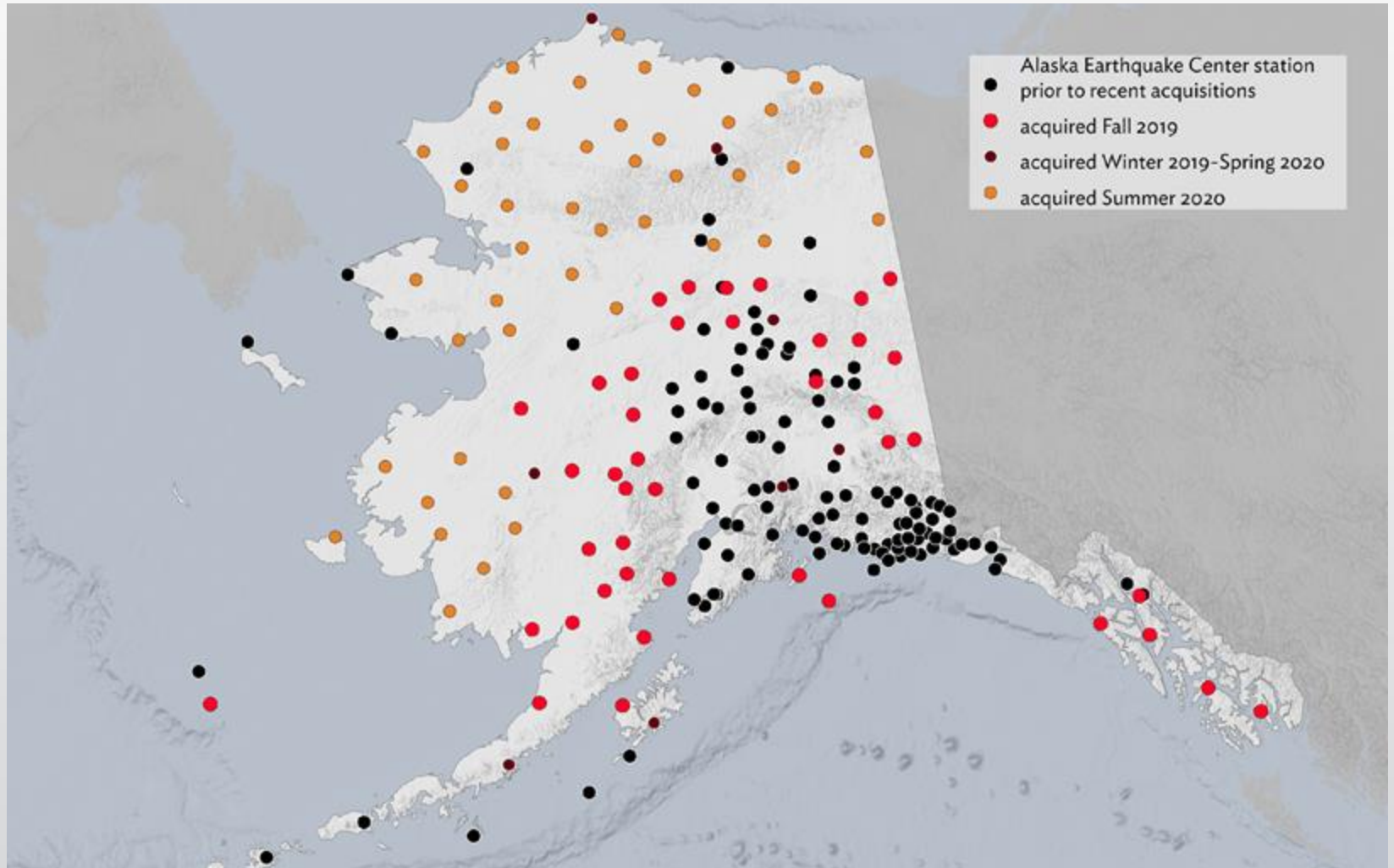


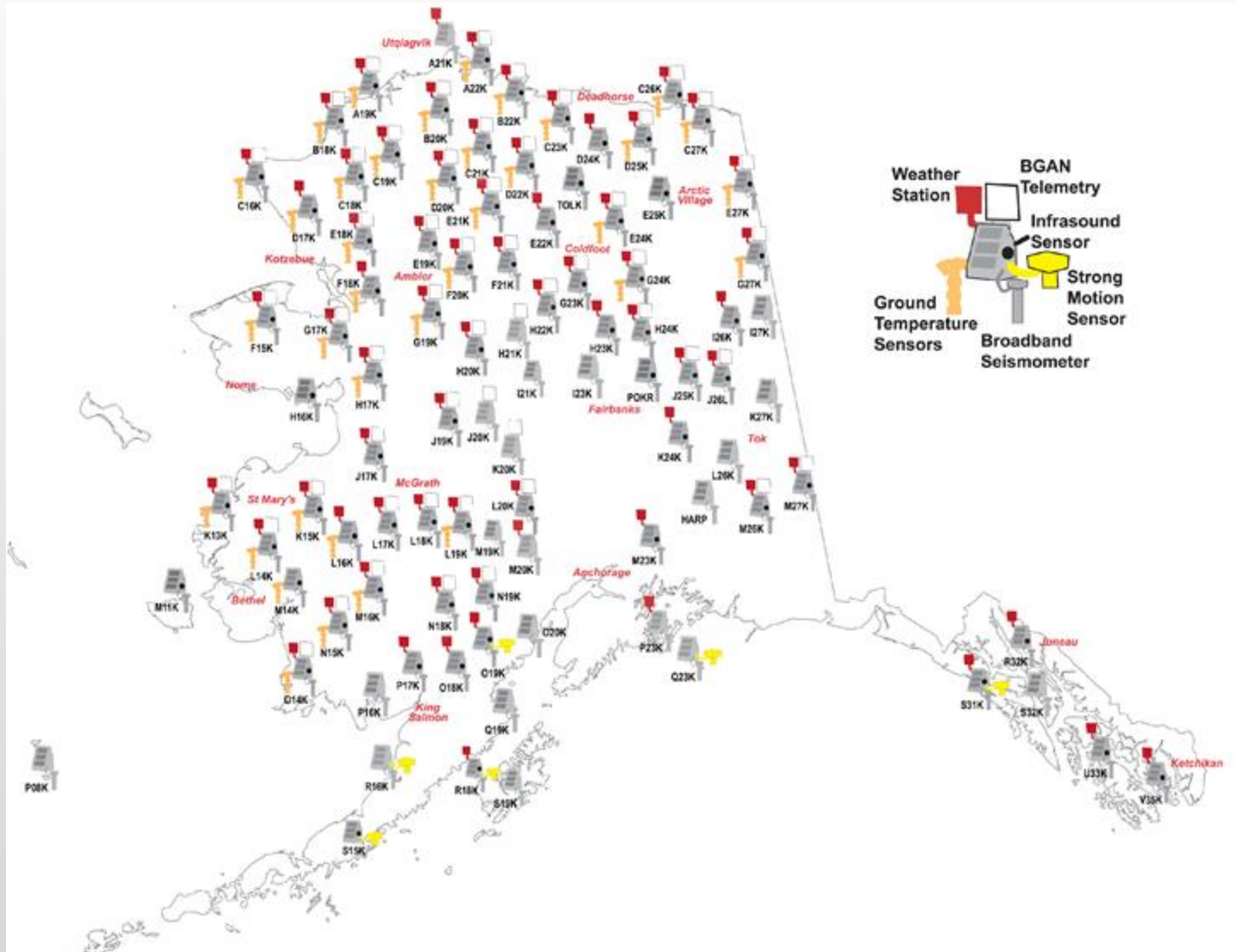
Gabe Paris
Developer

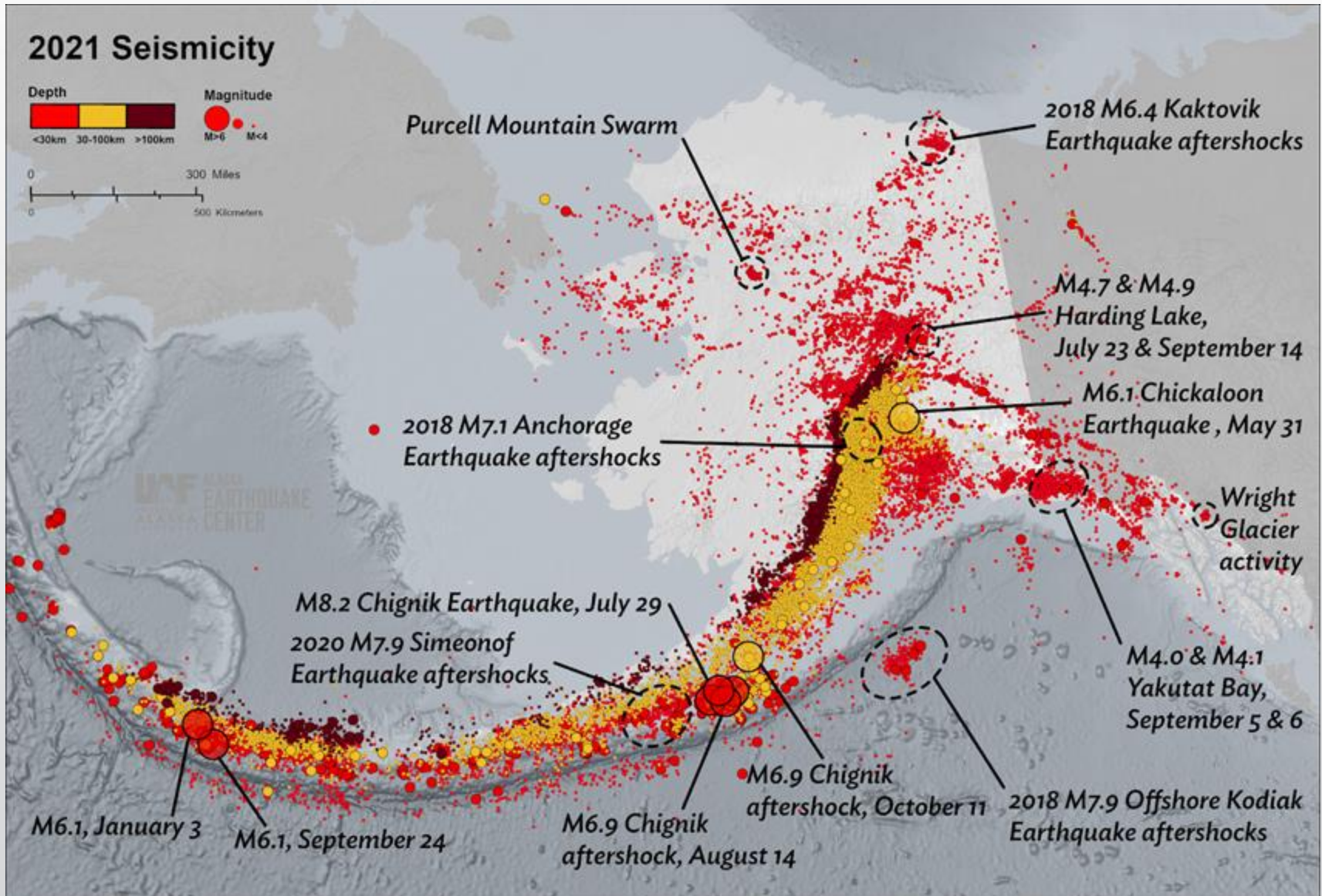
2018 permanent network



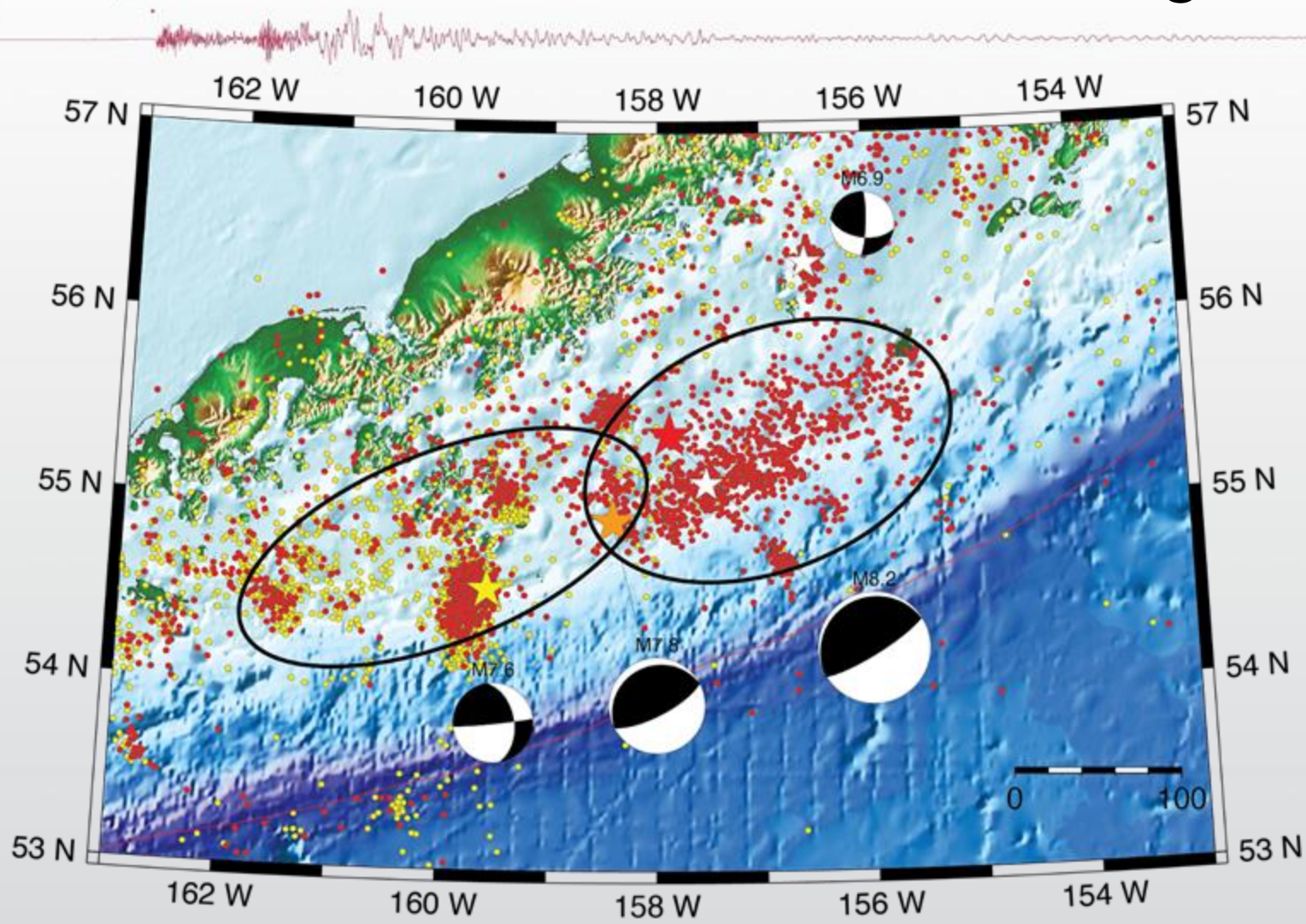
2022 permanent network





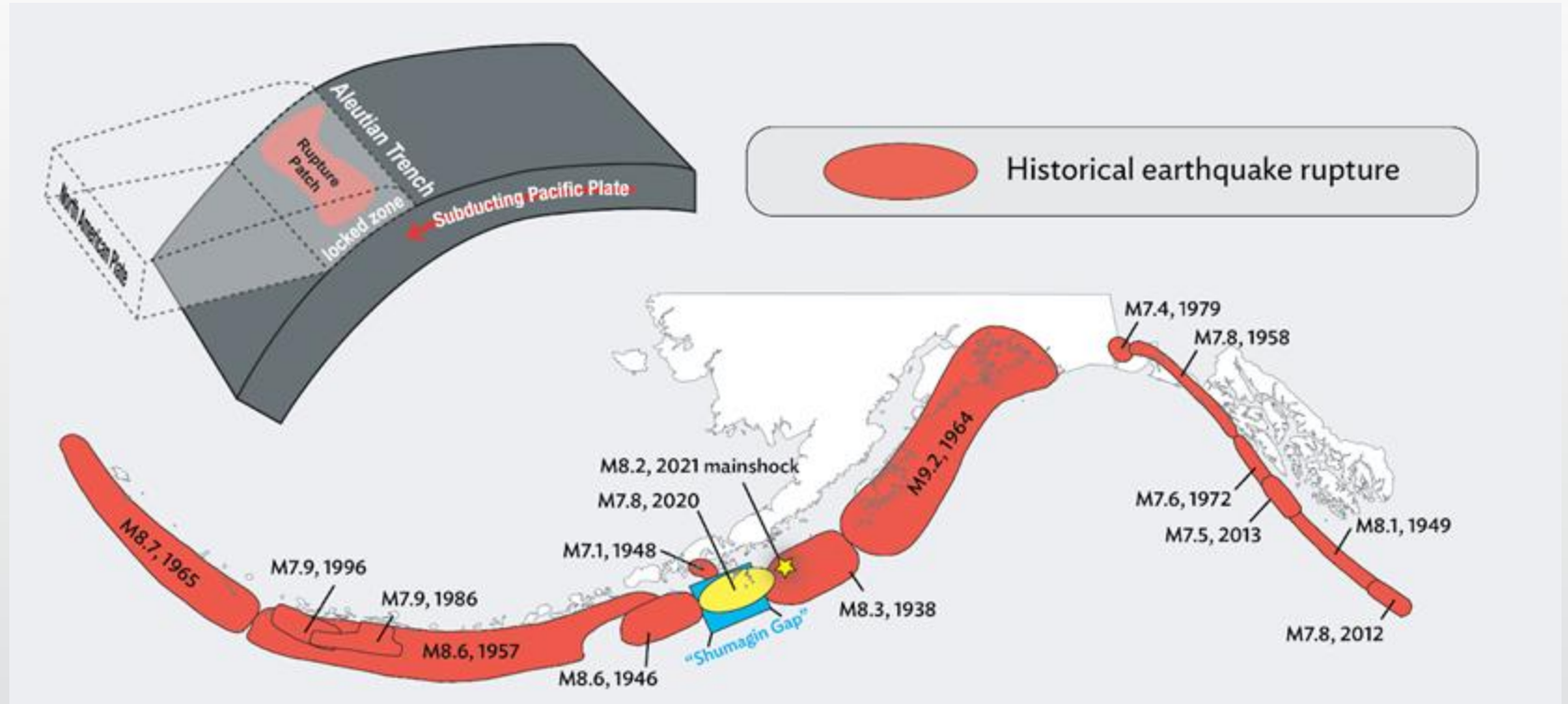


Simeonof M7.8, Chignik M8.2



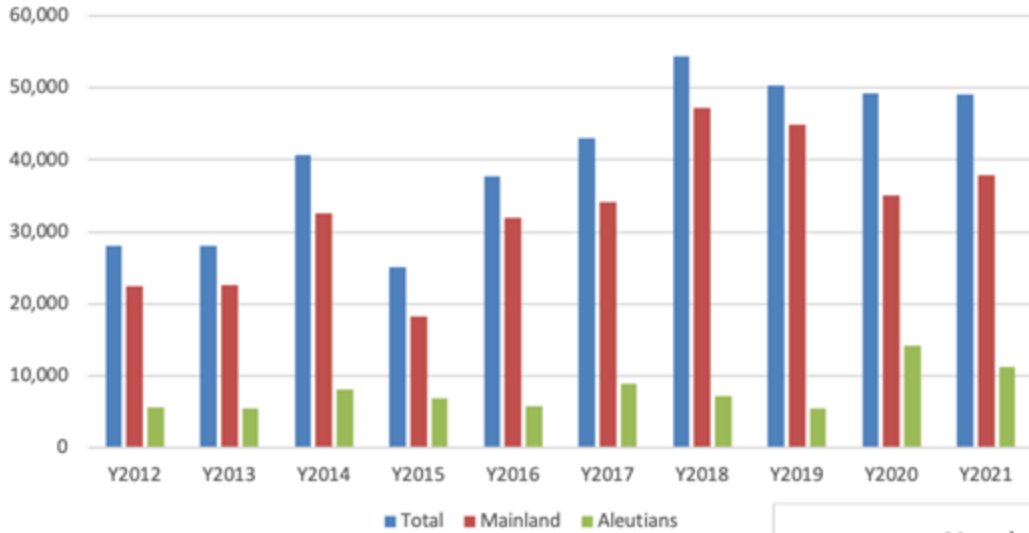
- | | | |
|--------------------------------|---------------------|-------------------------|
| ★ Jul 29, 2021 M8.2 | ★ Jul 22, 2020 M7.8 | ● Jan 1 - Jul 28, 2021 |
| ☆ Aug 14 and Oct 11, 2021 M6.9 | ★ Oct 19, 2020 M7.8 | ● Jul 29 - Dec 31, 2021 |

Simeonof M7.8, Chignik M8.2

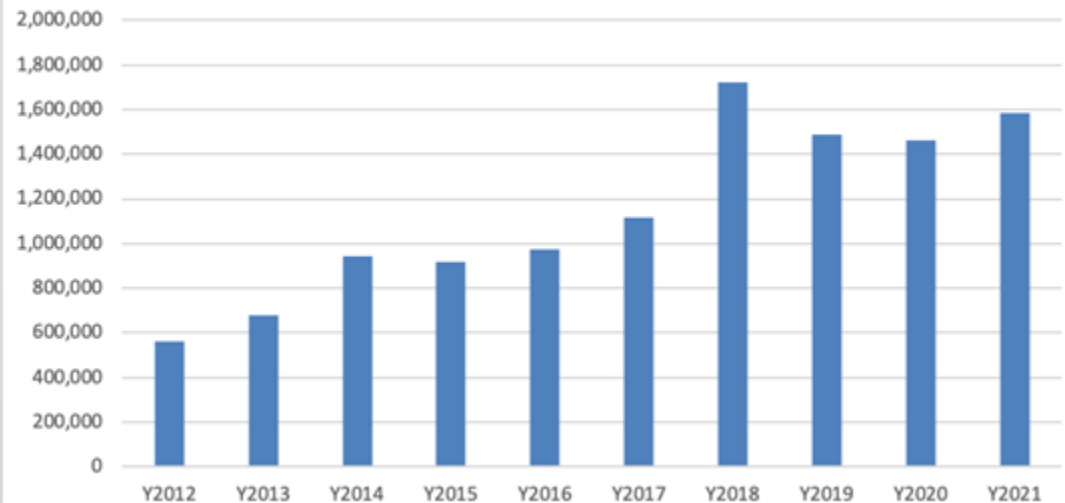




Number of seismic events in Alaska Earthquake Catalog



Number of seismic phases in Alaska Earthquake Catalog







The purpose of this project is to achieve two primary goals:

- 1) Ensure that Earthquake Center staff, researchers, and stakeholders always have straightforward access to the best available Alaska earthquake catalog**
- 2) Streamline the workflow from the real-time system to catalog QC to ensure that staff resources are being used effectively**



- **Use a unified mechanism for posting catalog information and downstream products**
- Provide analysts with the most up-to-date information available at the time of processing
- Support delayed review of earthquakes
- Retain the ability to edit all aspects of the catalog at future points in time
- Provide a mechanism for querying the best possible information at any point in time



eventname

a 10-character alphanumeric string that uniquely identifies an earthquake

022333u81m

<https://earthquake.alaska.edu/event/022333u81m>

<https://earthquake.usgs.gov/earthquakes/eventpage/ak022333u81m/executive>

evid

an 8-character integer that serves as a database primary key for an event

21156180

orid

an 8-character integer that serves as a database key for a particular earthquake solution

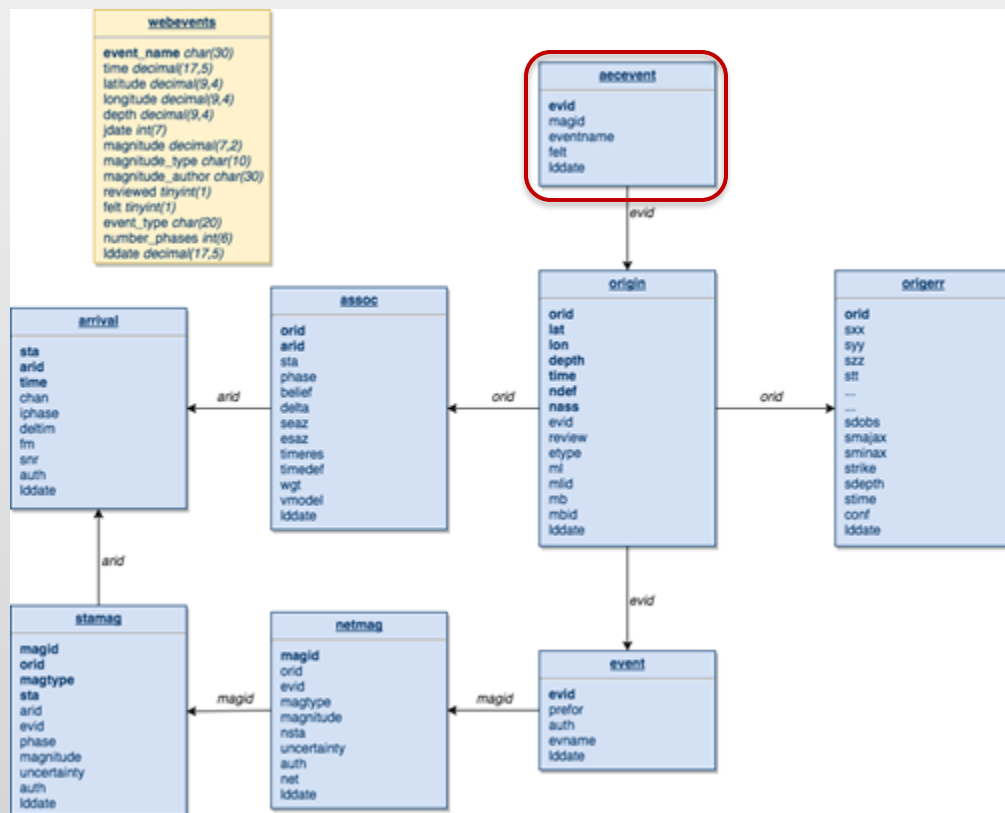
32941259

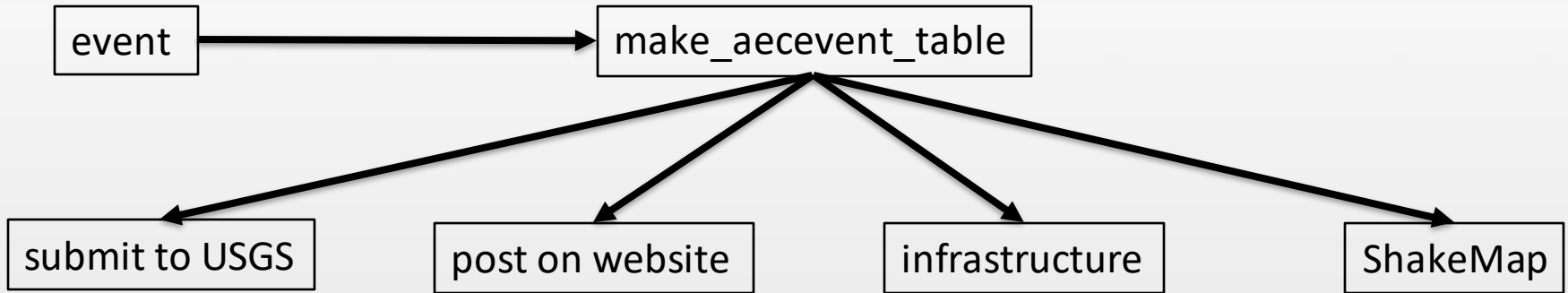


evid, orid can be renumbered at any time

eventname is never changed or reused

We deployed the eventname field as part of the 'aecevent' table in January 2019.





<p>poll database</p> <p>new orids?</p> <p>was event in ANSS region?</p> <p>write to new database</p> <p>poll new database for new orids</p> <p>write out quakeML file</p>

<p>listen for ORB packets</p> <p>was event in mission region?</p> <p>post to MySQL database</p>

<p>listen for ORB packets</p> <p>was event in mission region?</p> <p>was event M3.5 or greater?</p> <p>create JSON message and submit to SNS</p>
--

<p>poll database</p> <p>new orids?</p> <p>was event in mission region?</p> <p>was event M3.5 or greater?</p> <p>create ShakeMap input XML files</p> <p>run ShakeMap</p>



many similar checks

no synchronization

each product has own triggering mechanism

new products require building new trigger mechanism

no utilization of eventname (requires downstream programs to individually load eventname)



update_trigger

a single process that can control any number of downstream processes to run on a specified earthquake

watches for new origins in ORB, queries database to compare to existing origins (if applicable)

runs a series of tests to check if downstream processes should be run

produces a custom ORB packet



design goals

flexible

parameter file driven

separation of *tests* from *ordering & implementation*



suite of tests available via python module:

- basic qc check
 - smajax/sdepth check
 - min ndef vs magnitude (eg. mag ≥ 6 : ndef ≥ 25)
- check if event is reviewed or automatic
- check if origin is preferred
- check for minimum magnitude
- check for magnitude type
- check if origin is inside of a polygon
- check if origin has changed
 - location
 - depth
 - origin time
 - number of phases
 - magnitude
 - reviewed



```
default_params &Arr{
  mag_phase_error True
  preferred_origin True
  reviewed True
  mag_type &Tbl{
    mww
    mb
  }
}

db2mysql_params &Arr{
  origin_change &Arr{
    location_change 500 # location change, in km
    depth_change 500 # depth change from previous, in km
    ot_change 500 # origin time change, in seconds
    ndef_increase 500 # minimum number of phases ndef increases by
  }
  review_change True
  polygon &Arr{
    region_database /home/aecrt/run/dbpoly/akRegions
    region_name mission
  }
}

run_shake_params &Arr{
  magnitude 3.5
  origin_change &Arr{
    location_change 500 # location change, in km
    depth_change 500 # depth change from previous, in km
    ot_change 500 # origin time change, in seconds
    ndef_increase 500 # minimum number of phases ndef increases by
    review_change True # event has been reviewed
  }
  polygon &Arr{
    region_database /home/aecrt/run/dbpoly/akRegions
    region_name mission
  }
}
```

Default tests

```
db2quakeml_params &Arr{
  testgrp1 &Arr{
    review_required True
    polygon &Arr{
      region_database /home/aecrt/run/dbpoly/akRegions
      region_name mission
    }
    origin_change &Arr{
      location_change 500 # location change, in km
      depth_change 500 # depth change from previous, in km
      ot_change 500 # origin time change, in seconds
      ndef_increase 500 # minimum number of phases ndef increases by
      review_change True
    }
  }
  testgrp2 &Arr{
    polygon &Arr{
      region_database /home/aecrt/run/dbpoly/akRegions
      region_name anss
    }
    origin_change &Arr{
      location_change 500 # location change, in km
      depth_change 500 # depth change from previous, in km
      ot_change 500 # origin time change, in seconds
      ndef_increase 500 # minimum number of phases ndef increases by
      review_change True
    }
  }
}

run_ftgreely_trig_params &Arr{
  magnitude 2.5
  polygon &Arr{
    region_database /home/aecrt/run/dbpoly/akRegions
    region_name mission
  }
}
```

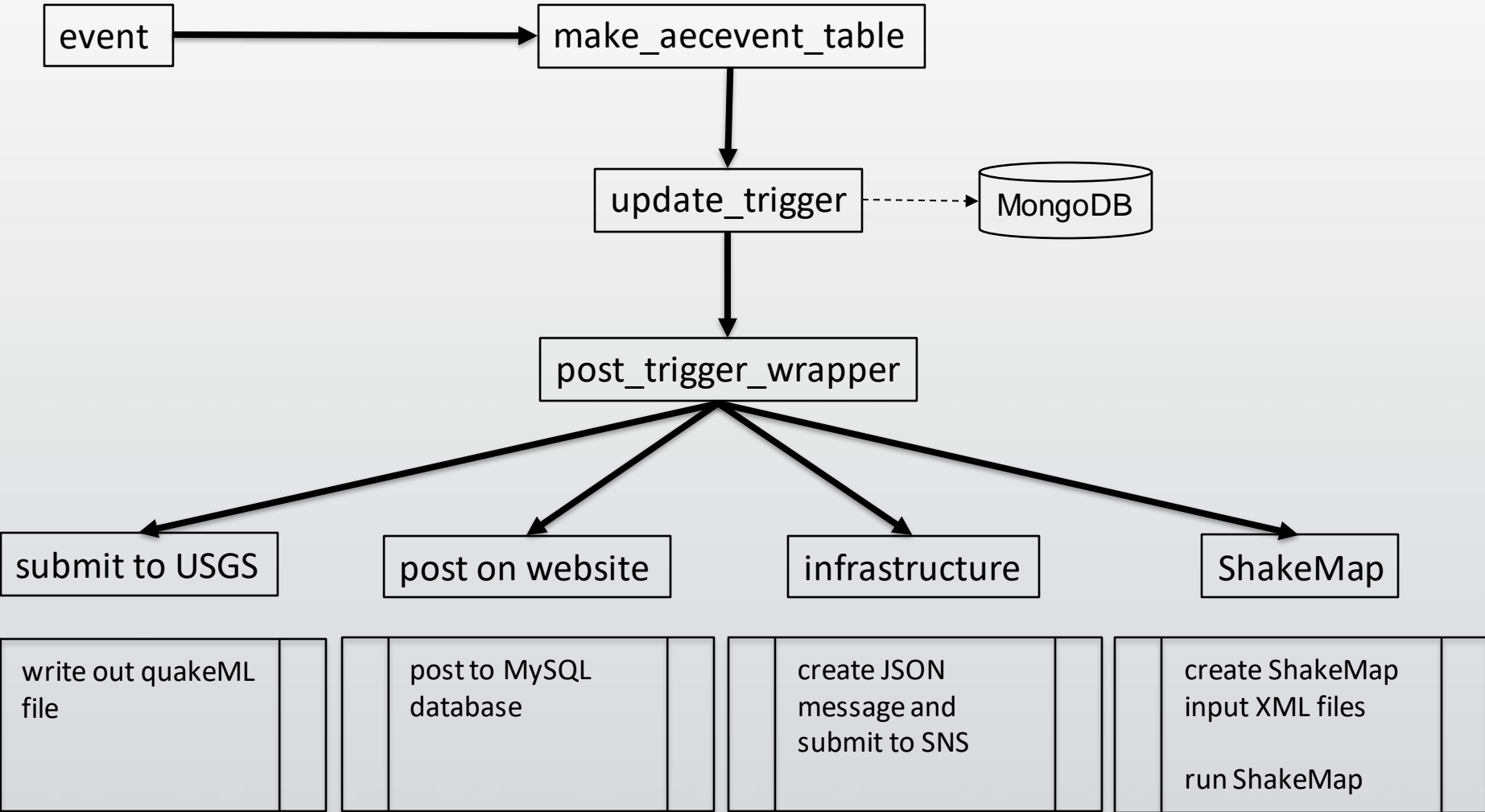
Grouped tests

/pf/triggering

```
aecevent      023bsk9kq
db             dbseg/summary
db2mysql      True
db2quakeml    True
evid          21256962
orid          24725834
run_ftgreely_trig False
run_shake     False
triggered_mag 1.07
```

MongoDB

```
_id: ObjectId('629e60b0f16066fae2d5b8cd')
eventname: "02277zbwpl"
orid: 24670743
magid: 1682530
lat: 62.795
lon: -150.983
depth: 150.0749
mag: 1.93
magtype: "ml"
ndef: 10
time: 1654546097.54029
lddate: 1654546608.200306
review: false
triggers: Array
  0: Object
    db2mysql: true
    db2quakeml: true
    run_ftgreely_trig: false
    run_shake: false
```

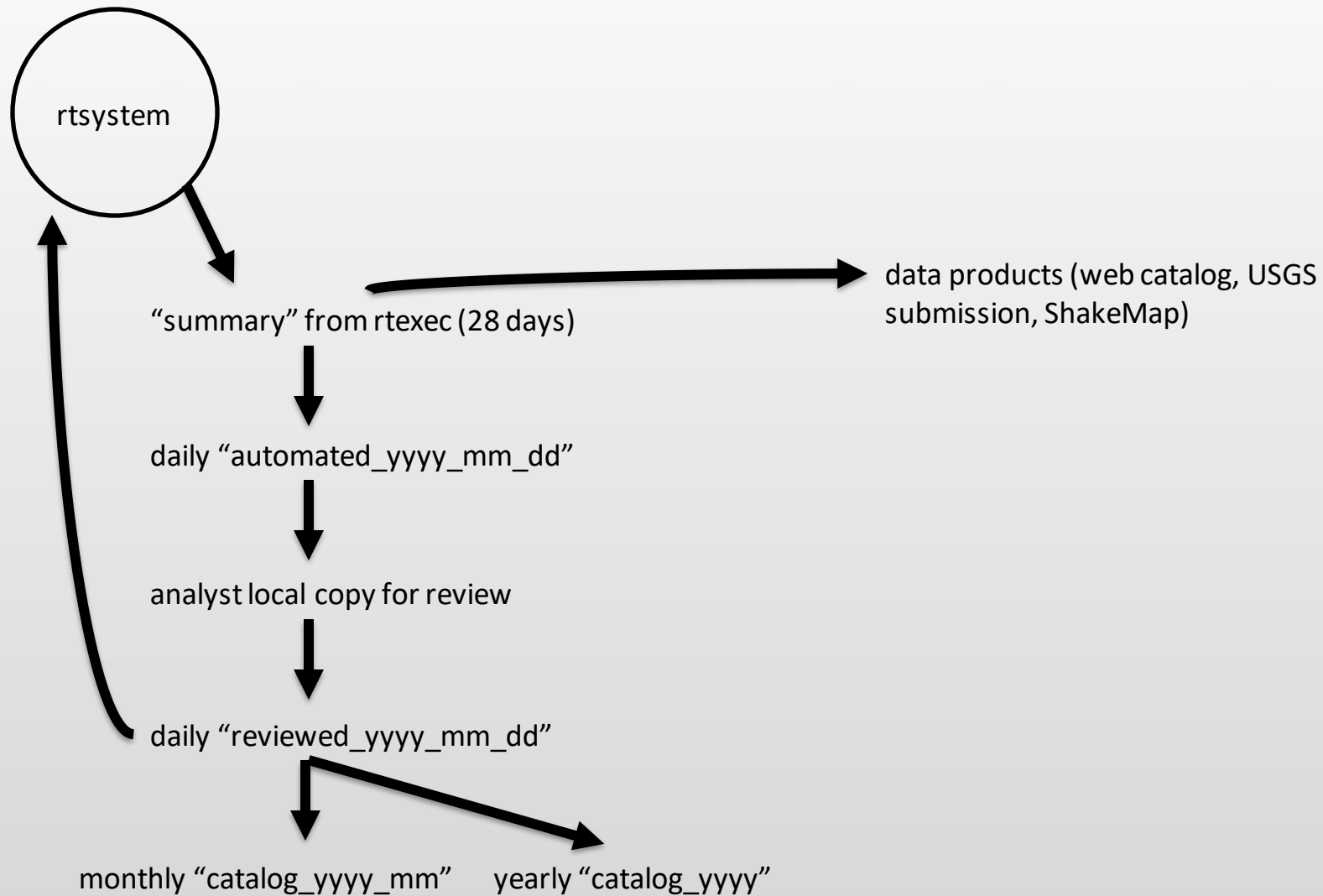




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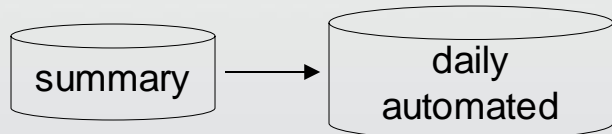
Old system





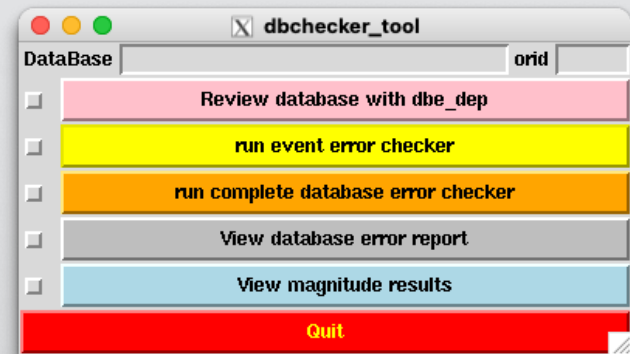
Analyst

- analyst would run analysis_control
 - creates local copy of automated database
- process database w/ dbloc2
- when done, run dbchecker_tool
- check-in via analysis_control



Automated

- Summary cleaned up by cron – contained ~28 days
- copied from summary daily at 00:15 UTC
- any updates (duty, USGS imports) occurring after 00:15 would not be reflected





Requests:

- **VPN+screen share is a notable bottleneck to processing remotely**
- **time segments of less than 1 day?**
- **easily see basic statistics (number of events, magnitude range) in segment**
- **map?**
- improve error checker
- rewrite GUIs into sustainable architecture



New system



Analyst Checkout Website

Checkout	Date	Assignee	Status	Unassign	tar / txt file	Waveform / txt file
	12/22/2022 8:00 - 16:00	rewilkesjr	checked out	Unassign		Download Wave Form/txt files
	12/23/2022 16:00 - 0:00	abakken	checked out	Unassign		Download Wave Form/txt files
	12/24/2022 0:00 - 8:00	sfkhan	checked out	Unassign		Download Wave Form/txt files
<input type="radio"/>	12/24/2022 8:00 - 16:00	unassigned	available			
<input type="radio"/>	12/24/2022 16:00 - 0:00	unassigned	available			
<input type="radio"/>	12/25/2022 0:00 - 8:00	unassigned	available			
	12/25/2022 8:00 - 16:00	abakken	checked out	Unassign		Download Wave Form/txt files
<input type="radio"/>	12/25/2022 16:00 - 0:00	unassigned	available			
<input type="radio"/>	12/26/2022 0:00 - 8:00	unassigned	available			
<input type="radio"/>	12/26/2022 16:00 - 0:00	unassigned	available			
<input type="radio"/>	12/27/2022 0:00 - 8:00	unassigned	available			
<input type="radio"/>	12/27/2022 16:00 - 0:00	unassigned	available			
<input type="radio"/>	12/28/2022 0:00 - 8:00	unassigned	available			
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<input type="radio"/>	12/28/2022 16:00 - 0:00	unassigned	available			
	12/29/2022 0:00 - 8:00	sacotton	checked out	Unassign		Download Wave Form/txt files
<input type="radio"/>	12/29/2022 8:00 - 16:00	unassigned	available			
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View Map						
Number of events: 28						
Largest Mag: 2.67						
<input type="radio"/>	12/24/2022 8:00 - 16:00	unassigned	available			
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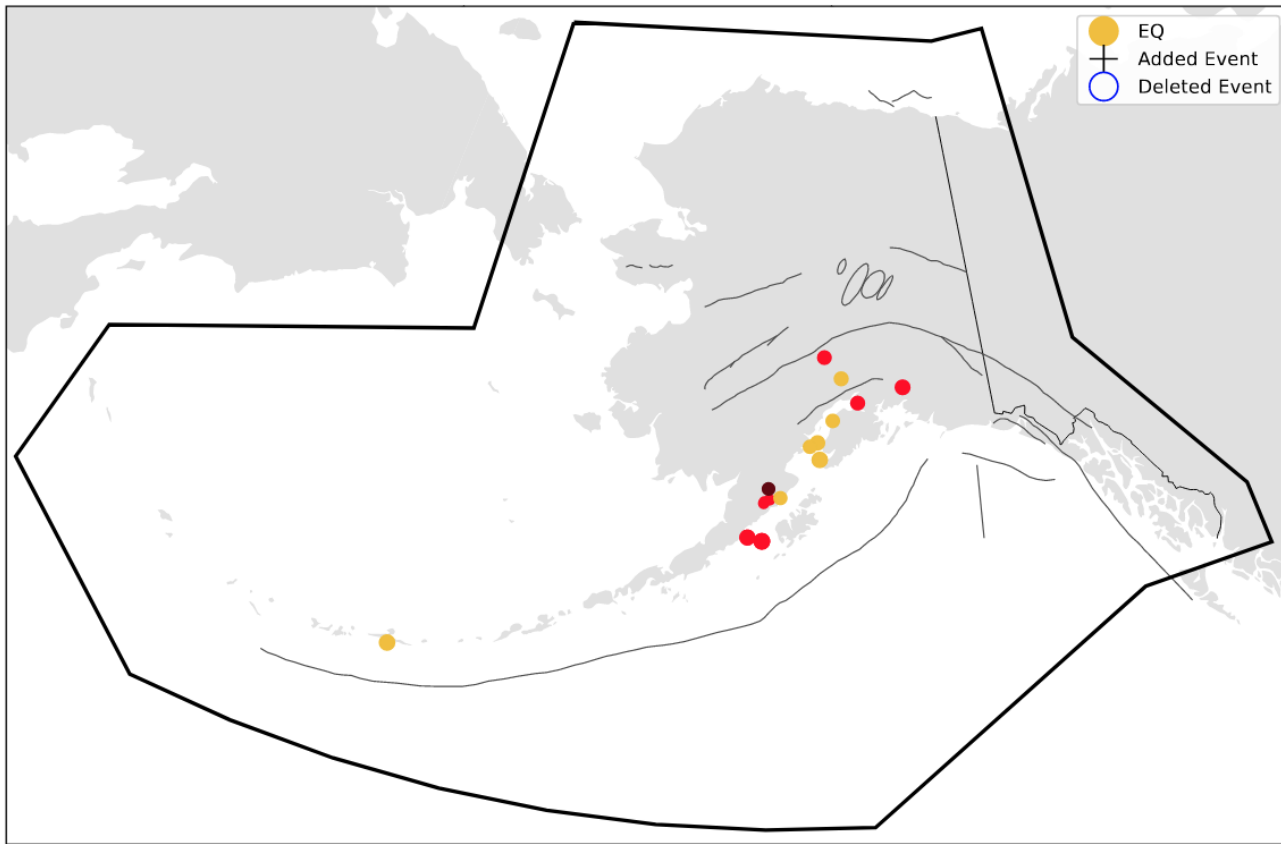


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	12/25/2022					
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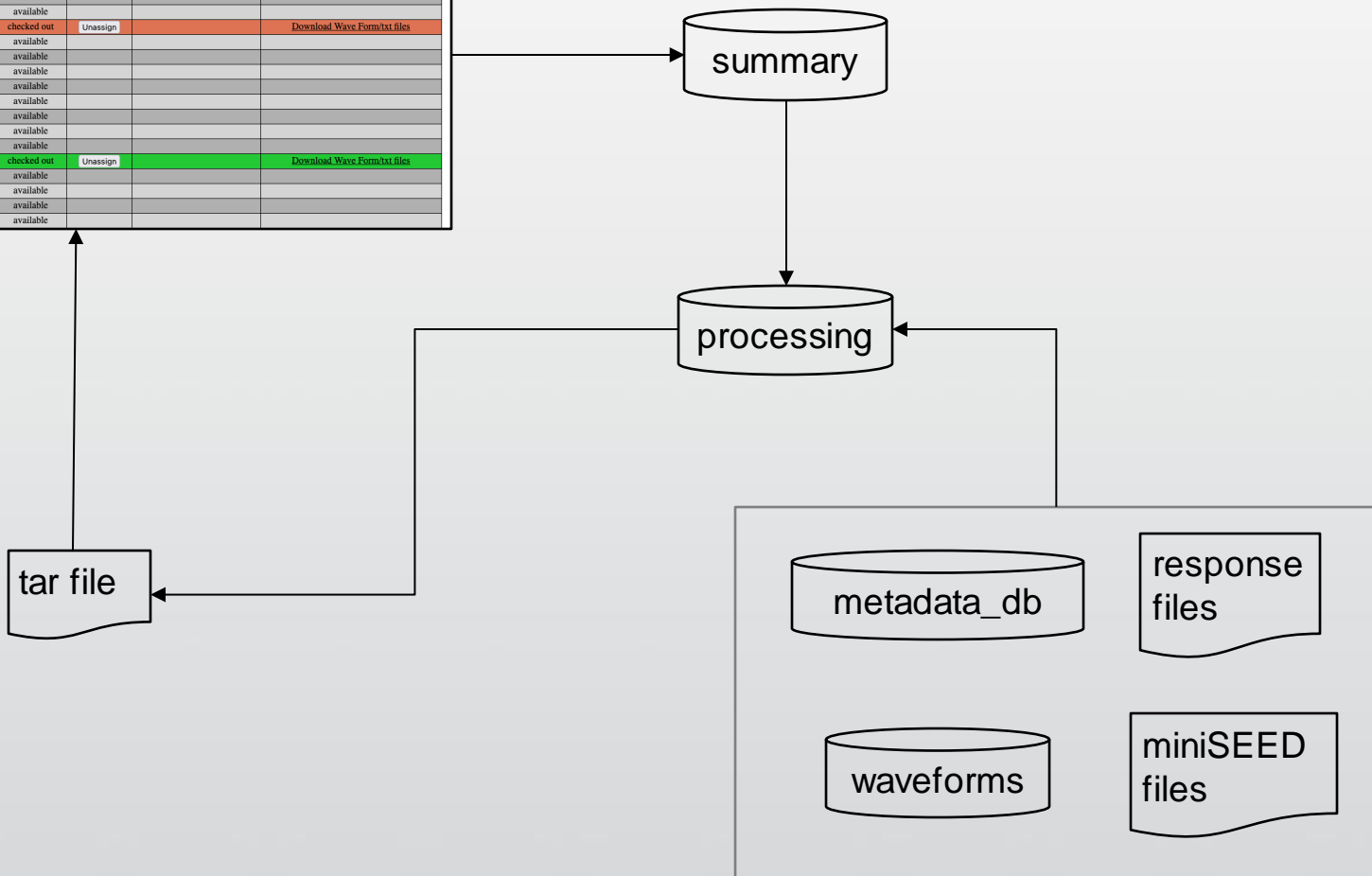


processing checkout



Analyst Checkout Website

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Questions?

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