Latest Advances in the Antelope Environmental Monitoring System

- ***Antelope 6.0***

Dr. Kent Lindquist

CTO, Boulder Real Time Technologies, Inc.

June, 2026

Opatija, Croatia AUG

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- Founded 1996
- Based in Boulder, Colorado, USA
- Makers of the ***Antelope*** *Environmental Monitoring System*



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Thanks to Kinemetrics

Thanks to our long-time strategic partners, Kinemetrics, Inc.



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Antelope Users' Group Meetings

- *Thanks to Tomislav Fiket, CROSSNET, and the Croatian Seismological Survey !!*



Kristina Kutleša, Unsplash

CROSSNET

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Antelope Users' Group Meetings



Looking forward to as rewarding a meeting as Rabat 2025

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Outline

- BRTT 3.0
- Antelope 6.0
- Antelope 6.0 Update 1
- Discussion

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BRTT 3.0

- Revamped management since 2025
- Growth mode
- Expanded team with cloud and product expertise
- Renewed customer support commitment
- Zendesk ticket queue driven to 0 outstanding tickets
- Prioritizing customer responsiveness
- Renewed customer dialogue for developing Roadmap
- Horsepower – Dream Team!

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Expanded Team



- Rohan Ambli
- Principal Cloud Architect
- Full-time March, 2026

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BRTT Team



Frank Vernon
CEO



Kent Lindquist
CTO



Jennifer Eakins
Head of Customer Success



Colby Toland
Principal Software Engineer



Rohan Ambli
Principal Cloud Architect



Joe Scharf
Business Strategy



Brian Schwalm
Cloud Engineering



Jen Seim
Business Process



Jeffrey Orrey
Science Messaging



Aprille Jordan
Webmaster



Trilby Cox
Seismology UI/UX

Antelope 6.0: A Generational Step Forward

- Previous major version shift from 4 to 5 was the move to 64-bit in 2010
- Building the ***Antelope Cloud Platform***
  — seismology as a managed service
- ***Keeping our on-premises traditional software***
- Lightweight Containers support for modern architectures
- Hybrid by design: keep on-premises Antelope, add cloud at your own pace
- Roadmap: alpha now → open beta Q3–Q4 2026 → GA Q1 2027 → AI/ML beyond

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Antelope 6.0 Platform Support

- macOS
  - ARM64-architecture Sequoia (compiled on M* macOS 15.3.2)
  - Also tested on Tahoe
  - Intel Support removed
    - Apple transition to ARM64 Silicon “complete” June, 2023
    - Apple Intel hardware “Vintage” 2028; “Obsolete” 2030
    - Very few Apple Intel machines supported by macOS Tahoe
- Linux
  - RHEL 9 (compiled on RHEL 9.6)
  - Ubuntu 22 (compiled on Ubuntu 22.04)
  - RHEL 8 Removed
- Docker
  - Monolith Container Image
  - Lightweight Container Images

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Antelope 6.0 Interpreters







- *Qt 6.10.1* (*Big upgrade to stay current*)
- *Perl 5.42.0* (*Aiming to change each release, collision avoidance*)
- *TclTk 8.4.19* and *8.6.0* (*Same as previous Antelope versions. Dead language.*)
- *MATLAB R2024b* *(Other versions deliverable on request)*
- *Python 3.13.11* (*Aiming to change each release, collision avoidance*)
- *ObsPy* support preserved through ***install_obspy***(1) command

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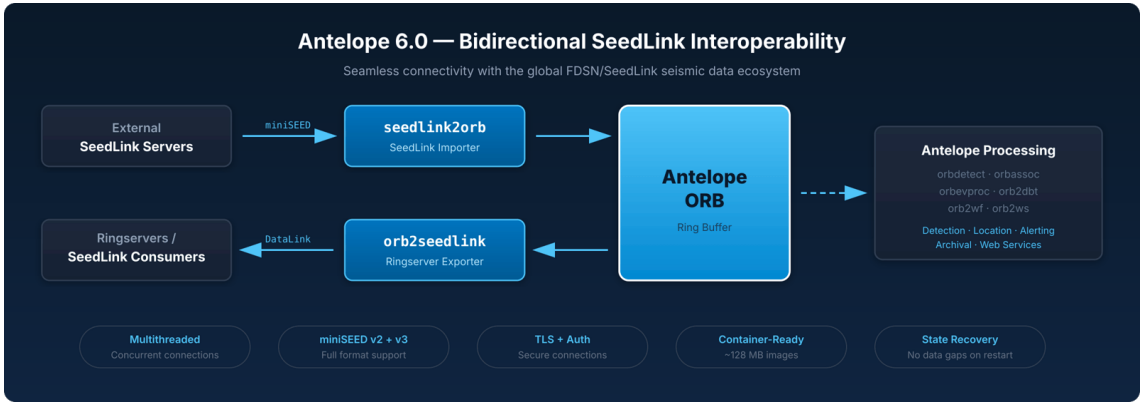
First-Class Kinemetrics Q8 Support

- ***q82orb*** and ***q8pocd***
- orb-based acquisition
- State-of-health monitoring
- ***dlcmd***-style command and control
- Built on ***orb2orb*** framework
- Supports Point-Of-Contact (POC) call-home capability to initiate acquisition from field install



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Bidirectional SeedLink Interoperability



- Commercial ***orb2seedlink*** and ***seedlink2orb***
- Fallback option when orb-protocol communications are not possible
- Threaded -- multi-source, multi-destination for single instances
- Based on Chad Trabant libraries, supports miniSEED *v3* (default), *v2* fallback
- SeedLink *v4* standardized 2024 by FDSN (*v3* also)
- Based on ***orb2orb*** framework libraries and models
- Handles all orb waveform packet types
- Tracks state

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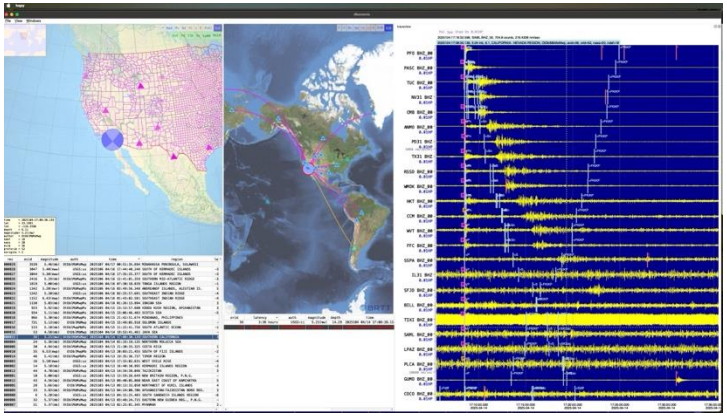
StationXML Round-Trip

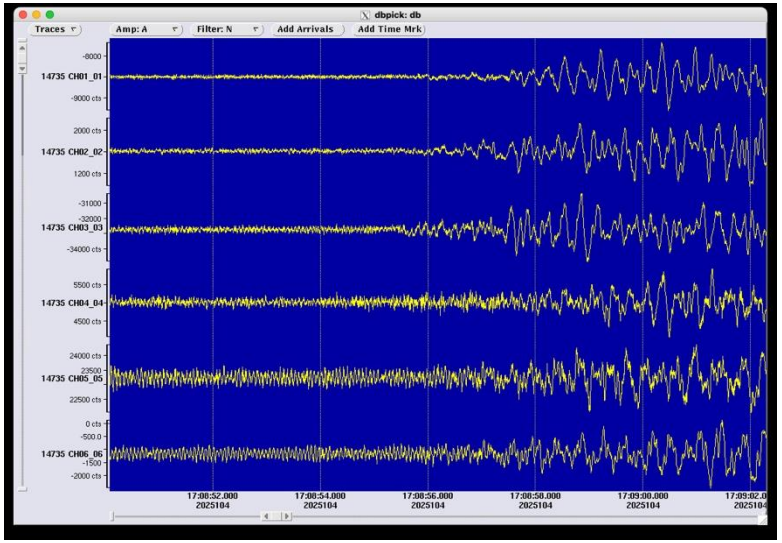
- New ***stationxml2db*** module
  - -- Tested on over 800 StationXML files
  - -- Takes FDSN Output directly
- ***db2stationxml*** fixed to take proper subset expressions
- ***db2stationxml*** extended to support more StationXML Features
- Full round-trip metadata handling works, miniSEED to CSS

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COSMOS V0 Format Support

- Read / Write support for COSMOS V0 Strong-Motion data format
- Integrated directly in Antelope trace library as a native format





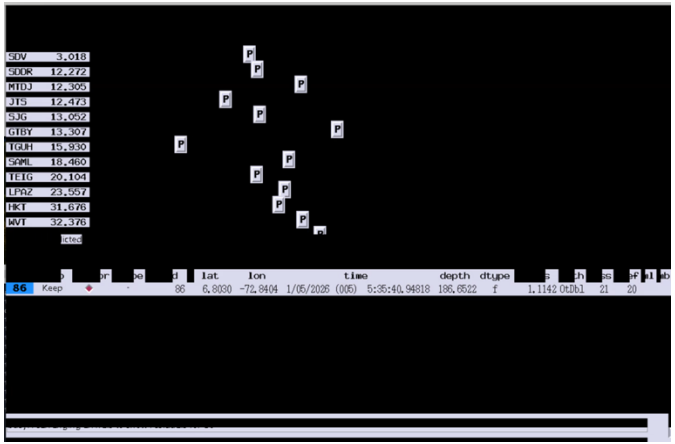
14 April 2025 5.2 Mw Julian, CA Event recorded at Long Beach Hospital with strong-motion instruments

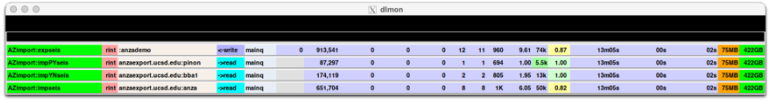
Imported into Antelope-based cloud test platform on GCP

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Major GUI Refresh: TCL/Tk to Python/Qt

- Finally time to remove all TCL/Tk and Perl/Tk from Antelope
- XQuartz on macOS last updated Jan 2023
- TCL/Tk retains 1990's look and feel, superceded by modern toolkits
- Numerous problems cropping up with Antelope programs, hard to fix







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The New rtm

- Entirely rewritten in Python/Qt
- Feature parity – plus
- Much improved CPU and Memory tracking (4 modes)
- Improved network ops panel

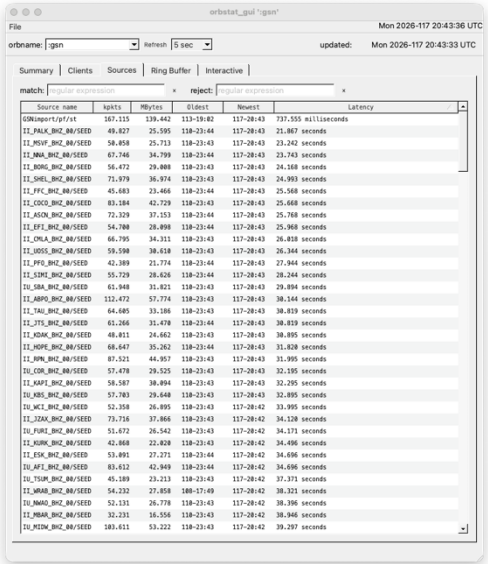




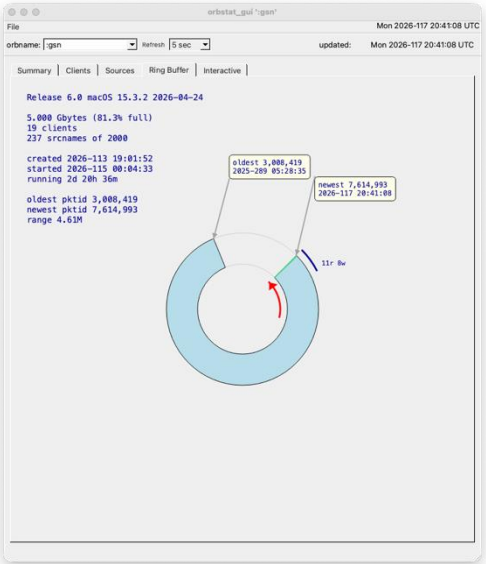
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The Updated orbstat_gui

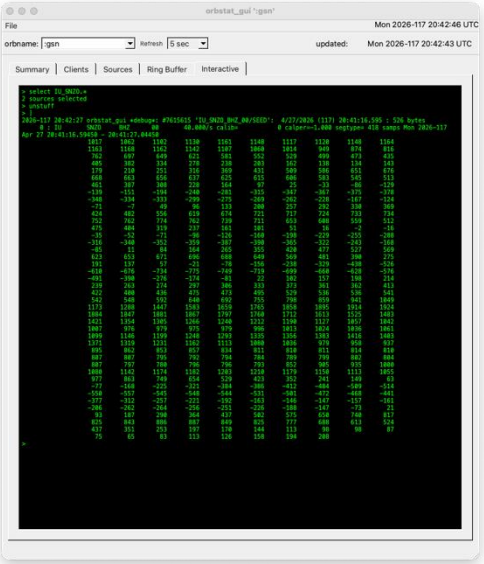
srcname regular expressions



Graphical view

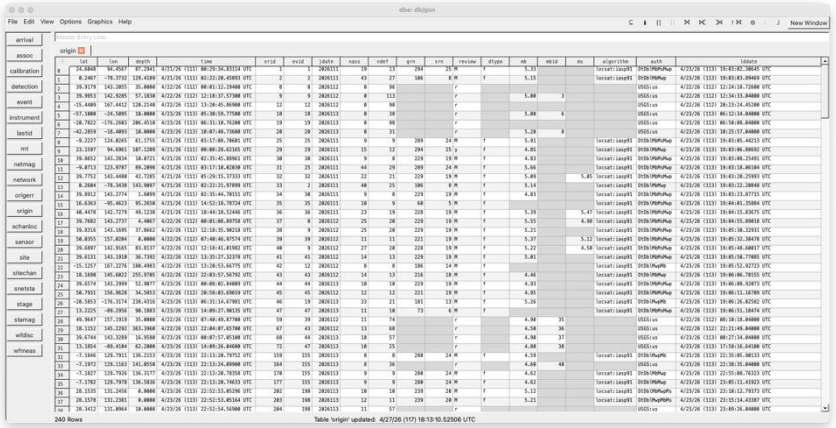


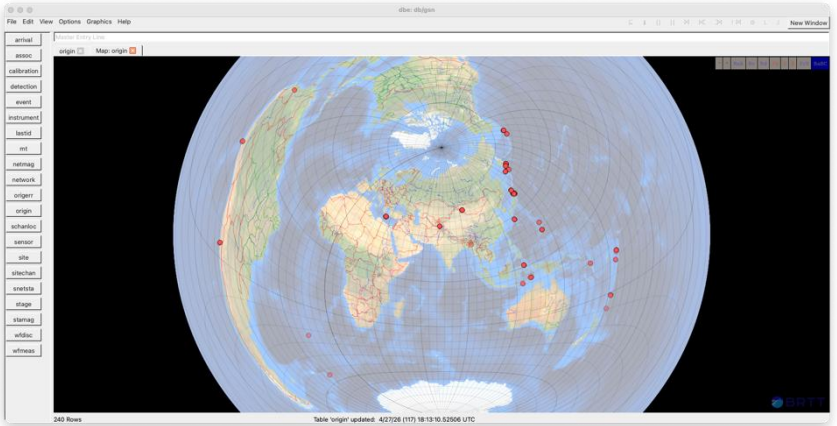
Interactive mode



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The Modernized dbe

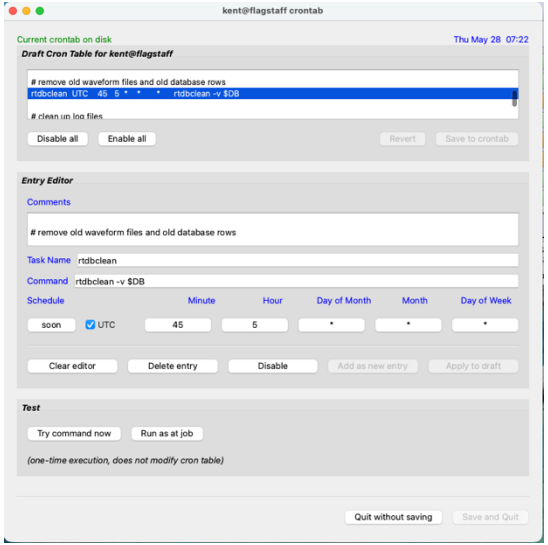


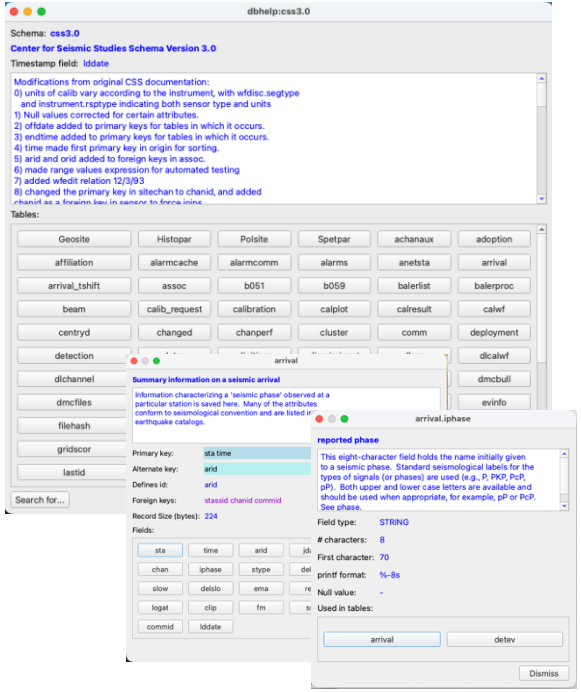


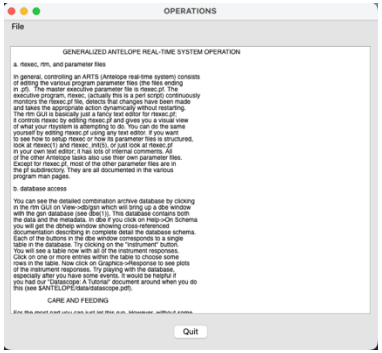
- Tables on left, tabs across top, modern database viewer pattern
- Station and origin maps show up in tabs
- Expression handling, bug fixes
- Thanks to Ludovico Manto for layout suggestion!

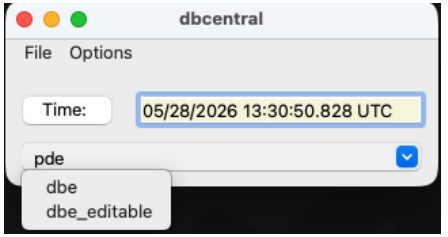
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ecrontab, showtext, dbcentral, dbhelp — Complete Rewrites









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Live macOS Dock Icon Previews

Live minimization icons for:

- rtm
- dbevents
- dbdisplaystations
- traceview
- rtd
- dlmon
- displayttgrid
- orbstat_gui





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Notable Bug Fixes in 6.0

- Memory leak fixes in Python interface that were affecting ***dbevents***
- Identification of GLIBC Malloc Arena problem on Linux affecting the ***orbserver*** under some high load conditions (one instance). Further manifestations of same phenomenon also
- Removal of an infinite reprocessing trap arising in ***orbassoc***
- ***orbassoc***, ***dbgrassoc***, and ***orbevassoc*** prevention of duplicate events when multiple origin-only solutions arrive by adding proximity matching in the smart associator
- Prevention of a thread deadlock in ***orb2orb*** under high load and some multi-connection configurations

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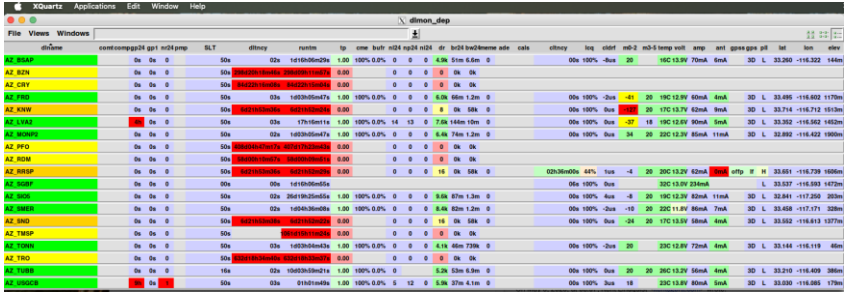
Antelope 6.0 Update 1

- Faster release cadence – mid-year non-breaking enhancements
- Update 1 released May 21, 2026 as ***patchA***
- Includes:
  - **--** *q82orb* subcode tagging
  - **--** *db2stationxml* performance improvements
  - -- ***dlmon*** Python/Qt port
  - -- ***dbbuild*** Python/Qt port
  - **-- *db2quakeml*** and ***quakeml2db***
  - **-- *trexcerpt*** C and Python API
  - -- ***fdsnserver***

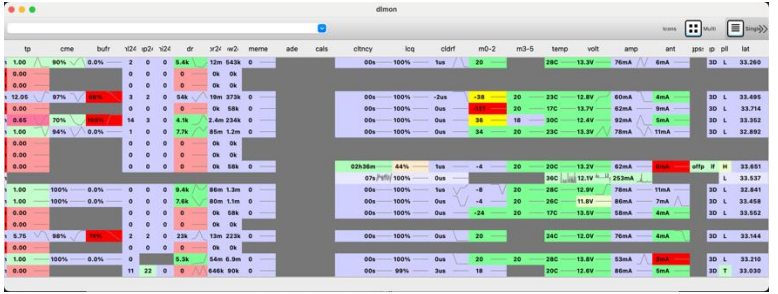
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dlmon Qt Port: Familiar Workflow, Modern Foundation

old



new



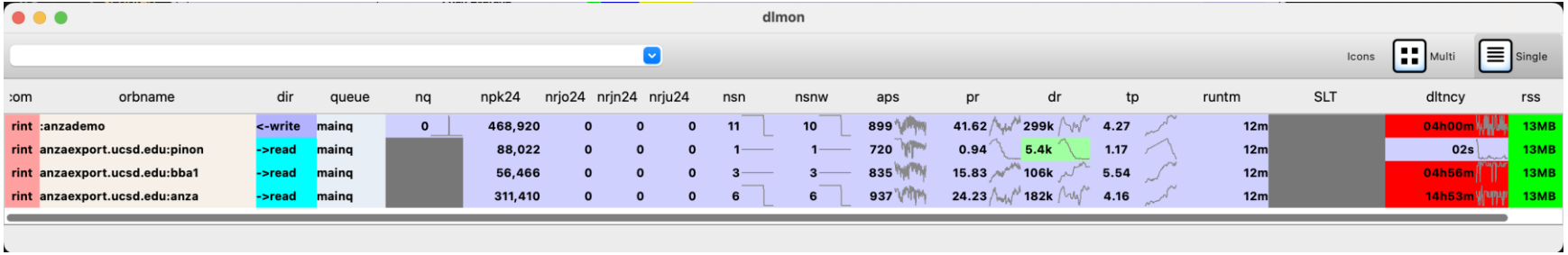
Dark mode

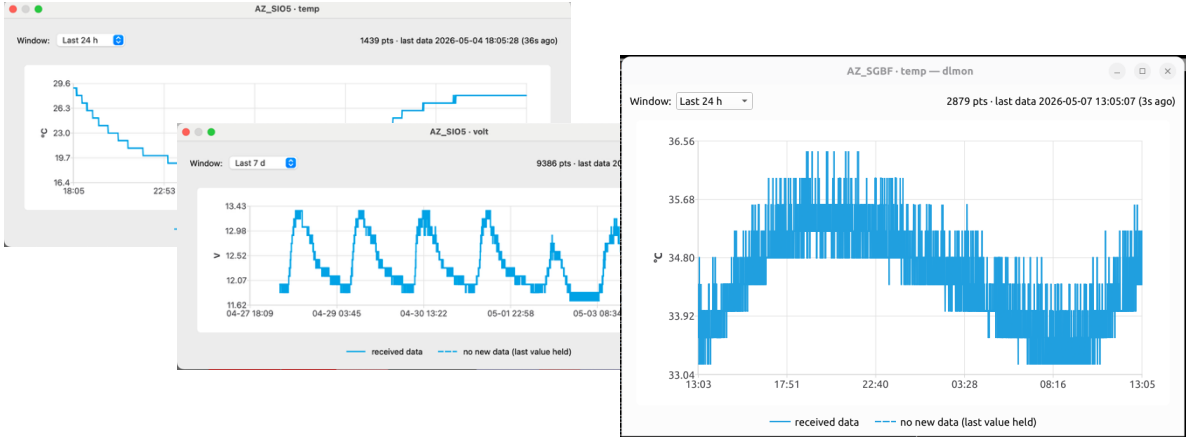


- Simplified parameter file
- Sort and color specs in modifiable Python module

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dlmon Per-Field Sparklines; Time-history returns





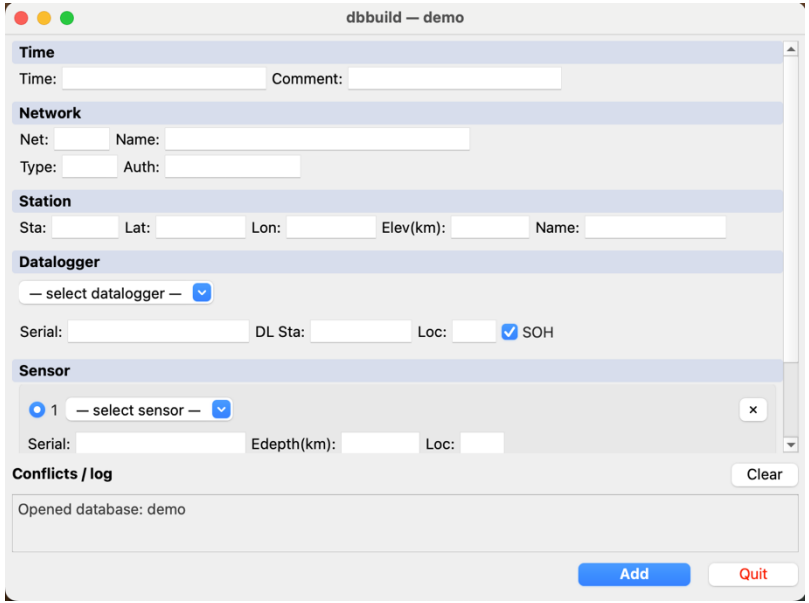
Most recent 10 minutes:

aps	pr	dr	tp
899	41.62	299k	4.27
720	0.94	5.4k	1.17
835	15.83	106k	5.54
937	24.23	182k	4.16

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dbbuild Qt Port

- Modernized look and feel
- 1:1 Conversion
- Original preserved as ***dbbuild_dep***



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QuakeML Round-Trip

- New ***db2quakeml*** and ***quakeml2db***
- QuakeML 1.2, CSS3.0, CSS3.1
- Full coverage of events, origins, uncertainties, network and station magnitudes, picks, arrivals, focal mechanisms, moment tensors
- Arbitrary Datascope subset expressions for selecting events
- More features – see the docs!
- New C++ library: ***libquakeml***, with Python bindings

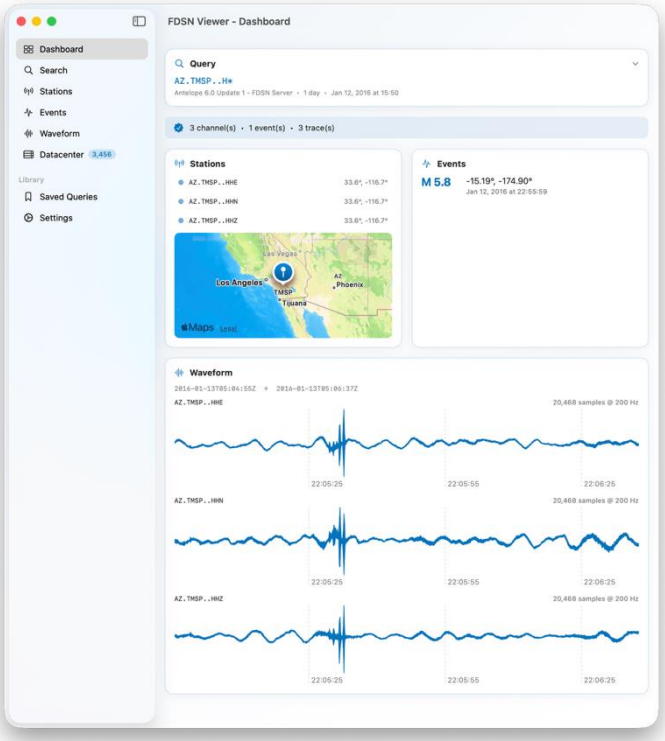
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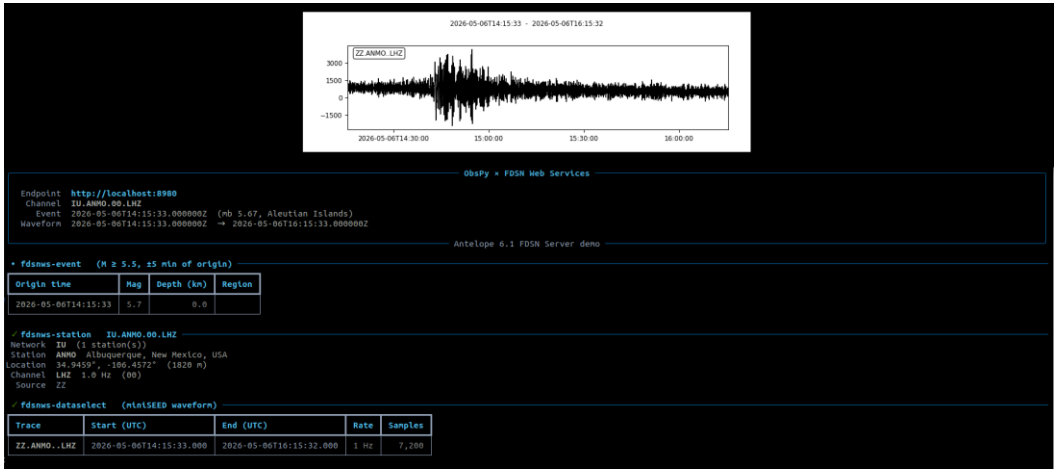
The New FDSN Web Services Server

- Headless FDSN web-services server ***fdsnserver***
- Supports all five services: *event*, *station*, *dataselect*, *availability*, *routing*
- Outputs
  - *-- QuakeML, plain text, CSV, GeoJSON, KML (event);*
  - *-- StationXML, plain text, GeoCSV (station);*
  - *-- plain text, JSON, GeoCSV (availability)*
- Authentication: JWT Bearer tokens, EIDA PGP, HTTP basic
- Per-channel restrictions; Live config reload
- Browser friendly; CORS headers
- Built-in interactive HTML query builder
- Optional Prometheus endpoint
- ***dbcentral*** database-clusters support

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The New FDSN Web Services Server





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Built-in HTML Query Builders

fdsnws-dataselect query builder

GET /fdsnws/dataselect/1/query

Network / Station / Location / Channel

network
PB,CI
Network codes; comma-separated, fnmatch wildcards

station
B081,*
Station codes; comma-separated

location
--,??
Location codes; use -- for blank location

channel
HH?,BH*
Channel codes; fnmatch wildcards

Time

starttime
2024-01-01T00:00:00
Start of requested time window (UTC ISO 8601)

endtime
2024-01-01T01:00:00
End of requested time window (UTC ISO 8601)

Quality & Options

quality
* (default)
Waveform quality indicator

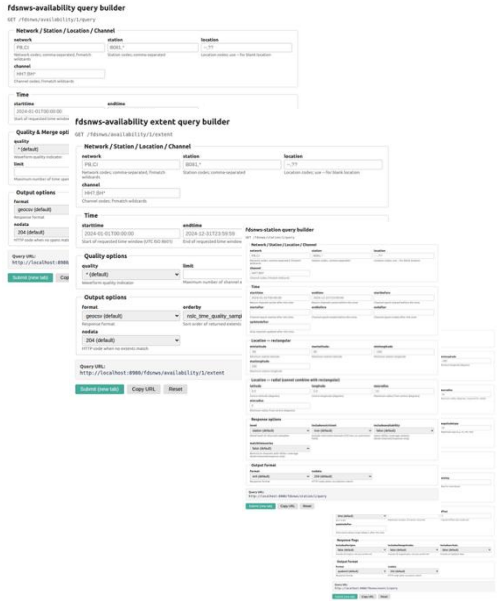
minimumlength
0.0
Minimum segment length in seconds

longestonly
false (default)
Return only the longest segment per channel

nodata
204 (default)
HTTP code when no data matches

Query URL:
`http://localhost:8980/fdsnws/dataselect/1/query`

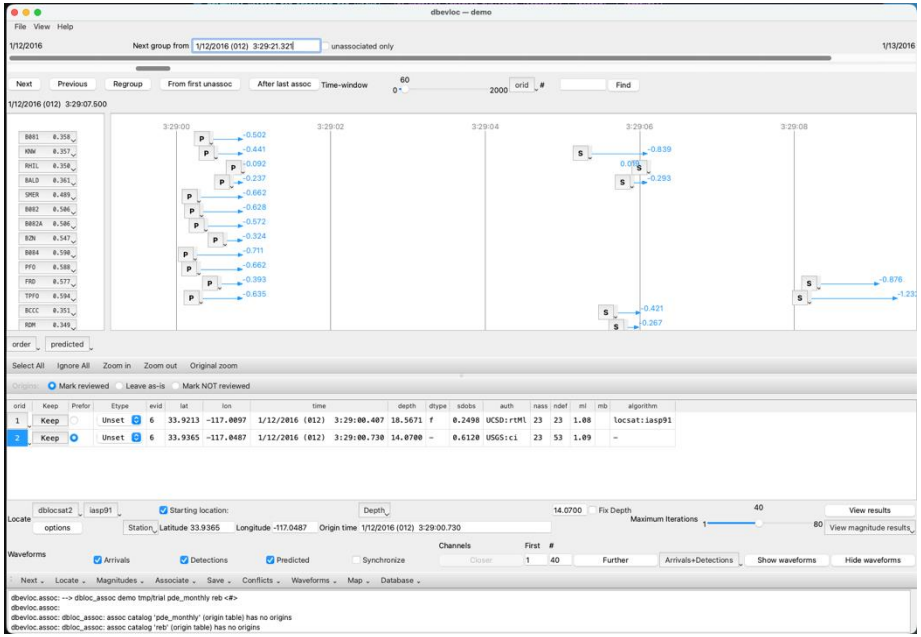
Submit (new tab) | Copy URL | Reset

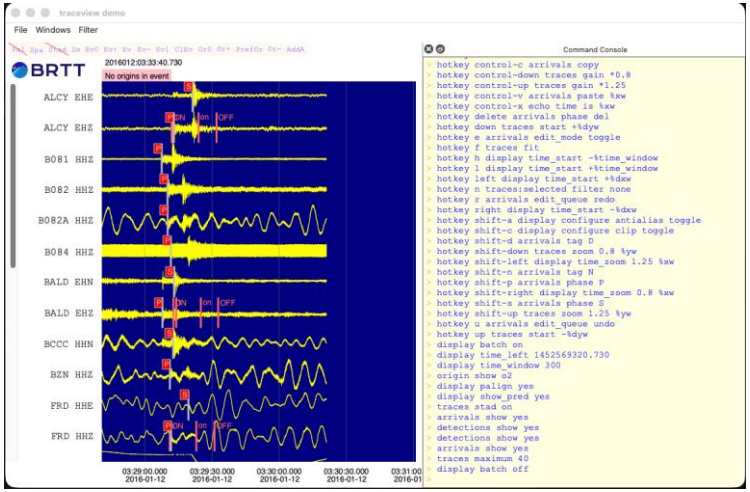


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What's Next After Update 1

dbevloc





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Coming Development Year

- Full press on Antelope Cloud and Containers Platform

Antelope is the product it is today because of our users, your needs and feedback.

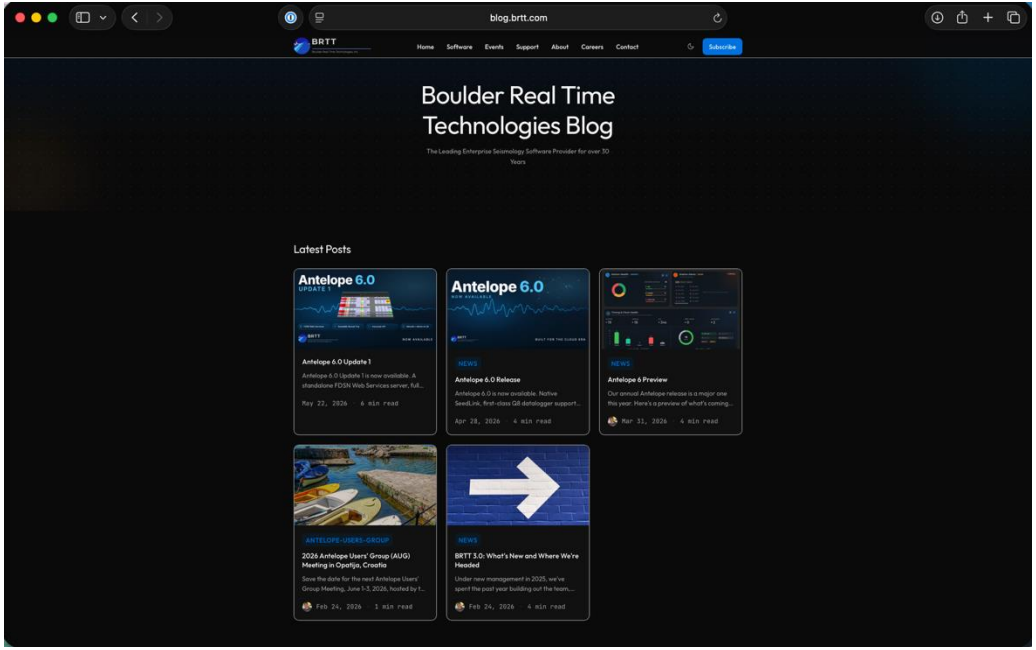
We look forward to continuing to support you.

Bring us your ideas!

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Sign up for our new blog!

https://blog.brtt.com



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Obtaining Antelope 6.0 and Update 1

- Evaluation copies, subscriptions or upgrades to Antelope 6.0:
  - Contact Kinemetrics, Inc.:
    - ***sales@kmi.com***
- Antelope 6.0 Update 1 installs with 6.0, or *patchA* with *antelope_update*
- Technical questions about Antelope:
  - Contact BRTT:
    - ***support@brtt.com***

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Thank You

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