



LASSO and MUSTANG:

How to access web services for station
diagnostics

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LASSO/MUSTANG

- What is MUSTANG?
 - Data quality metrics web service
 - Produces variety of metrics for data at DMC
 - <http://service.iris.edu/mustang>
- What is LASSO?
 - Tool for accessing/analyzing data quality metrics
 - Runs entirely within web-browser
 - <http://lasso.iris.edu>



MUSTANG Homepage

IRIS DMC Web Services

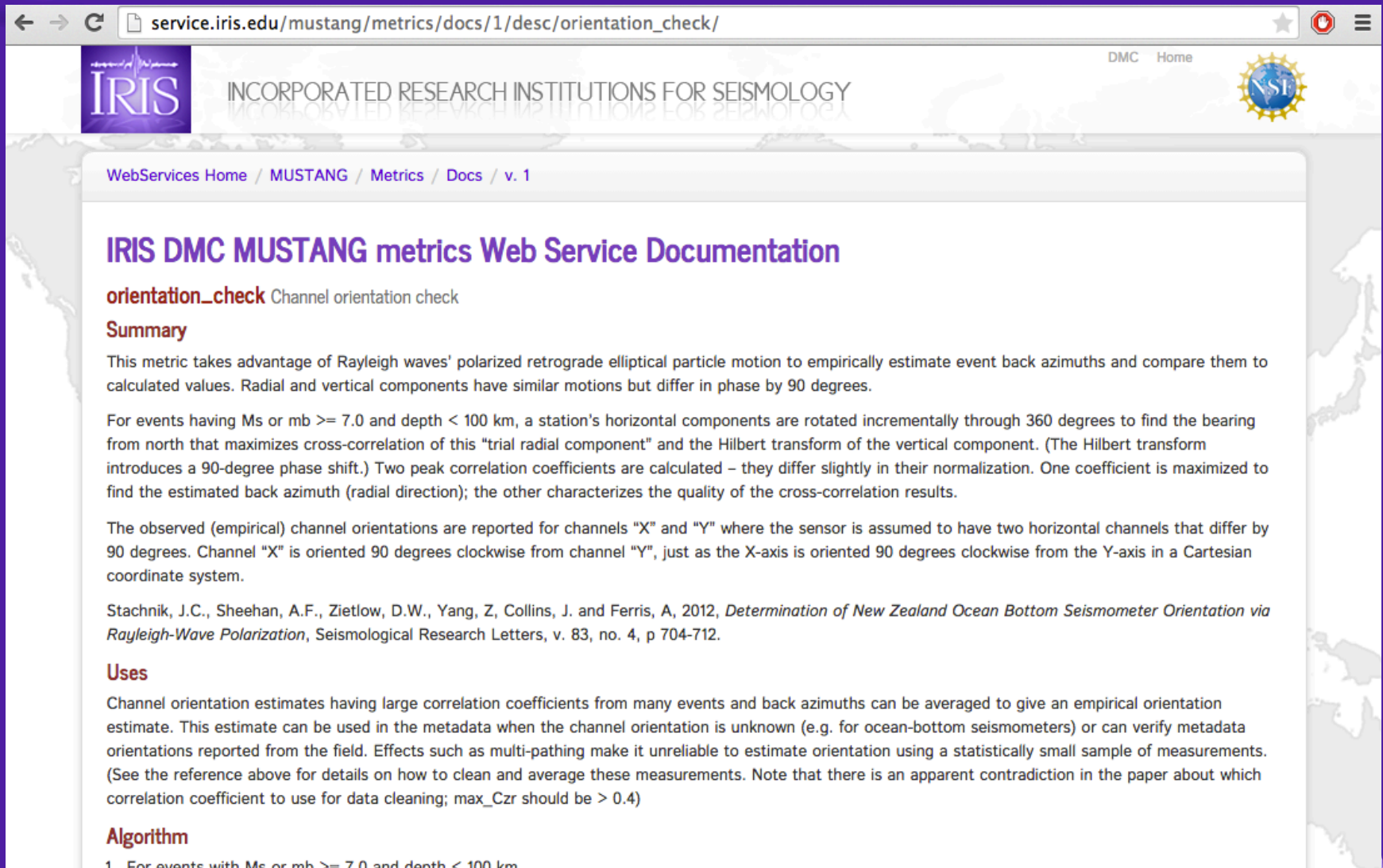
Services implementation: **MUSTANG**

Request tools

Service interface	Version	Summary	Return options
measurements	v.1	The main MUSTANG web service returning measurements for metrics relating to station data quality.	<ul style="list-style-type: none">• XML (default)• text• CSV• JSON• JSONP
noise-psd	v.1	Returns Power Spectral Density estimates of seismic data and can generate aggregate plots.	<ul style="list-style-type: none">• Text – CSV• XML• Plot (PNG)
noise-pdf	v.1	Returns Probability Density Functions in frequency `bins` and can generate aggregate plots.	<ul style="list-style-type: none">• Text – CSV• XML• Plot (PNG)
noise-mode-timeseries	v.1	Returns PDF Mode Timelines at select frequencies and can generate plots.	<ul style="list-style-type: none">• Text – CSV• XML• Plot (PNG)
metrics	v.1	The metrics web service returns a description of available metrics in a variety of formats	<ul style="list-style-type: none">• XML• HTML• XSD• JSON• JSONP
targets	v.1	The targets web service returns a list of stations and channels for a given metric.	<ul style="list-style-type: none">• Text



Product Documentation



The screenshot shows a web browser window with the address bar displaying `service.iris.edu/mustang/metrics/docs/1/desc/orientation_check/`. The page header includes the IRIS logo, the text "INCORPORATED RESEARCH INSTITUTIONS FOR SEISMOLOGY", and a "DMC Home" link. A breadcrumb trail reads "WebServices Home / MUSTANG / Metrics / Docs / v. 1". The main heading is "IRIS DMC MUSTANG metrics Web Service Documentation". Below this, the section "orientation_check" is described as a "Channel orientation check". A "Summary" section explains that the metric uses Rayleigh waves' polarized retrograde elliptical particle motion to estimate event back azimuths. It notes that for events with M_s or $m_b \geq 7.0$ and depth < 100 km, a station's horizontal components are rotated incrementally through 360 degrees to find the bearing from north that maximizes cross-correlation of this "trial radial component" and the Hilbert transform of the vertical component. Two peak correlation coefficients are calculated, differing slightly in their normalization. One coefficient is maximized to find the estimated back azimuth (radial direction); the other characterizes the quality of the cross-correlation results. A paragraph states that observed (empirical) channel orientations are reported for channels "X" and "Y" where the sensor is assumed to have two horizontal channels that differ by 90 degrees. Channel "X" is oriented 90 degrees clockwise from channel "Y", just as the X-axis is oriented 90 degrees clockwise from the Y-axis in a Cartesian coordinate system. A reference is provided: Stachnik, J.C., Sheehan, A.F., Zietlow, D.W., Yang, Z, Collins, J. and Ferris, A, 2012, *Determination of New Zealand Ocean Bottom Seismometer Orientation via Rayleigh-Wave Polarization*, Seismological Research Letters, v. 83, no. 4, p 704-712. A "Uses" section states that channel orientation estimates having large correlation coefficients from many events and back azimuths can be averaged to give an empirical orientation estimate. This estimate can be used in the metadata when the channel orientation is unknown (e.g. for ocean-bottom seismometers) or can verify metadata orientations reported from the field. Effects such as multi-pathing make it unreliable to estimate orientation using a statistically small sample of measurements. (See the reference above for details on how to clean and average these measurements. Note that there is an apparent contradiction in the paper about which correlation coefficient to use for data cleaning; `max_Czr` should be > 0.4). An "Algorithm" section begins with the first step: "1. For events with M_s or $m_b \geq 7.0$ and depth ≤ 100 km".



URL Builder

URL Builder: noise-psd v.1


Service interface URL builder Help Revisions

Use this form to build a URL to the **noise-psd** web service. Notice that as you edit the form, the link is automatically updated.

Usage

Targets


SNCLQ filter or Target? ☒ Filter ☐ Target

Network: 

Station:

Location:

Channel:

Quality: 

Output

Response ☒

Correction:

Format:

☒ XML (default)
☐ Text
☐ Plot

Temporal Constraints

Parameter: ☒ Start/end ☐ Time

Start time: 

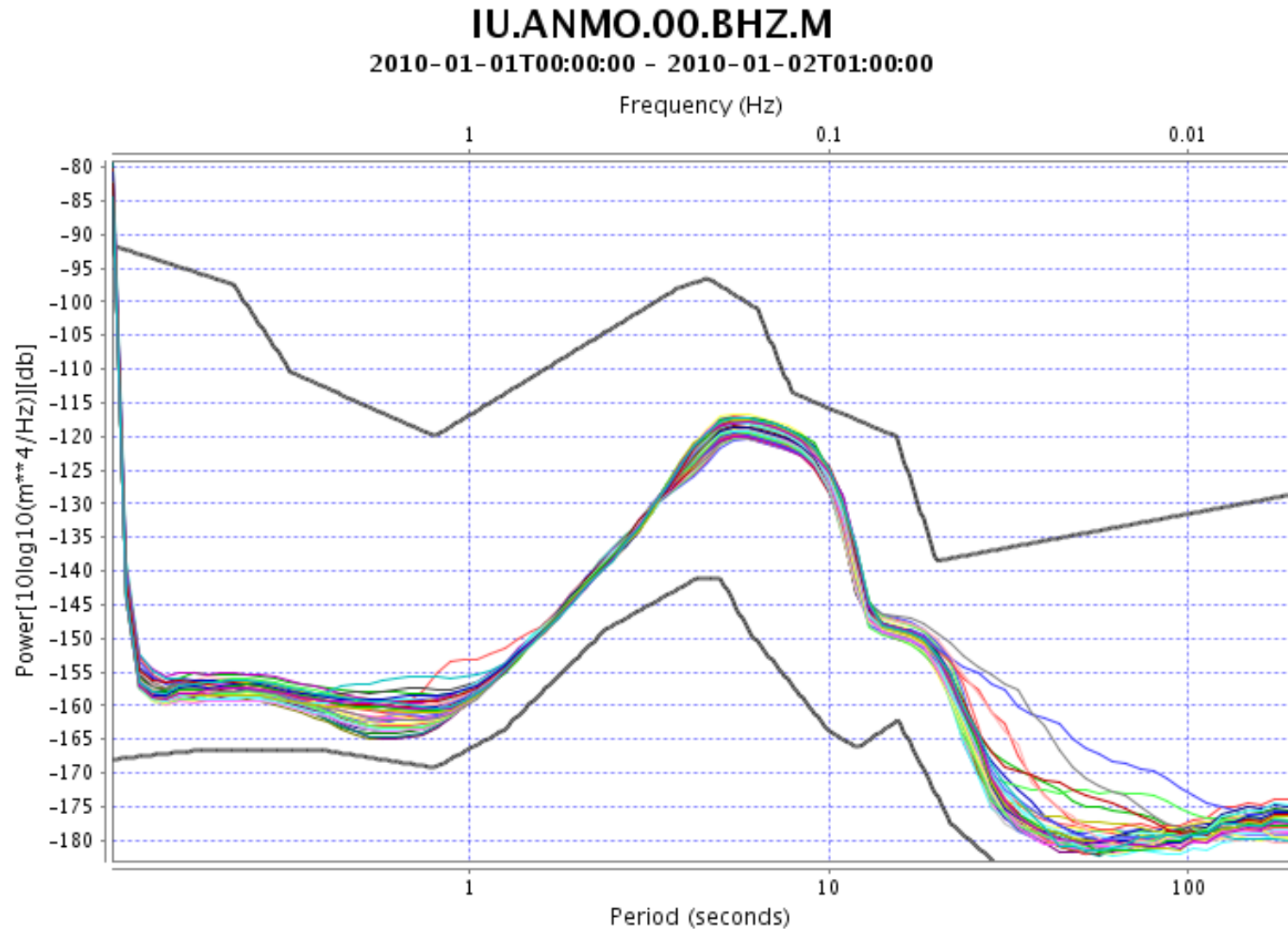
End Time: 

Click the link:

<http://service.iris.edu/mustang/noise-psd/1/query?net=IU&sta=ANMO&loc=00&cha=BHZ&quality=M&starttime=2010-01-01T00:00:00&endtime=2010-01-02T00:00:00&correct=true&format=xml>



Noise-PSD Quick Plot





Noise-Mode-Timeseries

URL Builder: noise-mode-timeseries v.1

Service interface URL builder Help Revisions

Use this form to build a URL to the **noise-mode-timeseries** web service. Notice that as you edit the form, the link is automatically updated.

? Usage

Targets

SNCLQ filter or Target? ☒ Filter ☐ Target

Network: IU

Station: ANMO

Location: 00

Channel: BHZ

Quality: M

Date Range:

Start time: 2014-04-01

End Time: 2014-04-07

Output

Format:

✓ XML
Text
Plot

Frequency Options

☒ Auto

☐ Frequencies:

0.1,0.01

Hz

☐ Periods:

10,100

sec

Click the link:

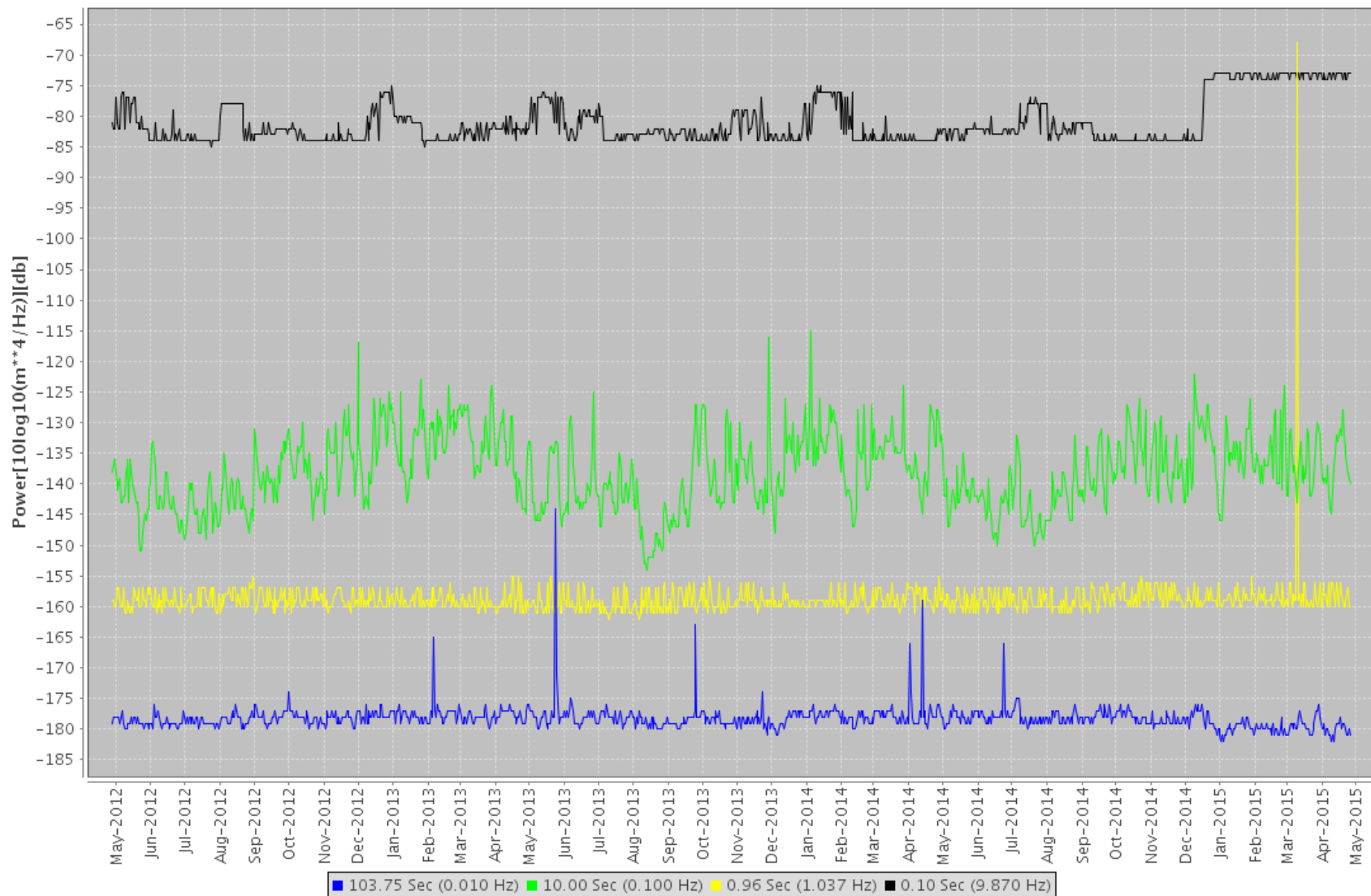
<http://service.iris.edu/mustang/noise-mode-timeseries/1/query?net=IU&sta=ANMO&loc=00&cha=BHZ&quality=M&starttime=2014-04-01&endtime=2014-04-07&format=xml&nodata=404>



Mode Quick Plot

Daily PDF Mode Timelines

IU.ANMO.00.BHZ.M: 2012-04-28 to 2015-04-27

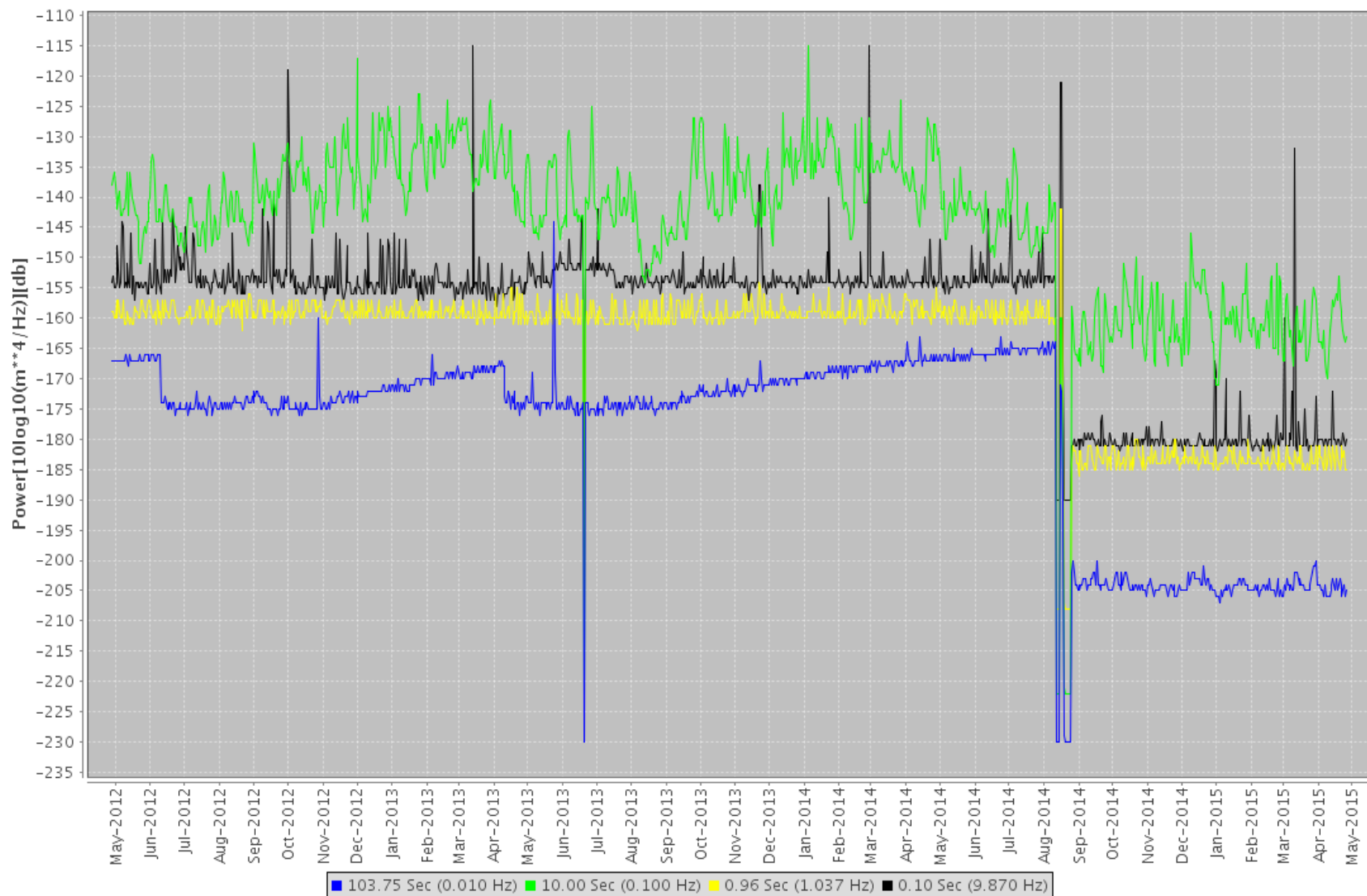




Mode Quick Plot

Daily PDF Mode Timelines

IU.ANMO.10.BHZ.M: 2012-04-28 to 2015-04-27





MUSTANG Data Browser

MUSTANG databrowser

IRIS DMC

? Plot Type and Metric

Plot Type

PDF Plot

Metric

No Plot Options for PDF plots

? Data Source and Timespan

Network - Station - Location - Channel

IU

ANMO

00

BHZ

Time Span

Start: 2015-03-01

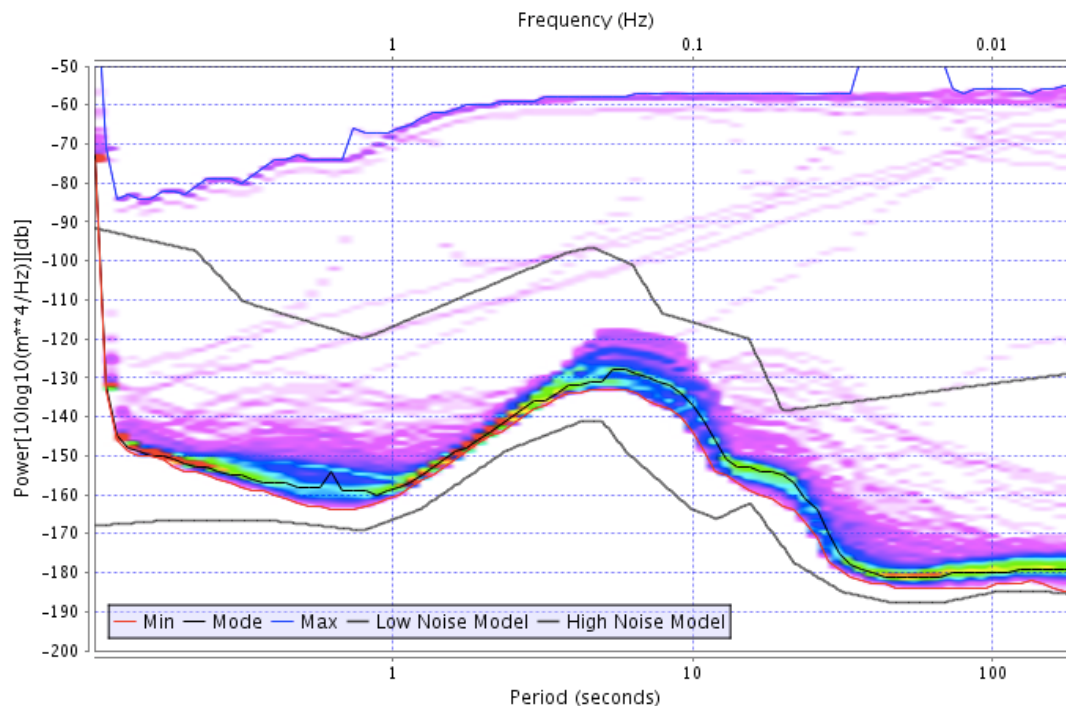
End: 2015-03-15

Access Speed (sec): data load=0.00, plot=11.03, R total=11.03

[data URL](#)

IU.ANMO.00.BHZ.M

2015-03-01T00:00:00 - 2015-03-13T23:59:59





LASSO Homepage

Latest Assessment of Seismic Station Observations (LASSO)

[Basic](#)[Advanced](#)[About](#)

View groups of MUSTANG metrics designed to examine specific aspects of a seismic station's performance. Groupings focus on seismometer component channels and are available by Virtual Network.

Virtual Network: Global Seismographic Network stations and arrays

View: Metric quality assessment groupings

Metric(s):

Location(s): Specify seismometer location code(s) per station

Ranking: ☒ Qualitative ☐ Quantitative

Table Type: ☒ Snapshot ☐ Mean for Period ☐ Median for Period

Time:  Display metrics closest to this date and time

Show Counts: ☐





LASSO Homepage

View groups of MUSTANG metrics designed to examine specific aspects of a seismic station's performance. Groupings focus on seismometer component channels and are available by Virtual Network.

Virtual Network: Global Seismographic Network stations and arrays

View: ☒ Mass Positions ☐ Metric quality assessment groupings

Metric(s):

- ☒ Mass Positions
- ☐ Noise Power
- ☐ Signal Quality
- ☐ Time Series Integrity
- ☐ Metadata Validity

Location(s): Specify seismometer location code(s) per station

Ranking: ☒ Qualitative ☐ Quantitative

Table Type: ☒ Snapshot ☐ Mean for Period ☐ Median for Period

Time:  Display metrics closest to this date and time

Show Counts: ☐

[Get Measurements](#)



Metric Quality Assessment Groups

- Mass Positions
 - Displayed in volts/day
- Noise Power
 - Displays 6 periods commonly of interest per day
 - Mode of PDF shown for 0.101s, 0.964s, 6.484s, 10.905s, 30.844s, and 103.747s



Metric Quality Assessment Groups

- Signal Quality
 - Grouping provides insight into quality of waveform recordings for a given day
 - Shows daily root-mean-square (RMS) variance of a time series
 - Shows daily ratio of the RMS variance calculated from teleseismic earthquakes
 - Shows % of PDFs in a day exceeding the Peterson(1993) high noise model



Metric Quality Assessment Groups

- Time Series Integrity
 - Grouping provides a sense of robustness of the archived data stream
 - Shows count for data gaps
 - Shows count for data overlaps
 - Shows % of data available during period requested
 - Shows length of largest gap (in seconds)



Metric Quality Assessment Groups

- Metadata Validity
 - Provides info on the timing quality of the seismic channels and whether calibration pulse is present
 - Shows if timing is questionable because clock has not obtained a lock since system power up
 - Daily avg timing quality based on accuracy of datalogger clock relative to GPS clock
 - Shows whether a timing correction has been applied



LASSO Fetching Results

Get Measurements

Disclaimer: Please note that metrics are still being developed for [MUSTANG](#) and back-populated for the entire IRIS archive. Most metrics for many major permanent networks are complete for the last several years, and gaps in metric coverage are being filled. [Metric](#) and [network](#) coverage reports are periodically updated. Channel labeling conventions are available through [IRIS Data Services](#) and Appendix A of the [SEED manual](#).

Time Series Integrity view of _GSN for 2013-07-01T00:00:00 thru 2013-09-29T00:00:00 requested at Thu Apr 23 2015 10:17:02 GMT-0600 (MDT):

Show entries

Search:

Target	Rank <input type="button" value="Weights"/>	num_gaps	Count	num_overlaps	Count	percent_availability <input type="button" value="Performance"/> <input type="button" value="Rule"/>	Count	max_gap	Count
		<input type="button" value="Performance"/> <input type="button" value="Rule"/>		<input type="button" value="Performance"/> <input type="button" value="Rule"/>				<input type="button" value="Performance"/> <input type="button" value="Rule"/>	
AU.MCQ..BHZ.M <input type="button" value="Data"/>	100.00	0.06	86/88	0.00	88/88	99.99	88/88	11.25	86/88
BK.CMB.00.BHZ.M <input type="button" value="Data"/>	100.00	0.01	86/87	0.00	87/87	99.98	87/87	13.80	86/87

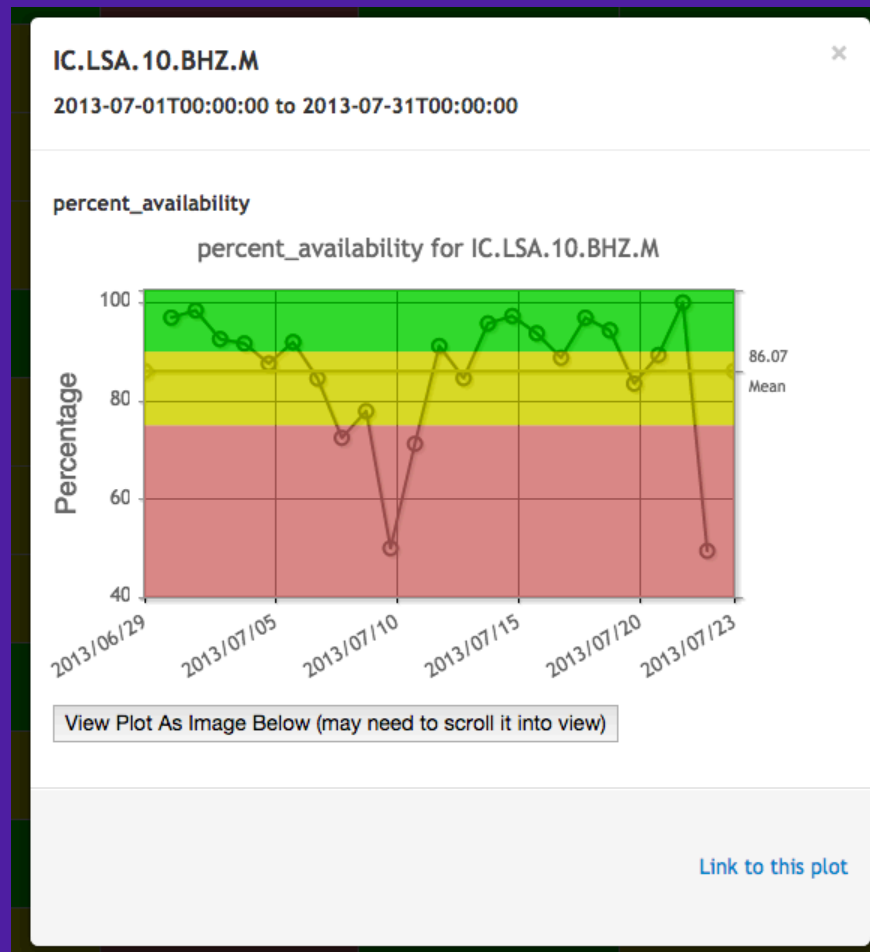


Time Series Integrity Results

Target	Rank Weights	num_gaps ? Performance Rule Count	num_overlaps ? Performance Rule Count	percent_availability ? Performance Rule Count	max_gap ? Performance Rule Count
AU.MCQ.00.BHZ.M Data	100.00	0.06 86/88	0.00 88/88	99.99 88/88	11.25 86/88
BK.CMB.00.BHZ.M Data	100.00	0.01 86/87	0.00 87/87	99.98 87/87	13.80 86/87
CI.PASC.00.BHZ.M Data	100.00	0.11 78/87	0.15 74/87	98.86 87/88	0.86 86/87
CI.PASC.10.BHZ.M Data	100.00	0.03 85/88	0.14 76/88	100.00 88/88	0.49 87/88
CU.ANWB.00.BHZ.M Data	100.00	0.00 88/88	0.00 88/88	100.00 88/88	0.00 88/88
CU.BBGH.00.BHZ.M Data	75.00	0.09 86/88	0.01 87/88	99.87 88/88	85.99 86/88
CU.BCIP.00.BHZ.M Data	100.00	0.00 88/88	0.00 88/88	100.00 88/88	0.00 88/88
CU.GRGR.00.BHZ.M Data	87.50	0.01 87/88	0.03 85/88	99.96 88/88	35.23 87/88
CU.GRTK.00.BHZ.M Data	62.50	0.23 70/80	0.01 79/80	84.15 70/88	4724.87 70/80
CU.GTBY.00.BHZ.M Data	75.00	0.07 86/88	0.01 87/88	99.90 88/88	71.04 86/88



Quick Plot of Metric Variance





User-defined Performance Criteria

Show	All	num_gaps Rules	num_overlaps Rules	num_overla	percent_availability Rules	max_gap Rules	max_gap	Count
		<div>bad >= -Infinity</div> <div>good >= 0</div> <div>fair >= 1</div> <div>bad >= 5</div> <div>Edit</div>	<div>bad >= -Infinity</div> <div>good >= 0</div> <div>fair >= 1</div> <div>bad >= 5</div> <div>Edit</div>	<div>?</div> <div>Performance</div> <div>Rule</div>	<div>bad >= 0</div> <div>fair >= 75</div> <div>good >= 90</div> <div>Edit</div>	<div>bad >= -Infinity</div> <div>good >= 0</div> <div>fair >= 30</div> <div>bad >= 60</div> <div>Edit</div>	<div>?</div> <div>Performance</div> <div>Rule</div>	
Target								
AU.MCQ.B							11.25	86/88
BK.CMB.00							13.80	86/87
CI.PASC.00.BHZ.M	Data	100.00	0.11	78/87	0.15	74/87	98.86	87/88
CI.PASC.10.BHZ.M	Data	100.00	0.03	85/88	0.14	76/88	100.00	88/88
CU.ANWB.00.BHZ.M	Data	100.00	0.00	88/88	0.00	88/88	100.00	88/88
CU.BBGH.00.BHZ.M	Data	75.00	0.09	86/88	0.01	87/88	99.87	88/88
CU.BCIP.00.BHZ.M	Data	100.00	0.00	88/88	0.00	88/88	100.00	88/88
CU.GRGR.00.BHZ.M		87.50	0.01	87/88	0.03	85/88	99.96	88/88



LASSO Advanced View

Latest Assessment of Seismic Station Observations (LASSO)

[Basic](#)[Advanced](#)[About](#)

Create a customized view of MUSTANG metrics, with the ability tune the parameters used to assemble the network-station-channel-metric display.

Metric(s):

data_latency
dc_offset
dead_channel_exp
digital_filter_charging
digitizer_clipping
event_begin
event_end
event_in_progress
feed_latency
glitches
max_gap
max_overlap
max_stalta
missing_padded_data
num_gaps
num_overlaps
num_spikes
orientation_check
pct_above_nhnm
pct_below_nlnm
percent_availability
polarity_check
pressure_effects
sample_max
sample_mean
sample_median
sample_min
sample_rms
sample_snr
spikes
station_completeness
suspect_time_tag
telemetry_sync_error
timing_correction

☒ Metrics ☐ Derived Metrics

Click to select metric(s) to display.

Contract metric list

Hold [control] (PC) or [command] (Apple) to make multiple selections or hold [shift] (any platform) to select





LASSO Advanced View

Latest Assessment of Seismic Station Observations (LASSO)

[Basic](#)[Advanced](#)[About](#)

Create a customized view of MUSTANG metrics, with the ability tune the parameters used to assemble the network-station-channel-metric display.

Metric(s):

data_latency
dc_offset
dead_channel_exp
digital_filter_charging
elimination_time

☒ Metrics ☐ Derived Metrics
Click to select metric(s) to display.

Expand metric list

Hold [control] (PC) or [command] (Apple) to make multiple selections or hold [shift] (any platform) to select metrics en masse.

Specify: ☒ By Network and Station ☐ By Virtual Network

Network(s):

BK

Enter "*" for all or use single network code, e.g. "II".

"*" not recommended due to size of potential return

Station(s):

CMB

Enter "*" for all or station code, e.g. "BORG".

Location(s):

00

Enter "*" or location code, e.g. "00".

Channel(s):

BHZ

Enter "*" or wildcard with "?", e.g. "VM?".

Quality:

M

Enter "*" for all; "M" is highly recommend.

Ranking:

☐ Qualitative ☒ Quantitative

Table Type:

☐ Snapshot ☒ Mean for Period ☐ Median for Period

Start Time:

Set to ▾

2013-07-01 00:00:00

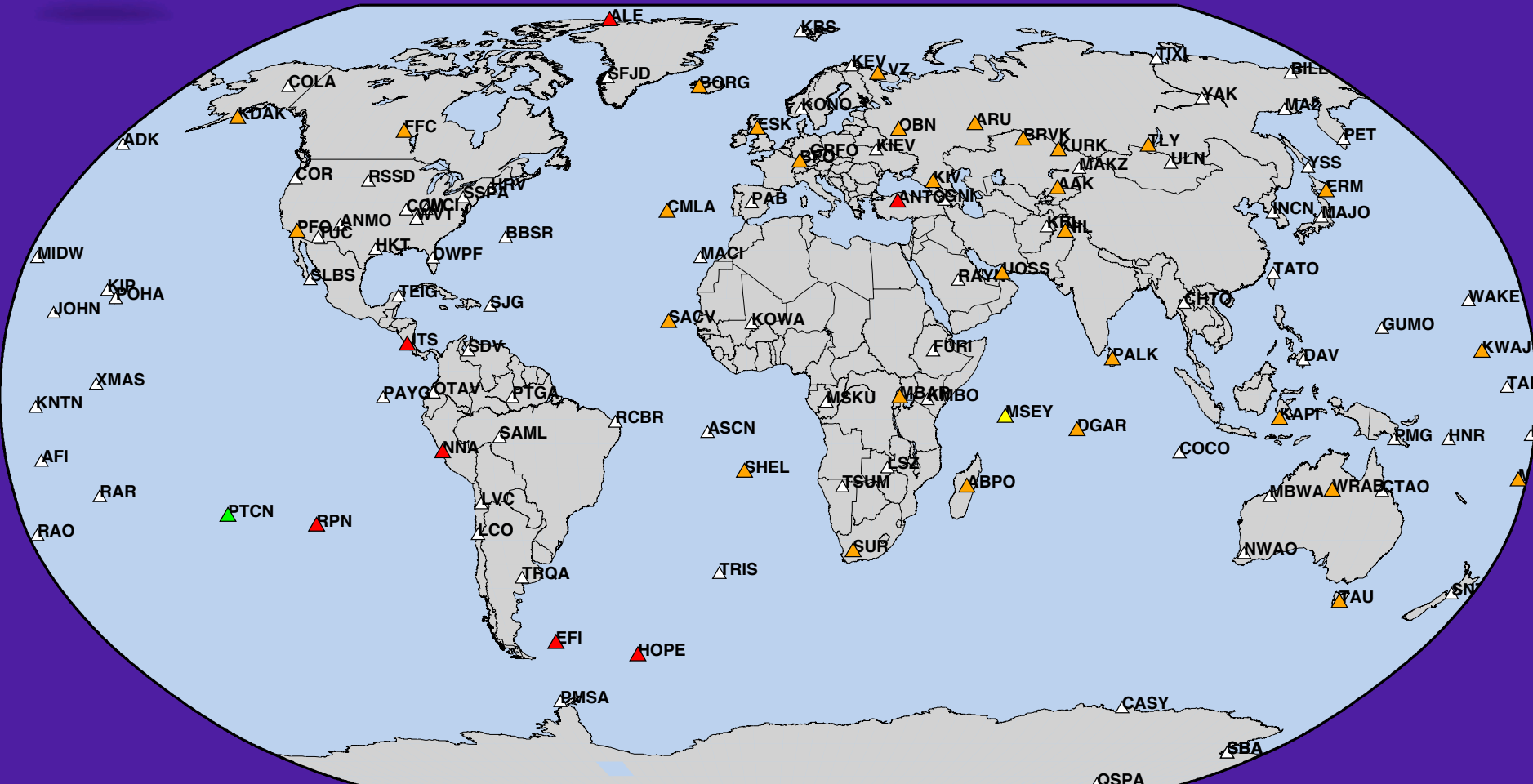


Start of metric averaging time window





Example: Timing Quality



66% of stations are between 90-100% timing quality
Estimates are based on time since last GPS lock



Command Line Queries

- MUSTANG products can be pulled directly via correctly-formatted URLs
- Allows users to access MUSTANG metrics from within personal scripts/codes



Command Line Queries

grab_pdf_all_GSN.bash — Edited

```
#!/bin/bash
#
home=`pwd`

START="2013-01-01"; END="2015-01-01"

curl "http://service.iris.edu/fdsnws/station/1/query?net=_GSN-BROADBAND&sta=*&loc=00,10,--&cha=BH?&starttime=${START}T00:00:00&endtime=${END}T00:00:00&level=channel&format=text&nodata=404" > temp
tail +2 temp > GSN.txt; rm temp

if [ ! -d "PDFPSD" ]; then
    mkdir PDFPSD
fi

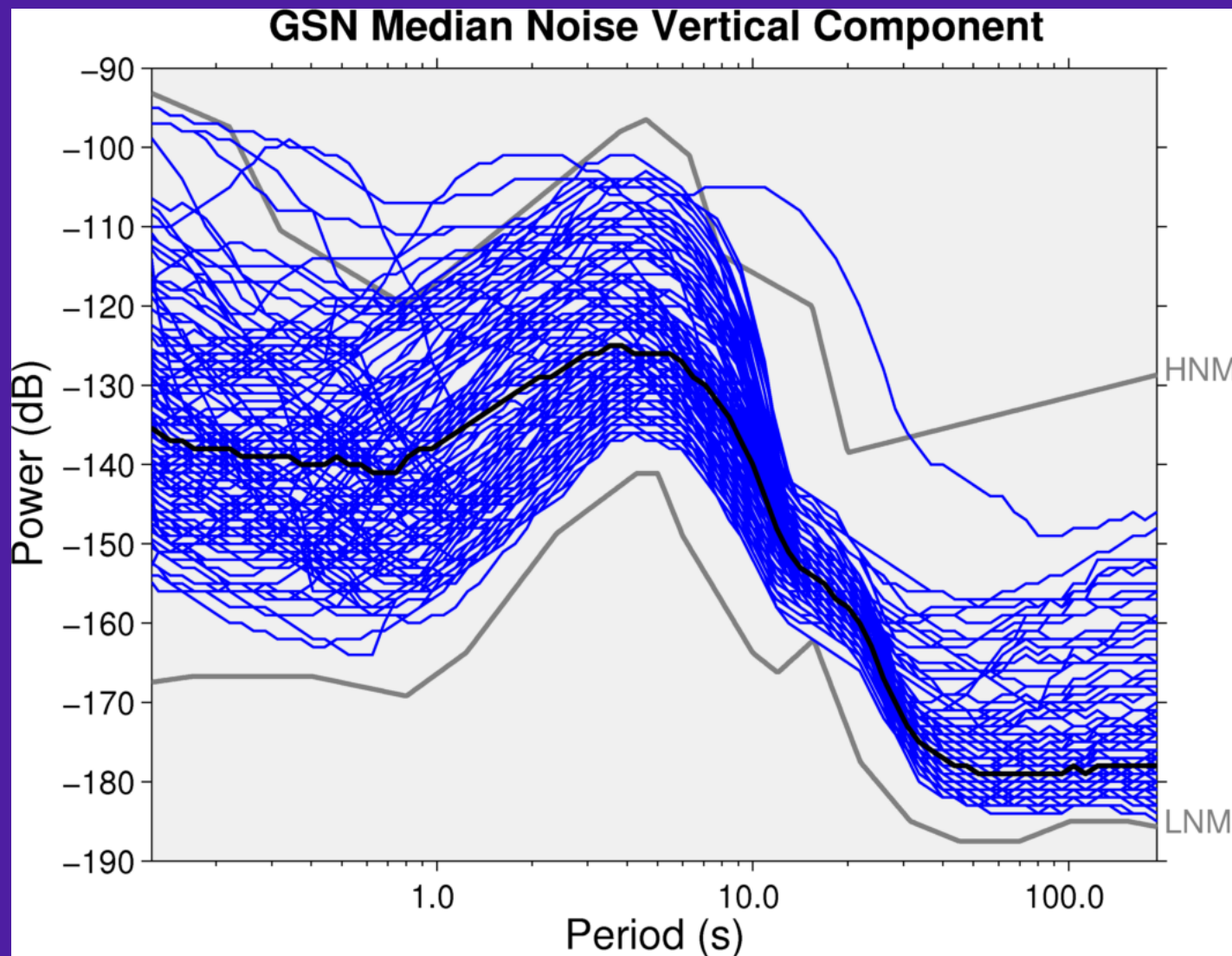
while read line; do
    name=$line;
    NET=`echo $name | awk -F'|' '{print $1}'`;
    STA=`echo $name | awk -F'|' '{print $2}'`;
    LOC=`echo $name | awk -F'|' '{print $3}'`;
    CHA=`echo $name | awk -F'|' '{print $4}'`;

    case $LOC in
        "")
            LOC="--";;
        *)
            ;;
    esac

    echo $NET.$STA.$LOC.$CHA
    curl "http://service.iris.edu/mustang/noise-pdf/1/query?net=${NET}&sta=${STA}&loc=${LOC}&cha=${CHA}&quality=M&starttime=${START}&endtime=${END}&format=text" > temp
    tail +7 temp > PDFPSD/${NET}.${STA}.${LOC}.${CHA}.bin
done < GSN.txt
```



Command Line Queries





LASSO the MUSTANG

<http://lasso.iris.edu>

<http://service.iris.edu/mustang>

What are you waiting for? Go be a cowboy!

