

Webservices and Fetch

Chuck Ammon and Danielle Sumy

Slides adapted from C. Trabant and A. Hutko (IRIS)

WILBER3

Event-Related Waveforms

Scenario: Need to download data from a specific event

- Stations: various distances and azimuths
- Preview ability

WILBER3 is your solution!
Web based, so all you need is your browser

Access online with WILBER III

Select event by:

Map location

Date

Magnitude

Filter options:

Station Distance

Station Azimuth

Network or VNet

Channels

Windowed by:

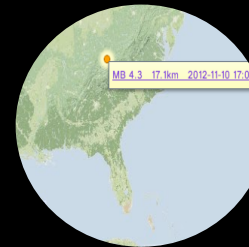
Event time

relative to P or S arrivals

Retrieved as:

SAC, SEED, ASCII

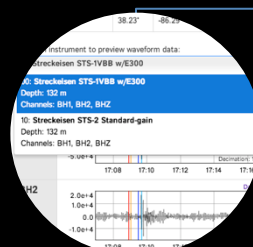
Individual files, gzip, or tar



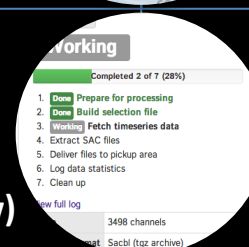
Pick Event



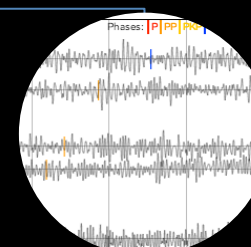
Choose Station(s)



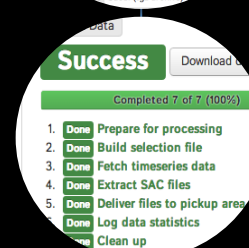
View station details
(preview)



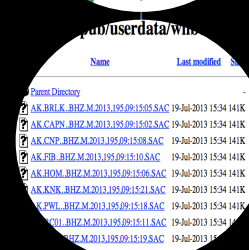
Request Data



Show Record Section
(preview)



Request processed



Retrieve Data

EarthScope Virtual Networks

Virtual Network	Description
_US-TA	USArray Transportable Array
_US-REF	USArray Reference Network
_US-FA	USArray Flexible Array
_US-MT	USArray Magnetotelluric
_US-ALL	All USArray Components
_PBO	Plate Boundary Observatory
_SAFOD	SAFOD

Many more virtual networks have been defined, see <http://ds.iris.edu/mda/>

WILBER3 (ds.iris.edu/wilber3)

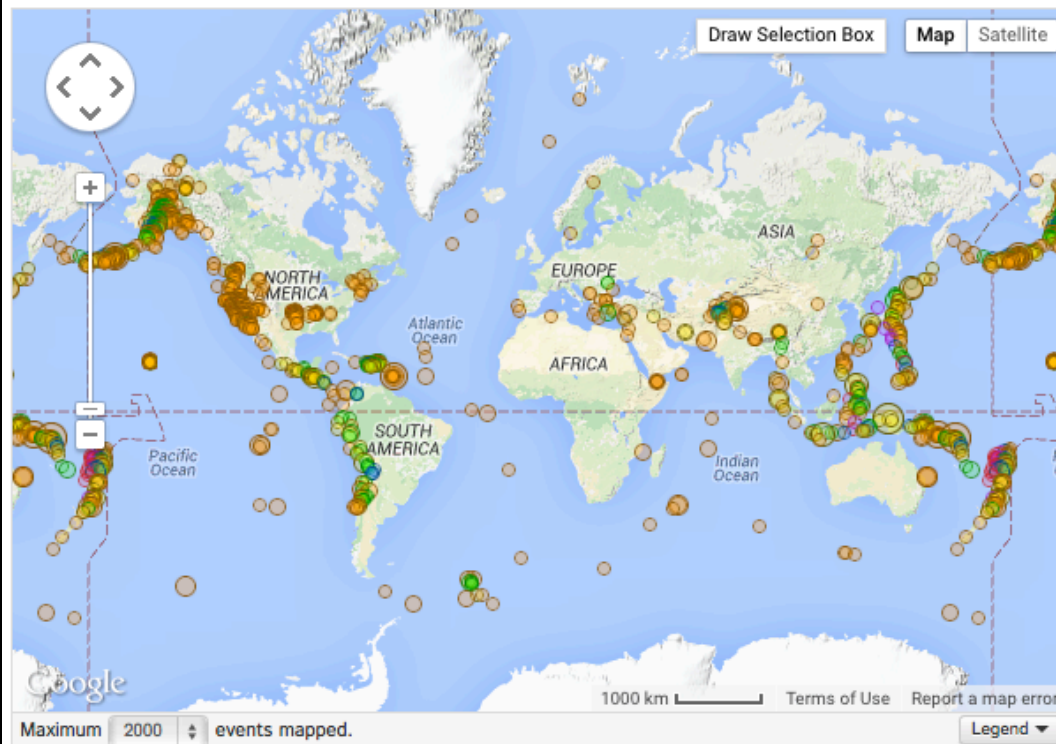
Wilber 3: Select Event

✉ Wilber Feedback/Questions

Looking for previously requested data? [View recent requests.](#)

Load Event Data: Custom Query

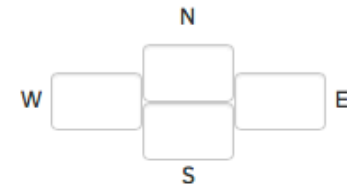
Using the map and controls below, select a geographic area and date/magnitude range, then click the **Get Events** button to load events matching those criteria. The full database contains several million events, so some queries (particularly across large spans of time) may be very slow.



Show Only

Clear

Location



Date

2015-07-03



2015-08-02



Magnitude

0

- 10

Get Events

WILBER Exercise

1. Choose an Event (18 April 2014, Guerrero, MX)
 - Custom query
 - Draw selection box around Mexico
 - Choose dates during April 2014
 - Sort by magnitude, choose largest event
2. Select Stations
 - Choose _US-TA for the network
 - Distance 0 – 25
 - Click on station
3. Explore Record Section
4. Request SAC data as gzipped tar archive
 - Label **WILBER3TEST**, your name & email

MANY Webservices!!

Waveforms

- **dataselect**
- rotation
- timeseries

Metadata

- **station**
- sacpz
- resp

Event Information

- **event**

Processing & Calculation

- travelttime
- distaz
- flinnengdahl
- evalresp

Data Quality metrics (new)

- mustang/noise-psd
- mustang/metrics (50 of them!)



MANY Webservices!!

service.iris.edu

IRISWS			
Service Interface	Version	Summary	Return options
fedcatalog	v.1	A service for federating requests for channel metadata across multiple data centers	text, request
syngine	v.1	A service for synthetic seismograms	SACZIP and miniSEED
timeseries	v.1	similar to ws-dataselect with additional options for processing and reformatting	ASCII, WAV, miniSEED , SAC , PNG
timeseriesplot	v.1	A charting webservice offering timeseries graphic display in single-line or helicorder styles	image: PNG (default) or JPEG
rotation	v.1	rotate waveform data into alternate coordinate system	• zipped (various) • png
sacpz	v.1	instrument response information (per channel)	Poles and Zeroes in ASCII
resp	v.1	channel response information	SEED RESP
evalresp	v.1	instrument response information evaluated from IRIS metadata	• ASCII : frequency-amplitude-phase • ASCII : complex-spectra • Bode style plots
virtualnetwork	v.1	list of stations in a virtual network	• XML • CVS
traveltime	v.1	travel times and ray parameters for seismic phases using a 1-D spherical earth model	ASCII
flinnengdahl	v.2	a Flinn-Engdahl region code or name for a latitude, longitude pair	• ASCII : region code • ASCII : name
distaz	v.1	distance, azimuth and back-azimuth between two locations	XML
metadatachange	v.1	changes made to SEED metadata	XML

Each service is fully documented

IRIS DMC FDSNWS station Web Service Documentation

Service interface URL builder Help Revisions



Description

The **fdsnws-station** web service returns station metadata in **FDSN StationXML** format ([schema here](#)) or as delimited text. Results are available at multiple levels of granularity: **network**, **station**, **channel** and **response**.

Metadata may be selected based on channel descriptors, time ranges, geographic regions, and more.

This service is an implementation of the [FDSN web service specification](#) version 1.

Below is a full list of service parameters and their usage.

Query Usage

```
/query? [channel-options] [geographic-constraints] [time-constraints] [misc-parameters][nodata=404]
```

where

```
channel-options      :: [network=<network>] [station=<station>] [location=<location>] [channel=<channel>]
geographic-constraints :: [boundaries-rect] OR [boundaries-circular]
boundaries-rect      :: [minlatitude=<degrees>] [maxlatitude=<degrees>] [minlongitude=<degrees>] [maxlongitude=<degrees>]
boundaries-circular  :: [latitude=<latitude>&longitude=<longitude>&maxradius=<degrees>] [minradius=<degrees>]
time-constraints     :: [starttime=<date>] [endtime=<date>] [startbefore=<date>] [startafter=<date>]
                       [endbefore=<date>] [endafter=<date>]
misc-parameters      :: [level=<station|network|channel|response>] [format=<xml|text>] [includeavailability=<false|true>]
                       [updatedafter=<date>] [matchtimeseries=<false|true>] [includerestricted=<true|false>]
```

Each parameter-value pair should be separated by an ampersand **&**, and with no space

Sample Queries

- <http://service.iris.edu/fdsnws/station/1/query?latitude=-56.1&longitude=-26.7&maxradius=15&nodata=404>
- .../query?startafter=2003-01-07&endbefore=2011-02-07&minlatitude=15&maxlatitude=55&minlongitude=170&maxlongitude=-170
- .../query?starttime=2013-01-01&network=IU&sta=ANMO&level=channel&nodata=404
- .../query?starttime=2013-01-01&network=IU&sta=A*&location=00&level=channel&format=text

Detailed Descriptions of each Query Parameter

parameter	examples	discussion	default	type
FDSN options				
start[time]	2001-12-19	Limit to metadata describing channels operating on or after the specified start time.	<i>any</i>	day/time
end[time]	2012-12-31	Limit to metadata describing channels operating on or before the specified end time.	<i>any</i>	day/time
startbefore	2001-12-31	Limit to metadata epochs starting before specified time. Applied to channel epochs.	<i>any</i>	day/time

Relevant Links

URL Builder

Description

Query Parameters

Examples

Detailed Parameter Descriptions

Quickly access and explore web service data using the URL Builders

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

Network:	IU	Remove mean:	☐
Station:	ANMO	Low-Pass Filter:	☐ 1.0
Location:	00	High-Pass Filter:	☐ 1.0
Channel:	BHZ	Band-Pass Filter:	☐ 0.01-1.0
Start Time:	2010-02-27T06:30:00	Differentiate:	☐
End Time:	2010-02-27T10:30:00	Integrate:	☐
Correction:	None	Envelope:	☐
Frequency Limits:	☐ 0.0033-0.004-0.05-0.06	Taper:	☐ 0.5
Auto Limits:	☐ 3.0-3.0	Taper Window Type:	☐ HANNING
Units:	☐ DEF	Decimate (samples per sec):	☐ 2.0
Scale:	☐ 2.0	Output:	plot
Div-Scale:	☐ 2.0	Dimensions (px):	☐ W 1000 H 700
		Anti Alias Plot:	☐
		Audio Dynamic Range Compression:	☐
		Audio Sample Rate (samples per sec):	☐ 16000

Click the link:

<http://service.iris.edu/irisws/timeseries/1/query?net=IU&sta=ANMO&cha=BHZ&start=2010-02-27T06:30:00&end=2010-02-27T10:30:00&output=plot&loc=00>

Web Services Exercise

<http://service.iris.edu>

- Plot 35 minutes of 3-Component data with event
 - From network **IU** and station **CHTO**
 - For the **LH?** channels
 - Starting 5 min before P wave arrival
 - For the largest shallow ($\leq 10\text{km}$) event occurring within the last month.
 - Rotated into RADIAL and TRANSVERSE components
- Use web services to do it.

Web Services exercise (hints)

<http://service.iris.edu>

1. **Event** – get event time, lat, lon, depth for largest shallow (<10km depth) event in last 30 days.
2. **Station** – get station name, lat & lon for net: **IU**, station: **CHTO**
3. **Distaz** – get distance & azimuth
4. **Traveltime** – Find first P arrival
5. **Rotation** – plot a response corrected, ZRT rotated seismogram for 5 min before P arrival to 30 minutes after P arrival. for **LH?** channels.

Web Services exercise (detailed)

<http://service.iris.edu>

Exercise

1. **Event** – get event time, lat, lon, depth for largest shallow (<20km depth) event in last 30 days.
2. **Station** – get station name, lat & lon for net: IU, station: CHTO
3. **Distaz** – get distance & back-azimuth
4. **Traveltime** – Find first P arrival
5. **Rotation** – plot a response corrected, ZRT rotated seismogram for 5 min before P arrival to 30 minutes after P arrival. for LH channels.

Hints.

- Builders help...
- **EVENT**
 - Text output
 - order by magnitude
 - change dates & times
 - max depth
 - don't need ALL events
- **STATION**
 - text output, station level
- **TRAVELTIME**
 - Only need min P phase traveltime
- **ROTATION**
 - Rotate into ZRT

AUTOMATE ACCESS WITH FETCH SCRIPTS



<http://seiscode.iris.washington.edu/>

The DMC's Fetch web service clients

FetchEvent: event information (EVENT WS)

event (earthquake) information as ASCII text or XML

FetchData: timeseries data (DATASELECT WS)

miniSEED data, simple metadata, and instrument responses
(SEED RESP & SAC PZs)

FetchMetadata:

Fetch primary channel metadata (coordinates, etc.) as text or XML

Usage: FetchEvent [options]

```
-v          More verbosity, may be specified multiple times (-vv, -vvv)
-s starttime Limit to origins after time (YYYY-MM-DD,HH:MM:SS.sss)
-e endtime   Limit to origins before time (YYYY-MM-DD,HH:MM:SS.sss)
--lat min:max Specify a minimum and/or maximum latitude range
--lon min:max Specify a minimum and/or maximum longitude range
--radius lat:lon:maxradius[:minradius] Specify circular region with opt. minimum radius
--depth min:max Specify a minimum and/or maximum depth in kilometers
--mag min:max  Specify a minimum and/or maximum magnitude
--magtype type Specify a magnitude type for magnitude range limits
--cat name     Limit to origins from specific category (e.g. ISC, DDE, SCMT)
--con name     Limit to origins from specific location (e.g. NE, NW, SE, SW)
--ua date      Limit to origins recorded after date (YYYY-MM-DD,HH:MM:SS)
--allorigins   Return all origins, default is only primary origin per event
--allmags      Return all magnitudes, default is maximum magnitude per event
--orderbymag   Order results by magnitude instead of time
--evid id      Select a specific event by DMC event ID
--orid id      Select a specific event by DMC origin ID
-X xmlfile     Write raw returned XML to xmlfile
-A appname     Application/version string for identification
-o outfile     Write event information to specified file, default: console
```

--help

Exercise: Quick access to metadata

Working in a Terminal window:

Use FetchMetadata to get channel information for:

TA.ELFS (network.station)

Hint 1: type **FetchMetadata -h** for usage

Hint 2: “-N TA -S ELFS”

Exercise: Quick access to metadata

```
$ FetchMetadata -N TA -S ELFS
```

Received 112.5 KB of metadata in 0.1 seconds (796.2 KB/s)

Processed metadata for 114 channel epochs in 0.4 seconds (316.7 KB/s)

```
#net|sta|loc|chan|lat|lon|elev|depth|azimuth|dip|instrument|scale|scalefreq|scaleunits|samplerate|start|end
TA|ELFS|--|ACE|40.6183|-120.7279|1553.0|0.0|0.0|0.0|Quanterra 330 Linear Phase Composite||0||0|2007-08-16T21:01:00|2007-10-09T18:
TA|ELFS|--|BHE|40.6183|-120.7279|1553.0|0.0|84.9|0.0|Streckeisen STS-2 G3/Quanterra 330 Linear Phase Co|6.27192E8|0.2|M/S|40|2007
TA|ELFS|--|BHN|40.6183|-120.7279|1553.0|0.0|354.9|0.0|Streckeisen STS-2 G3/Quanterra 330 Linear Phase Co|6.27192E8|0.2|M/S|40|200
TA|ELFS|--|BHZ|40.6183|-120.7279|1553.0|0.0|0.0|-90.0|Streckeisen STS-2 G3/Quanterra 330 Linear Phase Co|6.27192E8|0.2|M/S|40|200
TA|ELFS|--|LCE|40.6183|-120.7279|1553.0|0.0|0.0|0.0|Quanterra 330 Linear Phase Composite|1000000.0|0|S|1|2007-08-16T21:01:00|2007
TA|ELFS|--|LCQ|40.6183|-120.7279|1553.0|0.0|0.0|0.0|Quanterra 330 Linear Phase Composite|1.0|0|PERCENT|1|2007-08-16T21:01:00|2007
TA|ELFS|--|LHE|40.6183|-120.7279|1553.0|0.0|84.9|0.0|Streckeisen STS-2 G3/Quanterra 330 Linear Phase Co|6.25202E8|0.03|M/S|1|2007
TA|ELFS|--|LHN|40.6183|-120.7279|1553.0|0.0|354.9|0.0|Streckeisen STS-2 G3/Quanterra 330 Linear Phase Co|6.25202E8|0.03|M/S|1|200
TA|ELFS|--|LHZ|40.6183|-120.7279|1553.0|0.0|0.0|-90.0|Streckeisen STS-2 G3/Quanterra 330 Linear Phase Co|6.25202E8|0.03|M/S|1|200
TA|ELFS|--|LOG|40.6183|-120.7279|1553.0|0.0|0.0|0.0|Quanterra 330 Linear Phase Composite||0||0|2007-08-16T21:01:00|2007-10-09T18:
TA|ELFS|--|OCF|40.6183|-120.7279|1553.0|0.0|0.0|0.0|Quanterra 330 Linear Phase Composite||0||0|2007-08-16T21:01:00|2007-10-09T18:
TA|ELFS|--|UHE|40.6183|-120.7279|1553.0|0.0|84.9|0.0|Streckeisen STS-2 G3/Quanterra 330 Linear Phase Co|3.61051E7|0.002|M/S|0.01|
```

WS request generated:

<http://service.iris.edu/fdsnws/station/1/query?level=channel&network=TA&station=ELFS>

✧ **NOTE:** The existence of metadata does NOT
guarantee that time series data exists

FetchData example

Request 1 hour of GSN long-period vertical (LHZ) data and simple metadata for 2010-2-27 M8.8 Chilean earthquake:

```
$ FetchData
```

- `-N _GSN -L 00 -C 'LHZ'`
- `-s 2010-02-27T06:34:00 -e 2010,02,27,07,34,00`
- `-o /data/Chile-GSN-LHZ.mseed`
- `-m /data/Chile-GSN-LHZ.metadata`

Convert the miniSEED to SAC with metadata:

```
$ mseed2sac Chile-GSN-LHZ.mseed -m Chile-GSN-LHZ.metadata
```

- `-E '2010,058,06:34:11/-36.122/-72.898/22.9'`

Embedded use: a Fetching script

```
#!/usr/bin/bash
# usage: ./fetchingscript minmag:maxmag startday endday
a=$(./FetchEvent --mag ${1} --s ${2} --s ${3} --orderbymag --limit 1)
# parse output
a=${a%*|*|*|*|*|*}          # strip off the end
a=${a//[[:space:]]}          # remove all spaces
IFS=' ' read -r evid evdt evlat evlon evdep <<< ${b//|/ } # split fields
# wrestle dates
evdate=${evdt:0:10}
evtime=${evdt:10}
eventtime=$(date -j -f "%T" -v+10M ${evtime} "+%H:%M:%S") #add 10 minutes
evstart="${evdate}T${evtime}"
eventd="${evdate}T${eventtime}"

FetchData -N _GSN -C BHZ -s ${evstart} -e ${eventd} -o data.mseed
          -m data.meta -A test --radius ${evlat}:${evlon}:85:95

./mseed2sac data -m data.meta data.mseed
```

The IRIS Federator

Discover and access data across FDSN data centers

A catalog of channels across data centers and a service to search the catalog.

Simply add the `-F` option to your Fetch scripts!

The search interface: <http://service.iris.edu/irisws/fedcatalog/1/>

Based on your criteria, the service will tell you what channels exist (based on metadata) and at which data center you may access them.

NOTE: the existence of metadata does NOT guarantee that time series data exist.

EXAMPLE: 1+ hour of global LHZ data for the 1995 Mw 8.0 Chile earthquake:

```
FetchData -F -C LHZ -s 1995-7-30T05:11:23 -e 1995-7-30T06:30:00  
          -o event.mseed -m event.meta
```

Lastly, direct access with MATLAB®

irisFetch allows you to access DMC held data from MATLAB

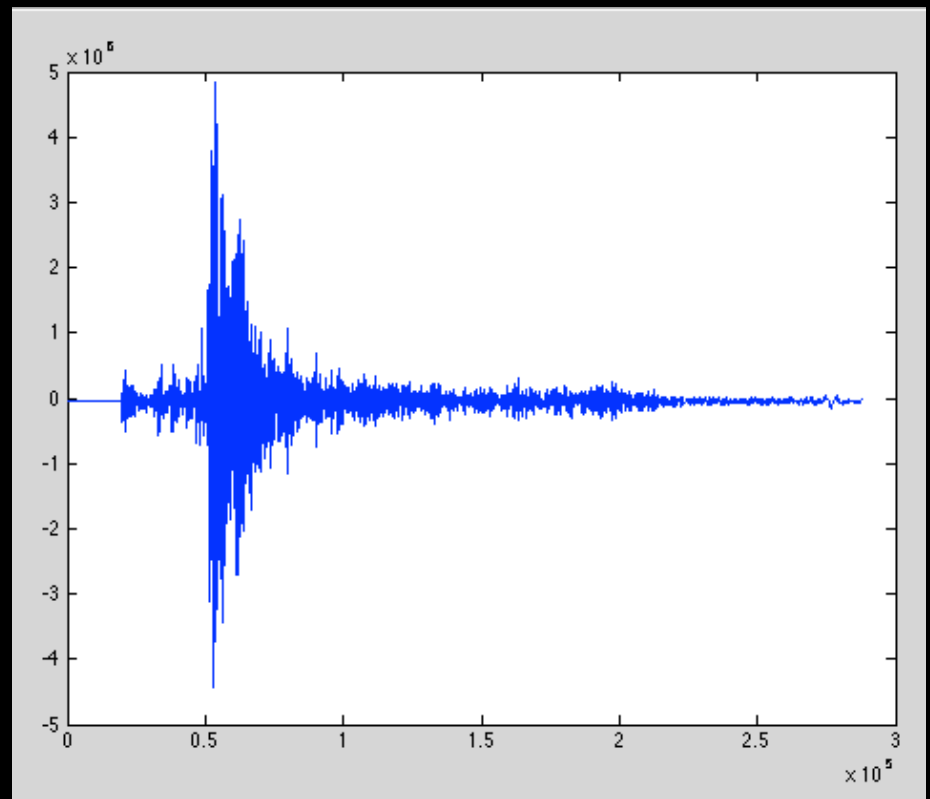
- Supports access to these data
 - Traces (waveforms + common metadata)
 - Station metadata
 - Event parameters
- Works with MATLAB R2009 and later releases
- Available for download at:
<http://ds.iris.edu/ds/nodes/dmc/software/downloads/irisFetch.m>
OR
seiscode.iris.washington.edu/projects/irisfetch

Example MATLAB access and plot

- Simple example:

```
>> tr = irisFetch.Traces('IU','ANMO','00','BHZ','2010-02-27  
06:30:00','2010-02-27 10:30:00')  
>> plot(tr(1).data);
```

- Makes this plot:

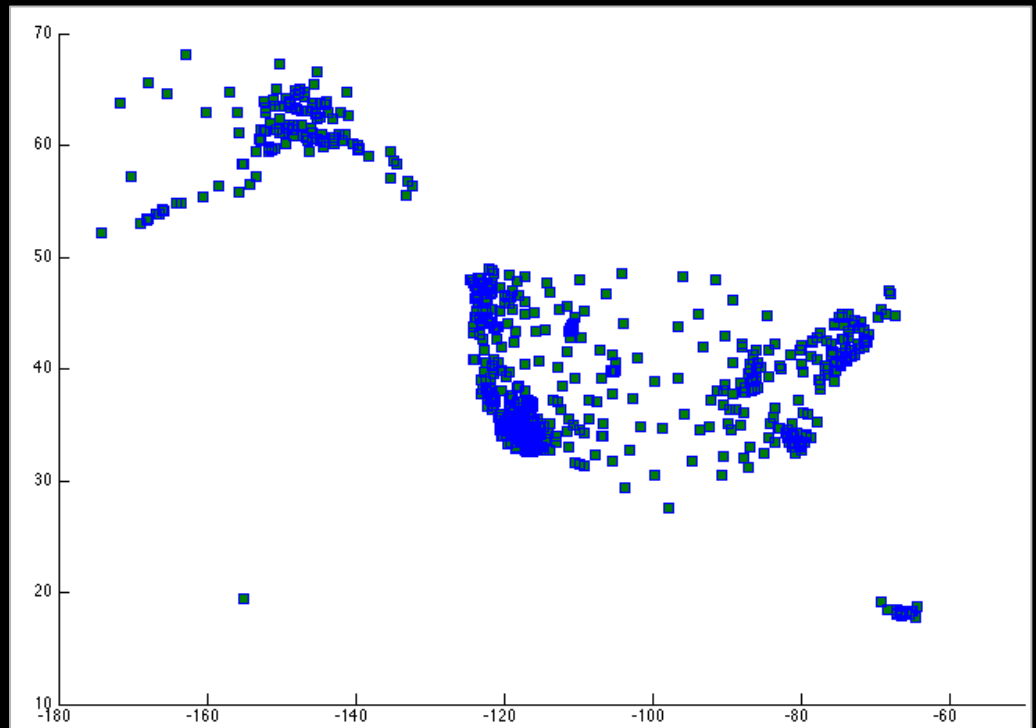


Example MATLAB access and plot

- Station example:

```
sf= irisFetch.Channels('channel','_US-REGIONAL','*','*','BHZ');  
scatter([sf.Longitude],[sf.Latitude],'s','markerfacecolor',[0 .5 0]);  
axis([-180,-50,10,70])
```

- Makes this plot:



irisFetch.m MATLAB exercise

Exercise: use irisFetch.m to access 30 minutes of **LH?** channels from network **IU** and station **COLA** for this time window:

Start time: 2010-02-27 06:50:00

End time: 2010-02-27 07:20:00

- a) Print channel metadata
- b) Plot seismograms

Download irisFetch.m if needed

```
>> javaaddpath('./IRIS-WS-2.0.15.jar')
```