DOWNLOADING RAW DATA

Exercise 1. Download raw gauge data in digital counts from strainmeter B073, process the gauge data to generate areal and shear strains.

1. Download data
2. Linearize
3. Combine into tensor strain

RAW DATA

- Any data sets other than 10 minute interval data you need to retrieve from the IRIS Data Management Center (DMC).
- Web Services recommended
- Data are archived using the SEED channel name convention. You will need to know the SEED codes for the site

SEED CODES

Data channels are uniquely identified by SEED code

PB.B073.RS1.T0

SEED CODES

Data channels are uniquely identified by SEED code

PB.B073.RS1.T0

PB = Network Code (two character code)

SEED CODES

Data channels are uniquely identified by SEED code

PB.B073.RS1.T0

PB = Network Code (PB = PB0)

SEED CODES

Data channels are uniquely identified by SEED code

PB.B073.RS1.T0

PB = Network Code
B073 = Site Code (four character code)

SEED CODES

Data channels are uniquely identified by SEED code

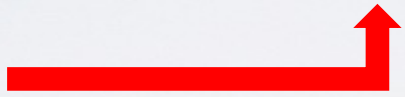
PB.B073.RS1.T0

GF = Network Code
B073 = Site Code
RS1 = Channel Code

SEED CODES

Data channels are uniquely identified by SEED code

PB.B073.RS1.T0



Sample Rate

R	<	1 sps
L	=	1 sps
B	=	20 sps
E	=	200 sps

SEED CODES

Data channels are uniquely identified by SEED code

PB.B073.RS1.T0

Measurement

S = Strain
H = Seismic
K = Temperature
E = Voltage

SEED CODES

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PB.B073.RS1.T0

Orientation

N = North
E = East
1 = “not North”
2 = Perpendicular to 1

SEED CODES

Data channels are uniquely identified by SEED code

PB.B073.RS1.T0

PB = Network Code
B073 = Site Code
RS1 = Channel Code
T0 = Location Code

SEED CODES

Data channels are uniquely identified by SEED code

PB.B073.RS1.T0

Location Code

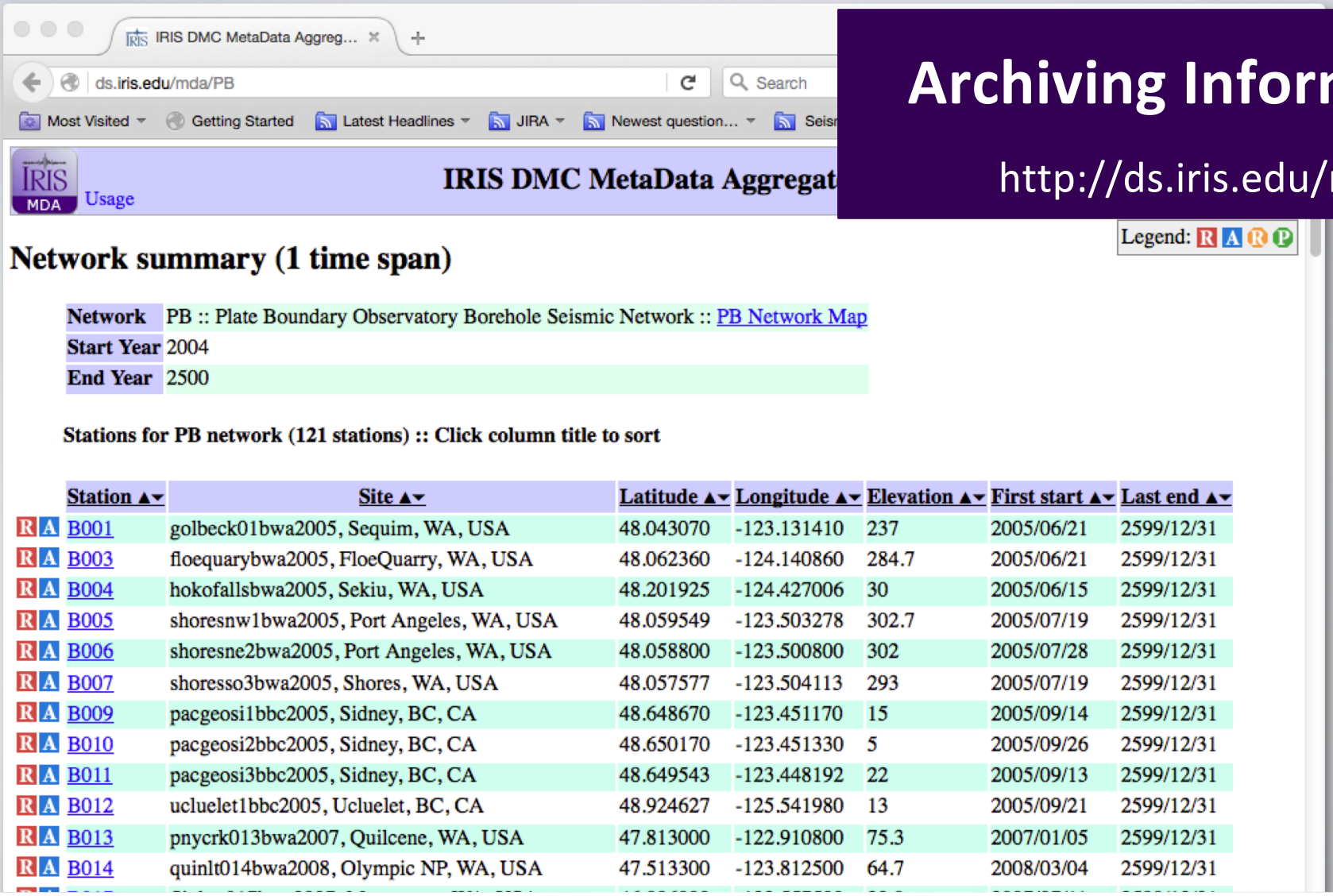
T0, TS = BSM

IR, IM, II = LSM

“blank-blank” = Seismic & Pore pressure

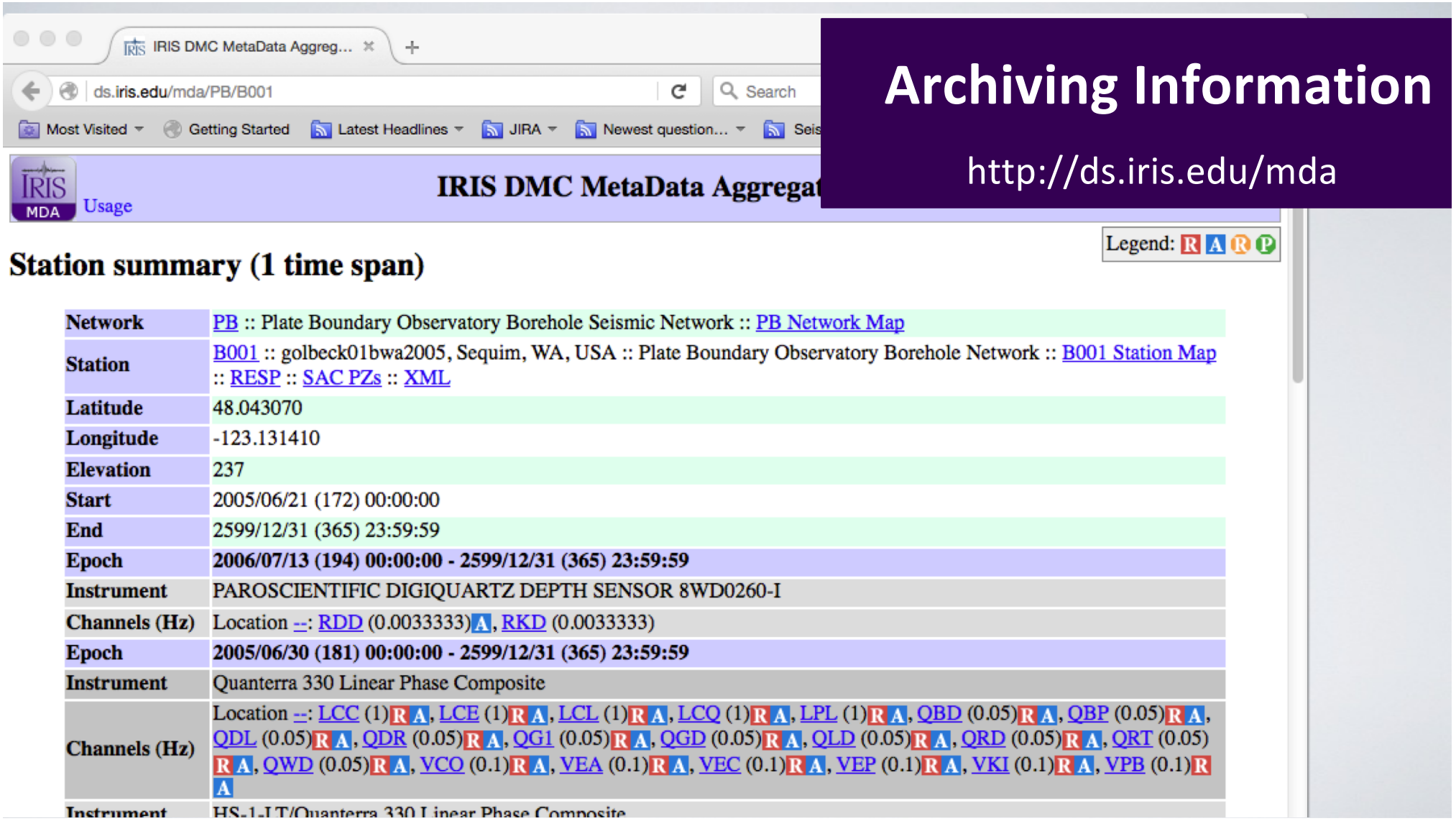
Archiving Information

http://ds.iris.edu/mda



Archiving Information

http://ds.iris.edu/mda



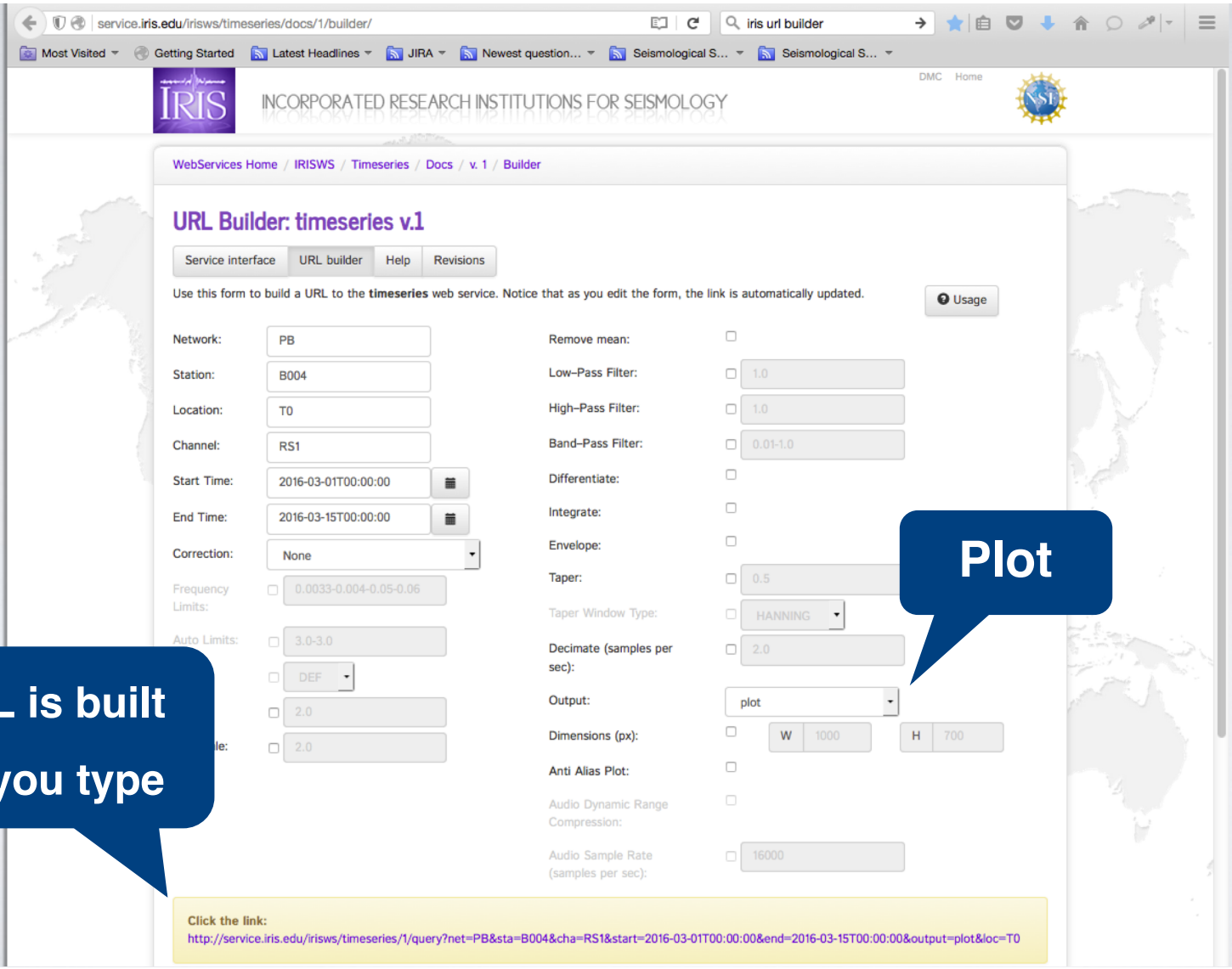
RAW DATA

Use web services to download data

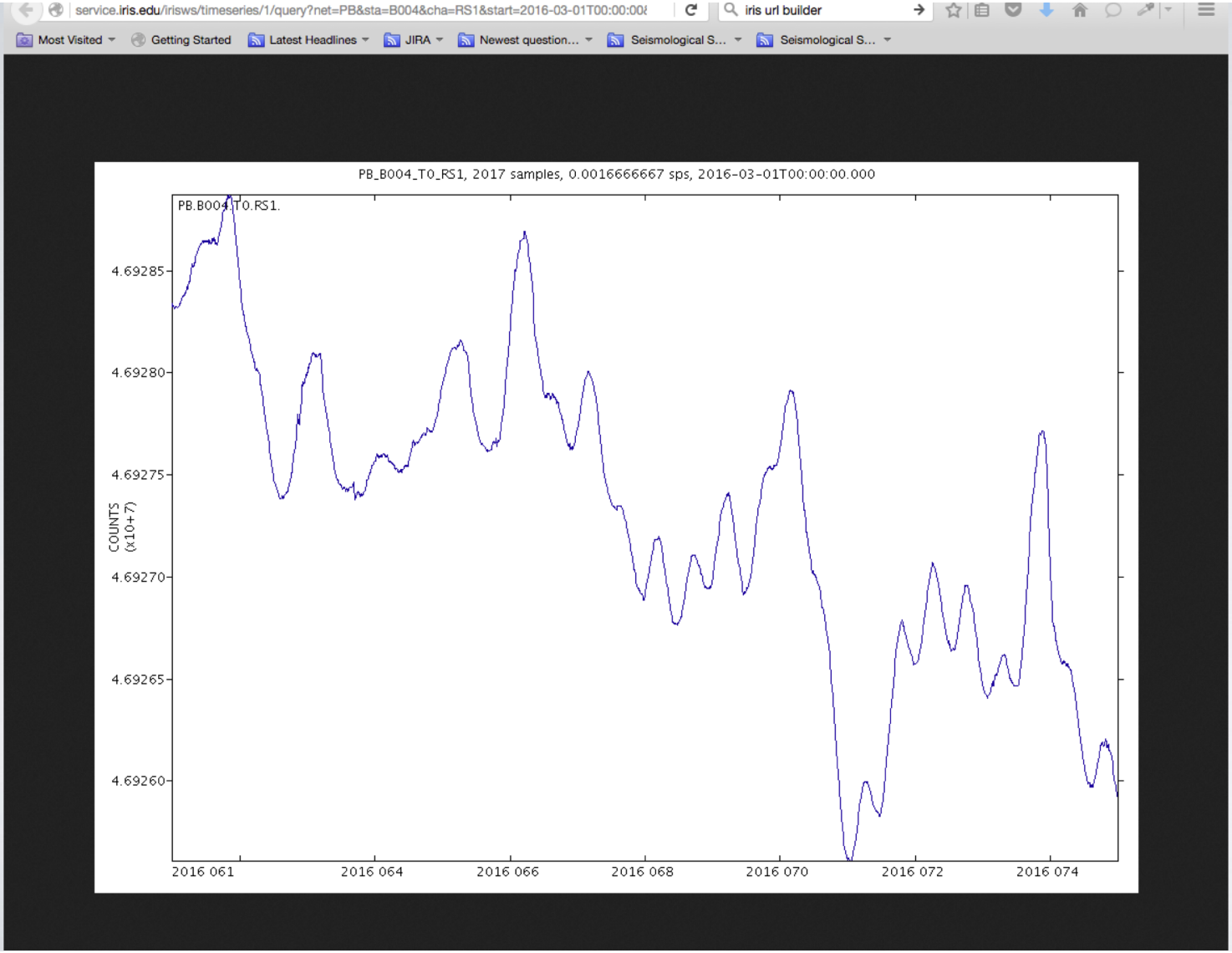
http://service.iris.edu/irisws/timeseries/docs/1/builder/

Google "IRIS webservices url builder"

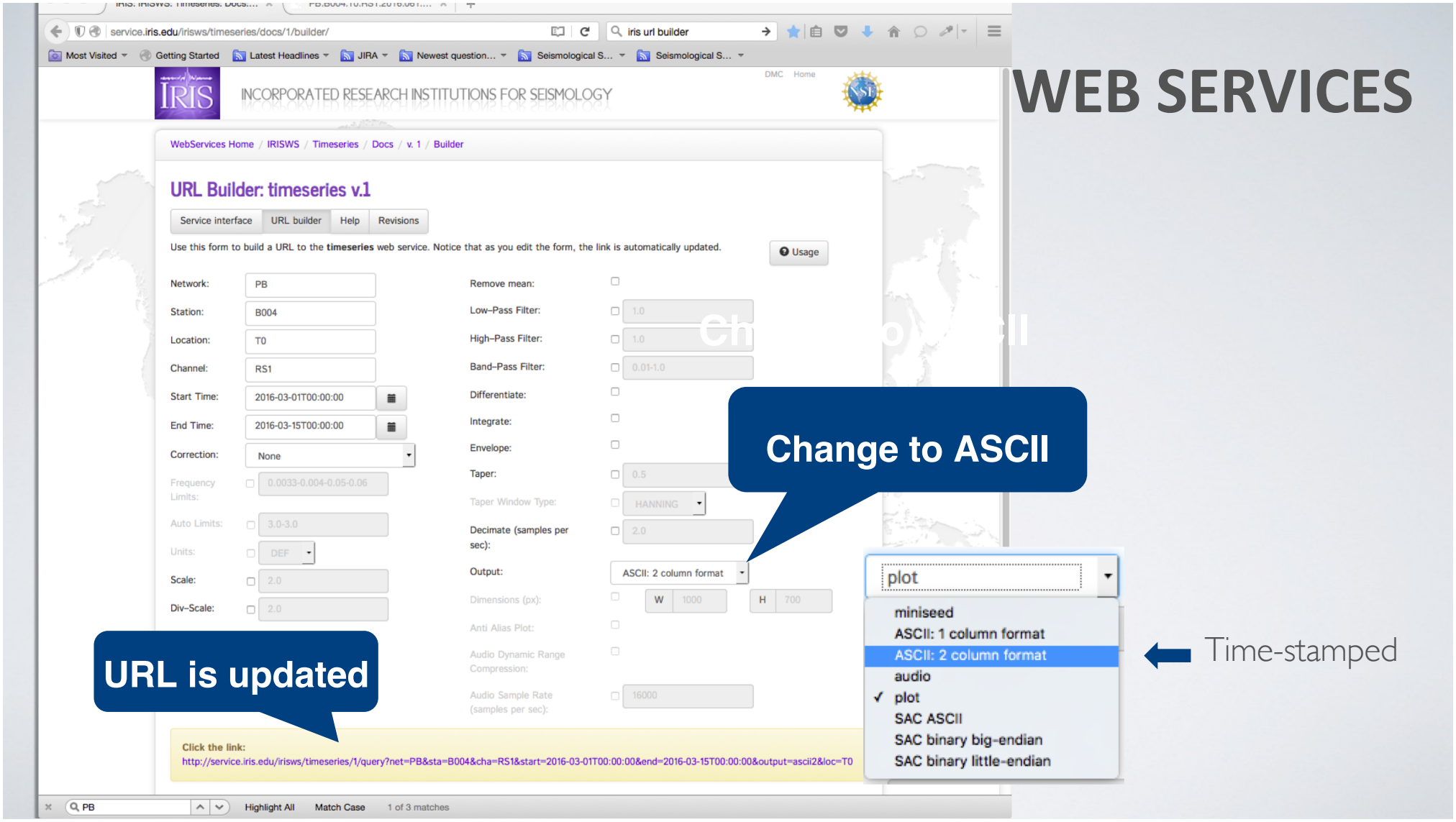
WEB SERVICES



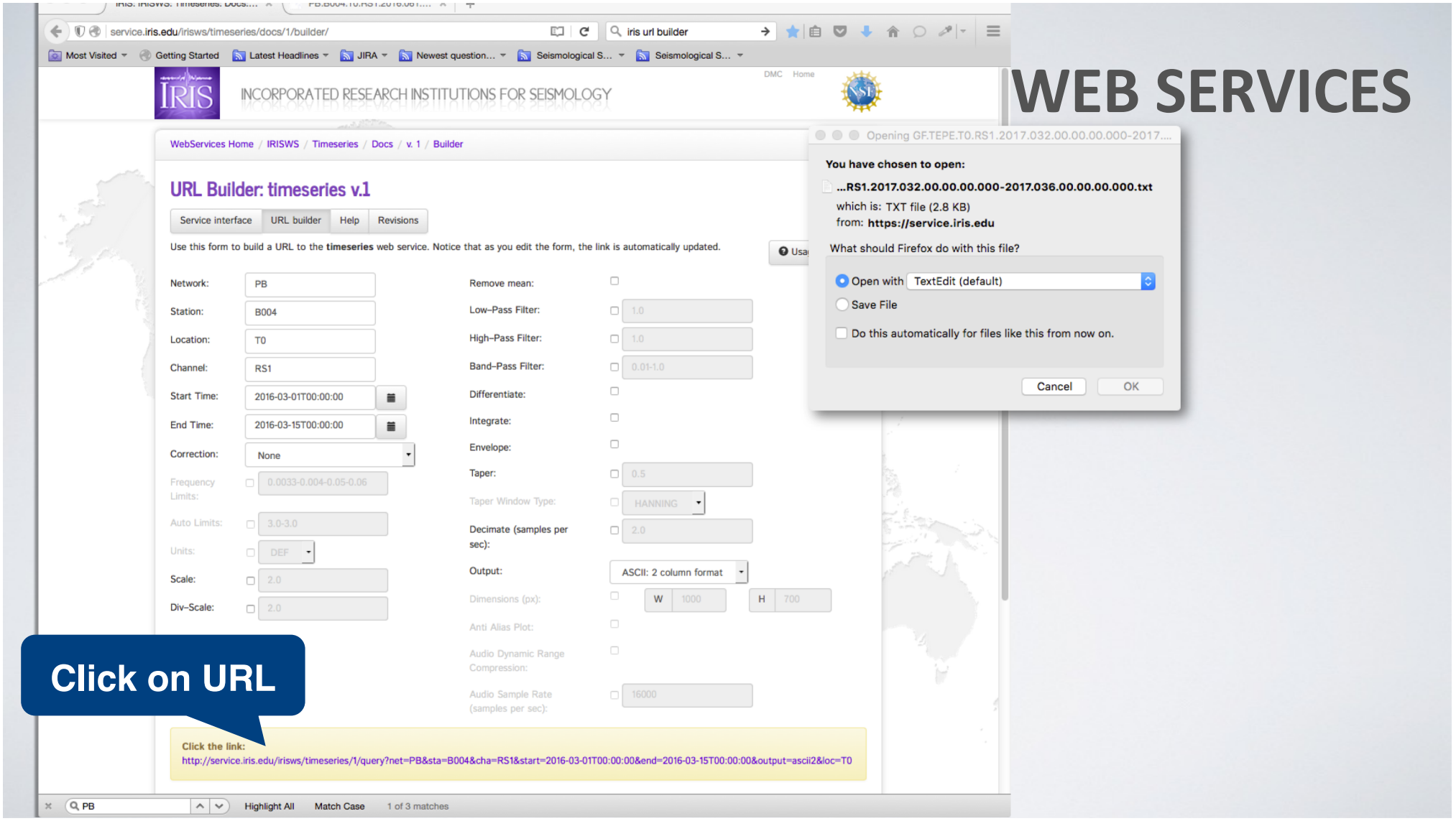
WEB SERVICES



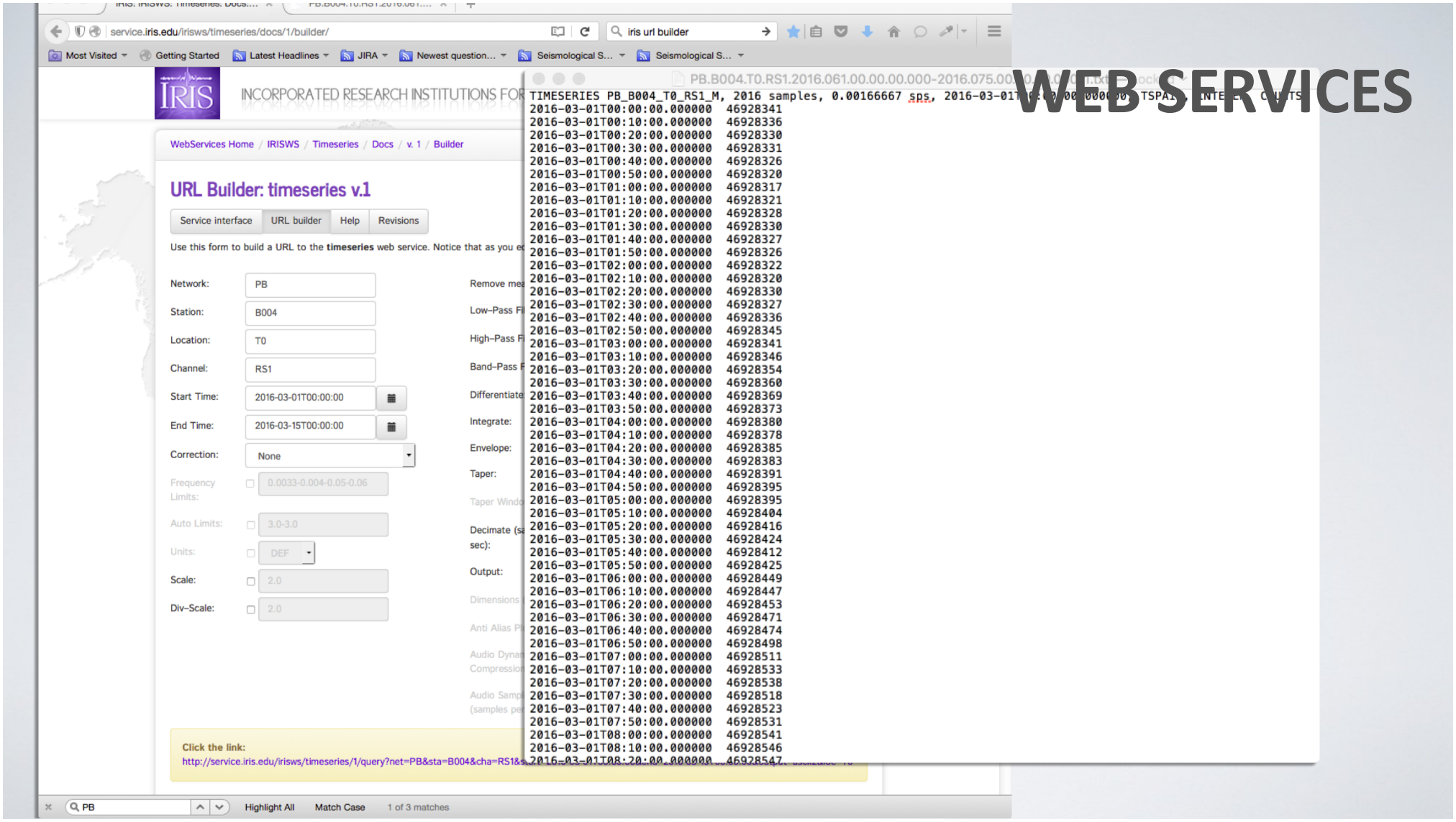
WEB SERVICES



WEB SERVICES



WEB SERVICES



WEB SERVICES

The URL forms a scriptable command we can run in the general directory,

% cd CLASS/general

copy paste the URL from your browser window to a terminal

wget -O MyData.txt
"http://service.iris.edu/irisws/timeseries/1/query?net=PB&sta=B004&cha=RS1&start=2016-03-01T00:00:00&end=2016-03-15T00:00:00&output=ascii2&loc=T0”

(ftp and curl also work)

WEB SERVICES

You should now have a file named B004.RS1.txt

TIMESERIES PB_B004_T0_RS1_M, 2017 samples, 0.00166667 sps, 2016-03-01T00:00:00.000000,

TSPAIR, INTEGER**, COUNTS**

2016-03-01T00:00:00.000000 46928341

2016-03-01T00:10:00.000000 46928336

2016-03-01T00:20:00.000000 46928330

2016-03-01T00:30:00.000000 46928331

2016-03-01T00:40:00.000000 46928326

2016-03-01T00:50:00.000000 46928320

2016-03-01T01:00:00.000000 46928317

Digital counts, contents of the bottle files

ASCII Translation of the native bottle file

DOWNLOADING DATA

Download raw gauge data in digital counts from strainmeter B073, process the gauge data to generate areal and shear strains.

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B073, 8 May 2012 , all 4 strain channels, 1-sps

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B073, 8 May 2012 , all 4 strain channels, 1-sps

Work in the CLASS/general directory, **get_data_ws.bash**

DOWNLOADING DATA

Download raw gauge data in digital counts from strainmeter B073, process the gauge data to generate areal and shear strains.

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B073, 8 May 2012 , all 4 strain channels, 1-sps

Use the time-series URL Builder to build the URL

DOWNLOADING DATA

1.Download 8 May 2012 , all 4 channels from strainmeter B073

Use get_data_ws.bash in the general directory

```
#!/bin/bash
for g in 0 1 2 3
do
    c= $ (( g + 1 ))
    wget  -O B073.CH$g.txt "http command"
    linearize.csh B073.CH$g.txt
done
```

Put http command here

DOWNLOADING DATA

1.Download 8 May 2012 , all 4 channels from strainmeter B073

Use get_data_ws.bash in the general directory

```
#!/bin/bash
for g in 0 1 2 3
do
    c= $ (( g + 1 ))
    wget  -o B073.CH$g.txt "http command"
    linearize.csh B073.CH$g.txt
done
```

Looping over channels

DOWNLOADING DATA

1.Download 8 May 2012 , all 4 channels from strainmeter B073

Use get_data_ws.bash in the general directory

```
#!/bin/bash
for g in 0 1 2 3
do
    c= $ (( g + 1 ))
    wget  -o B073.CH$g.txt "http command"
    linearize.csh B073.CH$g.txt
done
```

Requesting the data

DOWNLOADING DATA

1.Download 8 May 2012 , all 4 channels from strainmeter B073

Use get_data_ws.bash in the general directory

```
#!/bin/bash
for g in 0 1 2 3
do
    c= $ (( g + 1 ))
    ftp  -o B073.CH$g.txt "http command"
    linearize.csh B073.CH$g.txt
done
```

Linearizing

LINEARIZING RAW DATA

- Linearizing equation supplied by GTSM Technologies.
- The linear gauge strain, u_t, at time t, is calculated with respect to a fixed raw data point (d_o) . **Units will be strain.**

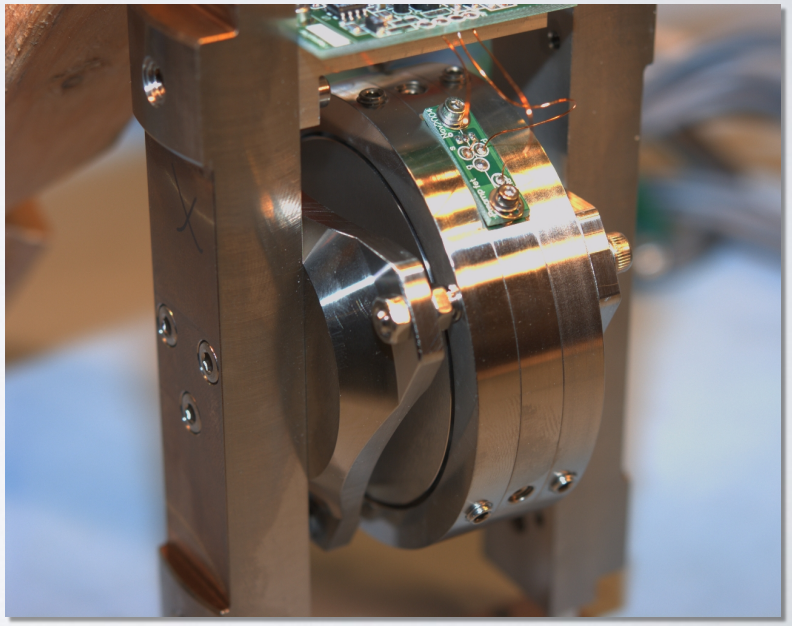
$$u_t = \left(\frac{10^{-8} d_t}{1 - 10^{-8} d_t} - \frac{10^{-8} d_0}{1 - 10^{-8} d_0} \right) * \frac{R}{M}$$

d_t data value at time t,

d_o data value at fixed time t_o

R instrument reference gap (10^{-4} or 2×10^{-4} m)

M instrument diameter (0.087 m)



DOWNLOADING DATA

To run,

% ./get_data_ws.bash

Edit bash shell so scripts can run from anywhere, e.g.,
vi ~/.profile
export PATH="/opt/local/bin:/opt/local/sbin:.:$PATH"

DOWNLOADING DATA

You should now have 4 raw files

B073.CH0.txt

B073.CH1.txt

B073.CH2.txt

B073.CH3.txt

and 4 files with linearized data

LINEAR.B073.CH0.txt

LINEAR.B073.CH1.txt

LINEAR.B073.CH2.txt

LINEAR.B073.CH3.txt

DOWNLOADING DATA

TIMESERIES PB_B073_T0_LS1_M, 86401 samples, 1 sps, 2012-05-08T00:00:00.000000, TSPAIR, INTEGER, COUNTS ,**linearStrain_nanostrain**, **gap=0.0001**

2012-05-08T00:00:00.000000 47722919 0.00
2012-05-08T00:00:01.000000 47722915 -0.17
2012-05-08T00:00:02.000000 47722917 -0.08
2012-05-08T00:00:03.000000 47722923 0.17
2012-05-08T00:00:04.000000 47722921 0.08
2012-05-08T00:00:05.000000 47722918 -0.04
2012-05-08T00:00:06.000000 47722922 0.13
2012-05-08T00:00:07.000000 47722925 0.25
2012-05-08T00:00:08.000000 47722923 0.17
2012-05-08T00:00:09.000000 47722922 0.13

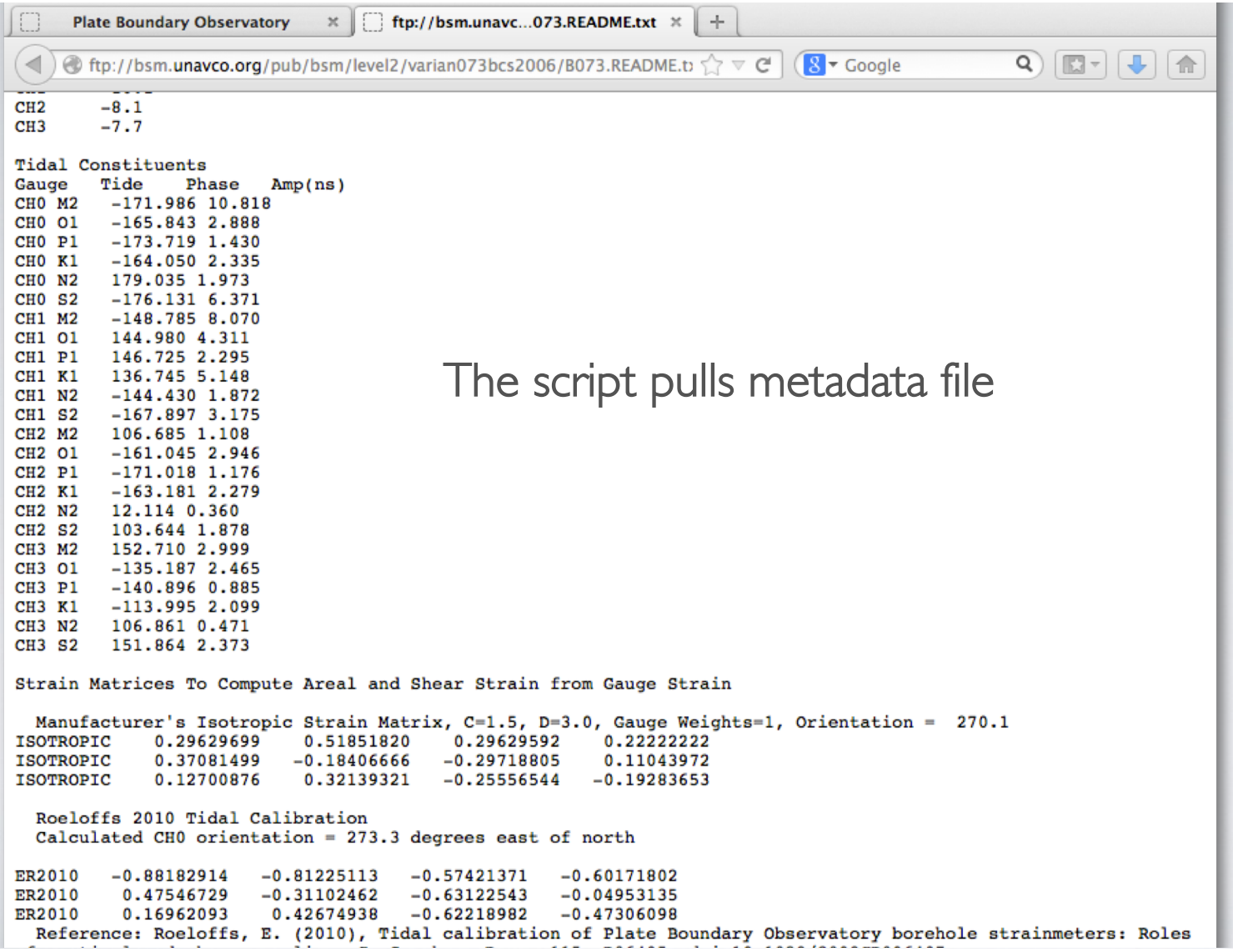
TENSOR STRAIN

Before we can combine the data we need to know the gauge orientations, gauge weightings, scale factors i.e., the calibration matrix (***S***).

$$S\begin{bmatrix} e_0 \\ e_1 \\ e_2 \\ e_3 \end{bmatrix} = \begin{bmatrix} e_{EE} + e_{NN} \\ e_{EE} - e_{NN} \\ 2e_{EN} \end{bmatrix}$$

This can be found in the XML file or README file available from UNAVCO.
ftp://bsm.unavco.org/pub/bsm/level2/B073/B073.README.txt

TENSOR STRAIN



The script pulls metadata file

TENSOR STRAIN

Use make_tensor.pl in the general directory

```
%   make_tensor.pl   B073
```

TENSOR STRAIN

make_tensor.pl does the following

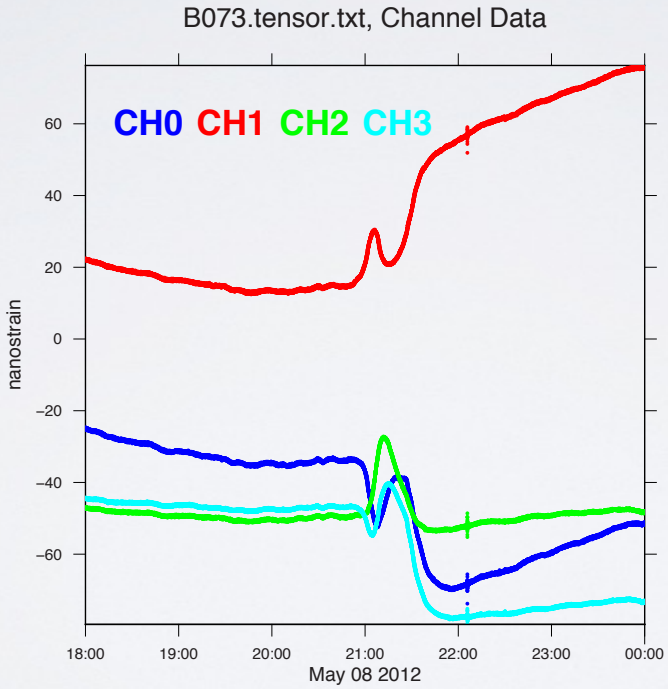
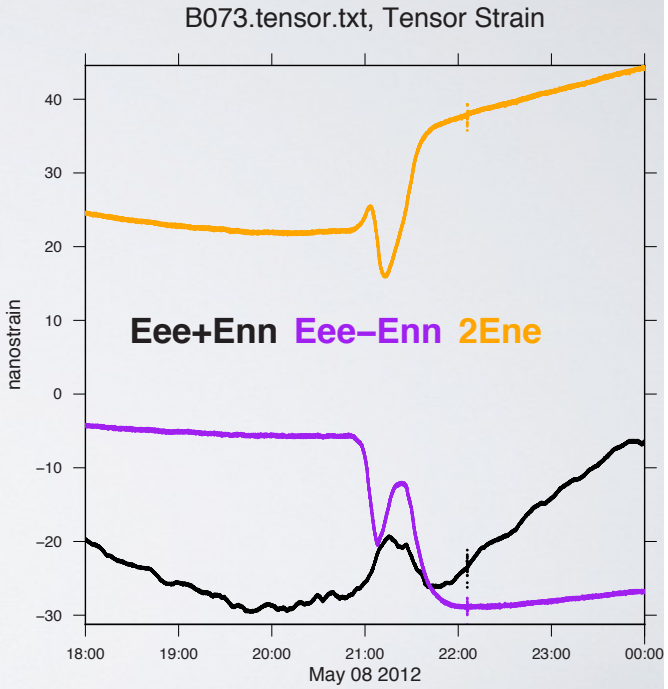
- downloads the B073.README.txt file
- extracts the calibration matrix from the readme.txt files
- combines the gauges using the matrix
- prints out gauge measurements, areal and shear strain
- outputs a file, B073.tensor.txt

TENSOR STRAIN

B073.tensor.txt

DateTTime	CH0L	CH1L	CH2L	CH3L	Eee+Enn	Eee-Enn	2Ene
2012-05-08T00:00:00.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2012-05-08T00:00:01.00	-0.17	0.00	0.03	-0.03	-0.05	-0.08	-0.02
2012-05-08T00:00:02.00	-0.08	0.06	-0.06	-0.07	-0.03	-0.03	0.04
2012-05-08T00:00:03.00	0.17	0.06	-0.16	-0.07	0.02	0.09	0.10
2012-05-08T00:00:04.00	0.08	0.12	-0.03	-0.10	0.05	0.01	0.08
2012-05-08T00:00:05.00	-0.04	0.06	0.03	-0.10	0.01	-0.05	0.03
2012-05-08T00:00:06.00	0.13	-0.12	0.00	0.03	-0.02	0.07	-0.03
2012-05-08T00:00:07.00	0.25	-0.25	0.00	0.10	-0.03	0.15	-0.07
2012-05-08T00:00:08.00	0.17	0.00	-0.13	0.00	0.01	0.10	0.05

TENSOR STRAIN

- Use GMT script **plot_tensor.bash** to plot the data
- Creates postscript file **B073.tensor.ps**
- To view,

  gs B073.tensor.ps