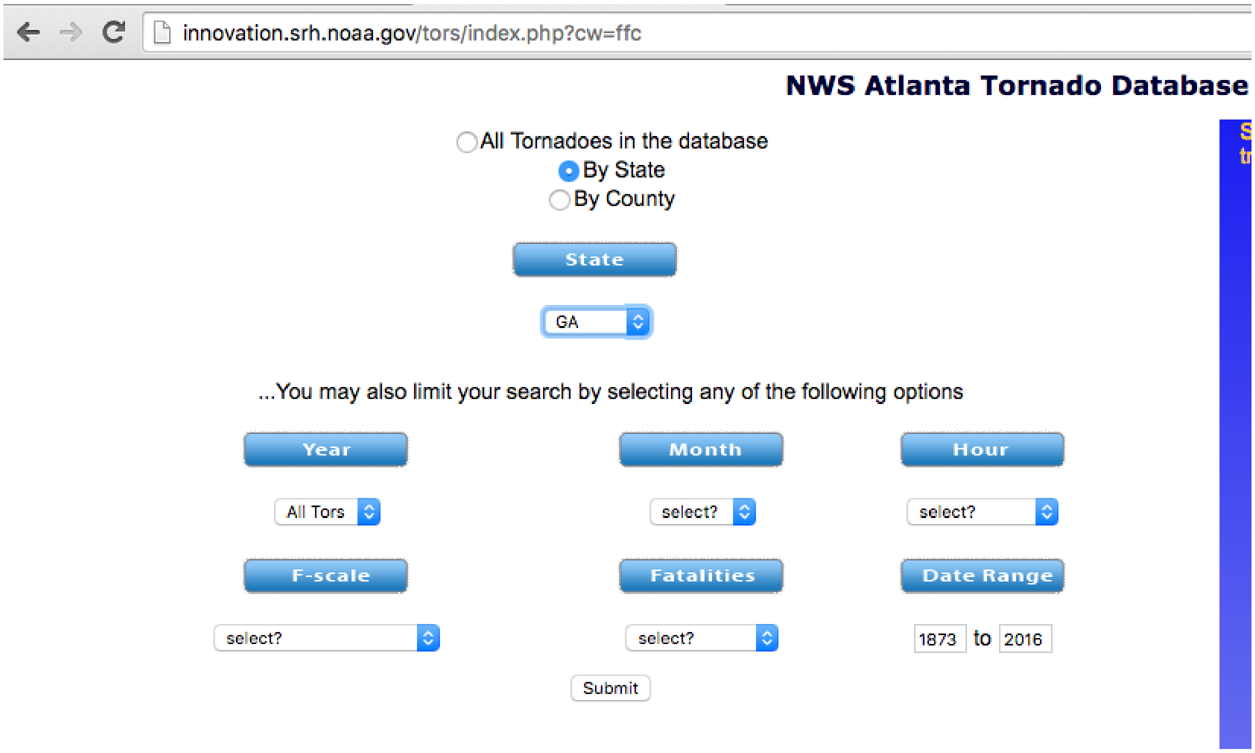
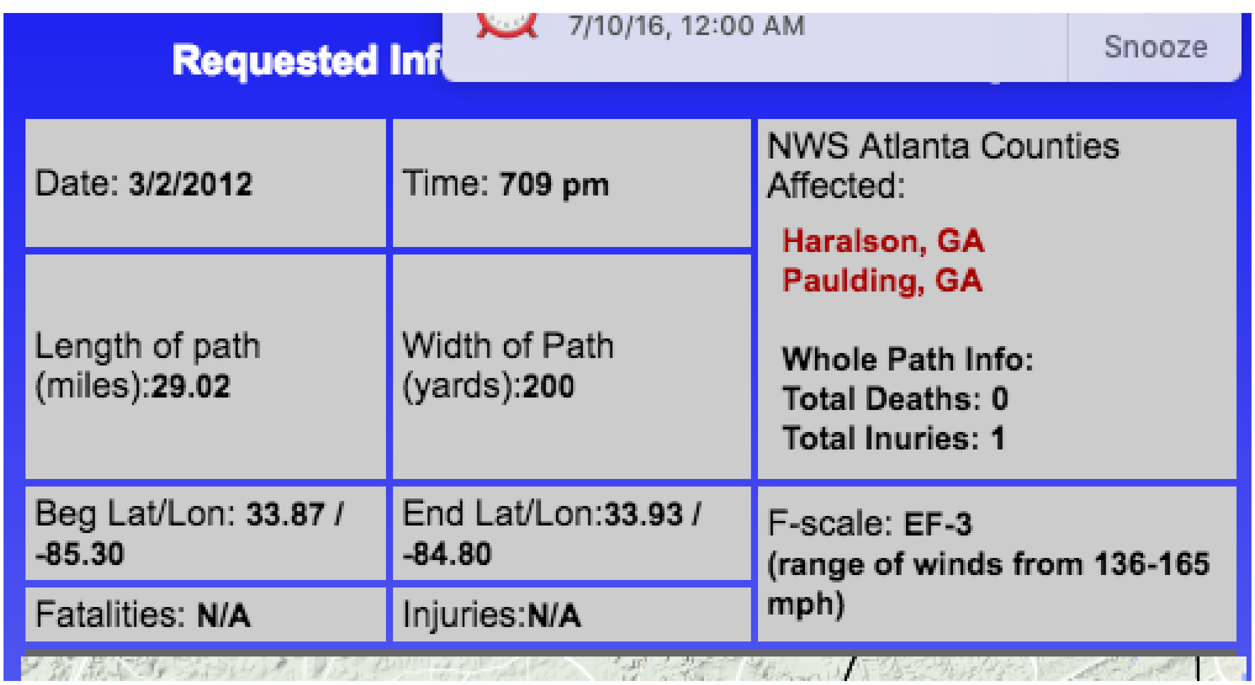
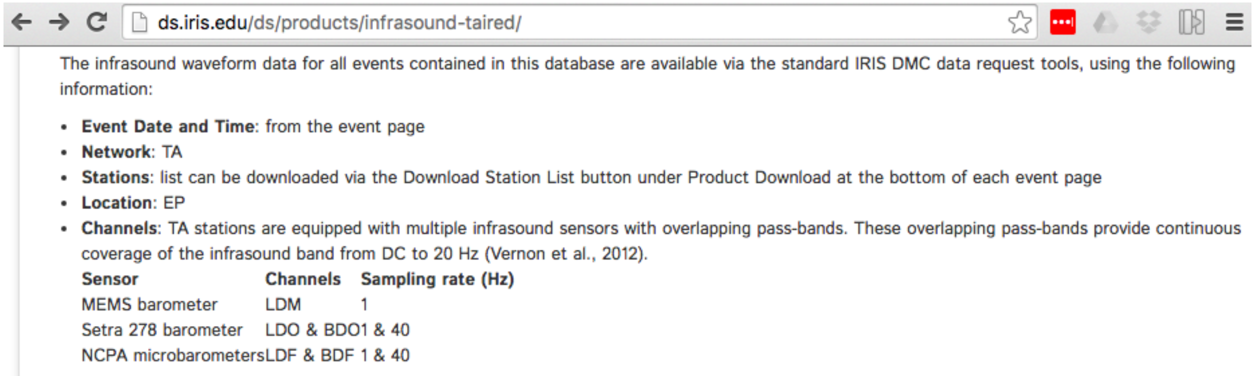
Find a tornado time for the state of Georgia:





Visit the IRIS website and find out what channel codes correspond to pressure sensors:



The infrasound waveform data for all events contained in this database are available via the standard IRIS DMC data request tools, using the following information:

- **Event Date and Time**: from the event page
- **Network**: TA
- **Stations**: list can be downloaded via the Download Station List button under Product Download at the bottom of each event page
- **Location**: EP
- **Channels**: TA stations are equipped with multiple infrasound sensors with overlapping pass-bands. These overlapping pass-bands provide continuous coverage of the infrasound band from DC to 20 Hz (Vernon et al., 2012).

Sensor	Channels	Sampling rate (Hz)
MEMS barometer	LDM	1
Setra 278 barometer	LDO & BDO	1 & 40
NCPA microbarometers	LDF & BDF	1 & 40

Note here that the network is TA, which is the EarthScope Transportable Array. This is an array of about 400 seismic stations which has been marching across the lower 48 states for the last 10 years (and is now moving to Alaska). Each station is deployed for 2 years, and many have co-located pressure sensors, for recording low frequency sound waves. The relevant channel names are BDO and BDF for high sample rate data (40 Hz) or LDO, LDF and LDM for low sample rate data (1 Hz). Note: the 1-Hz data might be good enough for tornado analysis, but I assume below that you want the 40-Hz data.

If you have GISMO installed, then you also have the irisFetch program. To find stations with pressure sensors and download coordinates and other metadata, we use irisFetch.Channels, which tells us to look at irisFetch.Network for a full usage instructions. Get help on this program:

```
>> help irisFetch.Network
```

OK, so we want to see which stations were operating within a 200 km radius of the tornado start point from 7pm to 8pm on 2012-03-02. I assume these are local times, i.e. EST, 5 hours behind UTC, as the scientific community (including IRIS) use UTC. So the actual time to search is 00:00 to 01:00 UTC on 2012-03-03. Let's grab the stations with a BDO and/or BDF channel code:

```
>> s = irisFetch.Channels('channel','TA','*','*','BD*', …
'StartTime', '2012-03-03 00:00:00', …
'EndTime','2012-03-03 01:00:00', …
'radialcoordinates',[33.87 -85.30 km2deg(200) 0])
```

The output variable, s, is an array of structures. It has 12 elements. Its fields are:

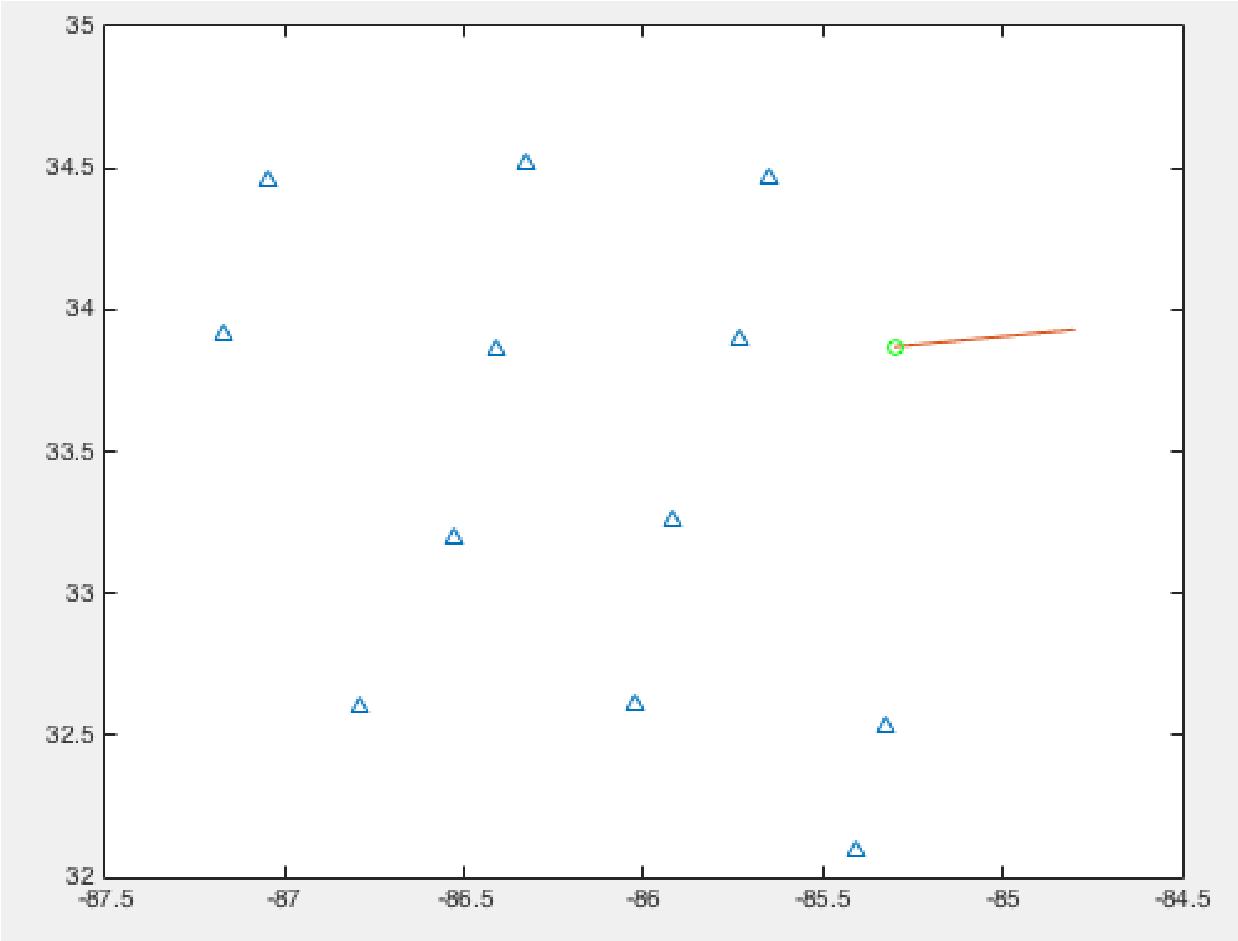
NetworkCode StationCode LocationCode ChannelCode NetworkDescription StationName Site Latitude Longitude Elevation Depth Azimuth Dip SampleRate SampleRateRatio StartDate EndDate Description Type	Response SensitivityFrequency SensitivityUnitDescription SensitivityUnits SensitivityValue Equipment StorageFormat ClockDrift DataLogger Sensor PreAmplifier ExternalReference CalibrationUnits DataAvailability RestrictedStatus AlternateCode HistoricalCode StationDescription

Make a simple map of the station coordinates:

```
>> lat = [s.Latitude];
>> lon = [s.Longitude];
>> plot(lon,lat,'^')
```

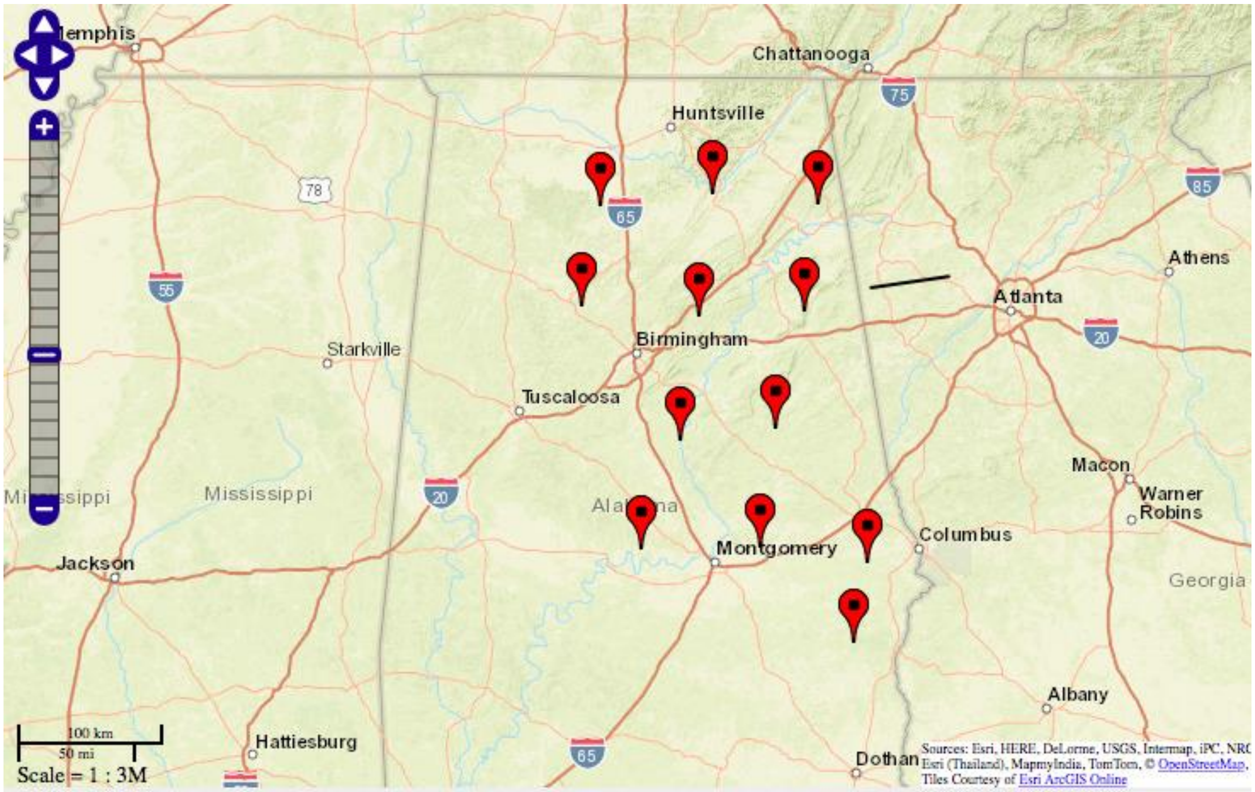
Add the tornado start and end points:

```
>> hold on
>> plot([-85.3 -84.8], [33.87 33.93])
>> plot(-85.3,33.87,'go')
```



A more sophisticated map:

```
>> p = geopoint(lat, lon);
>> h1 = webmap();
>> wmmarker(p)
>> wmline([33.87 33.93], [-85.3 -84.8]);
```



OK, but what we really want is the waveform data. How do we get that?

We always get waveform objects by defining:

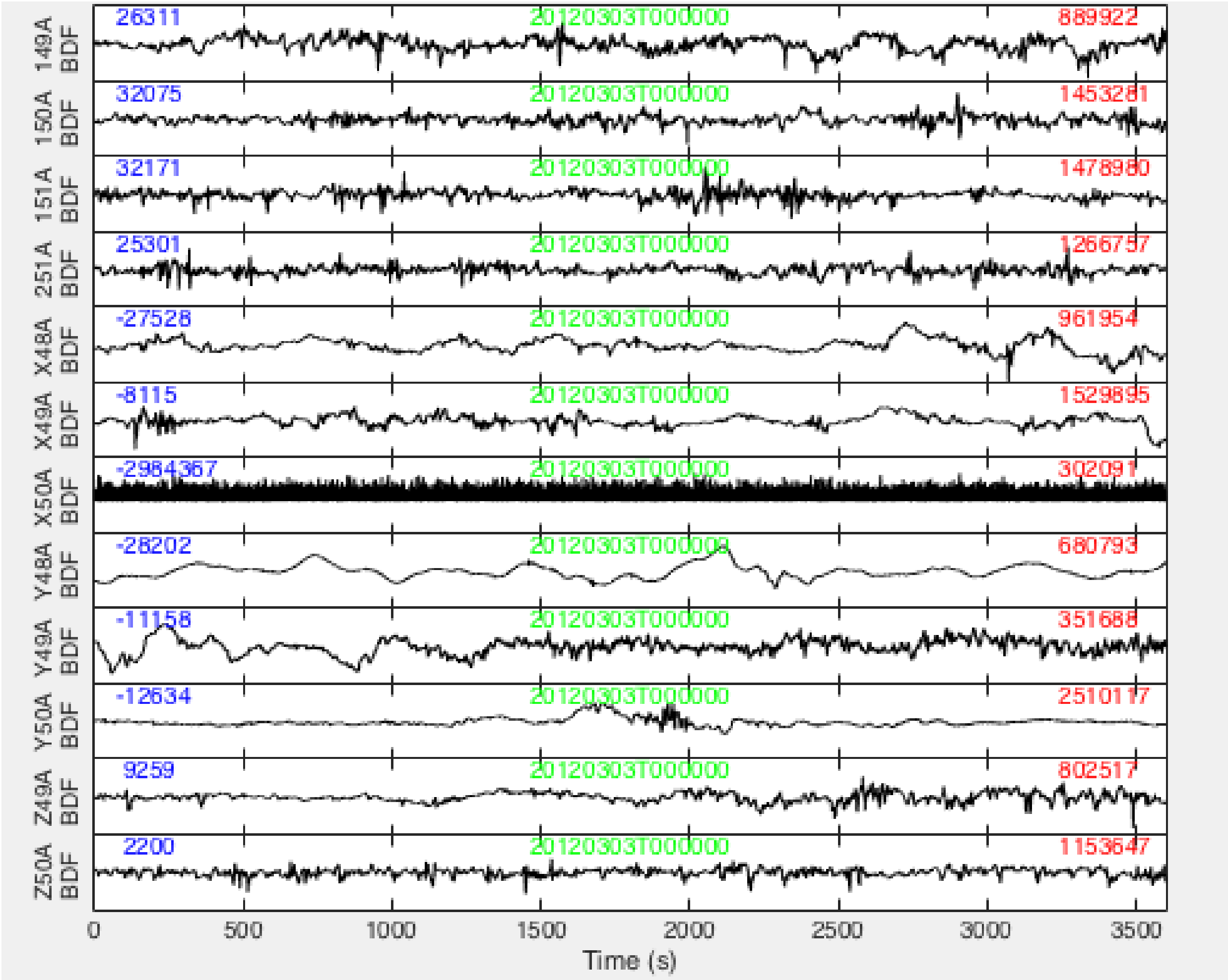
- A datasource – in this case irisdmcws (IRIS Data Management Center web services)
- An array of ChannelTag objects, containing the network, station, location and channel codes to retrieve
- A start time and an end time

```
>> nscl = ChannelTag.array({s.NetworkCode}, {s.StationCode},
{s.LocationCode}, {s.ChannelCode})
>> startTime = datenum(2012,3,3,0,0,0);
>> endTime = datenum(2012,3,3,1,0,0);
>> w = waveform(ds, nscl, startTime, endTime);
```

This will take a few minutes (lots of data), but eventually we get back 24 waveform objects, each containing 1 hour of data. There are 12 stations, and a BDO and BDF sensor at each.

Let's just plot the BDF stations for now – these are the odd number-indexed waveform objects, w(1), w(3), …, w(23)

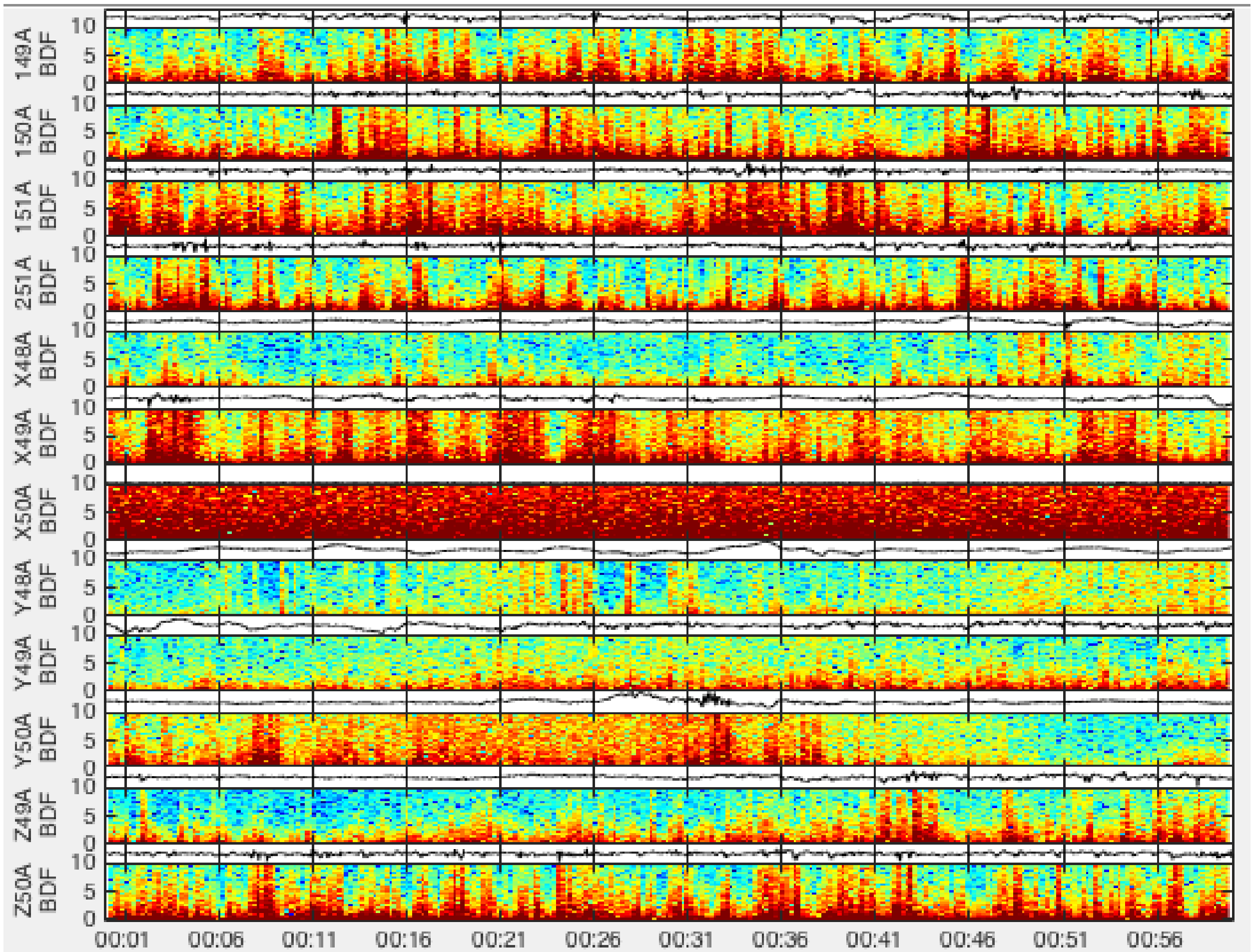
```
>> plot_panels(w(1:2:24))
```



We can immediately see that X50A.BDF is malfunctioning. The other waveforms look reasonable.

What about spectrograms?

```
>> spectrogram(w(1:2:24))
```



OK, so this gets us started.

The next things to look at are (i) data quality and (ii) cross-correlation. This will take some work.

IRIS does have a service called MUSTANG which is supposed to automatically compute some data quality parameters and may even return cleaned data (I'm not sure). Also, some infrasound colleagues of mine might have MATLAB codes that compute their preferred data quality metrics.

There are cross-correlation codes built into GISMO, but I didn't write them and have never used them, so to me they are currently the most mysterious part.