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Sandia National Laboratories

INPULSE

INfrasound Processing WorkFlow SoftwarE

Version 1.21
Build 2012.09.11
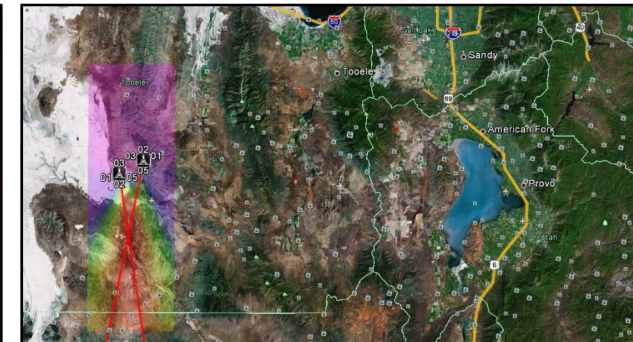
Infrasound Processing Workflow Software (INPULSE)
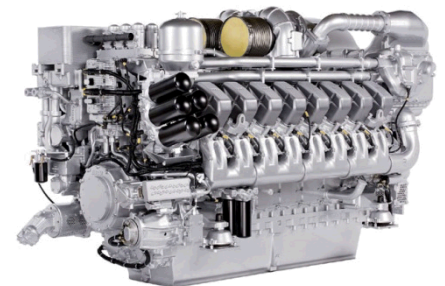
An Infrasound Analysis Tool

What is Infrasound?
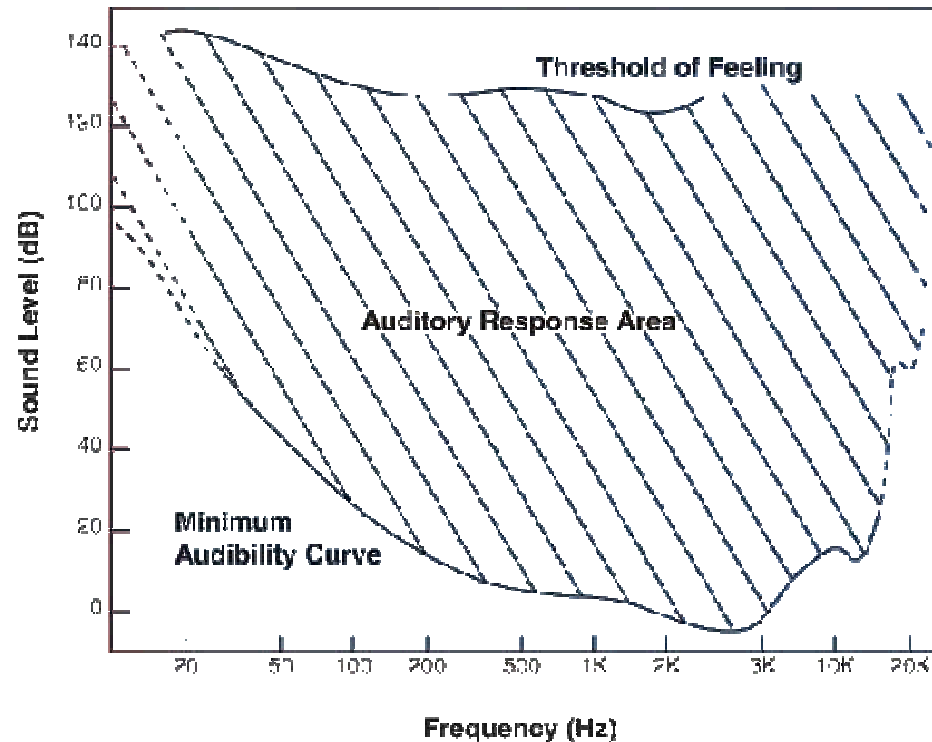
- Infrasound is sound with a frequency of less than 20Hz – too low for the human ear to detect at any volume.

- Very low attenuation over vast distances – can be detected hundreds of miles away.

Common Sources of Infrasound

Natural

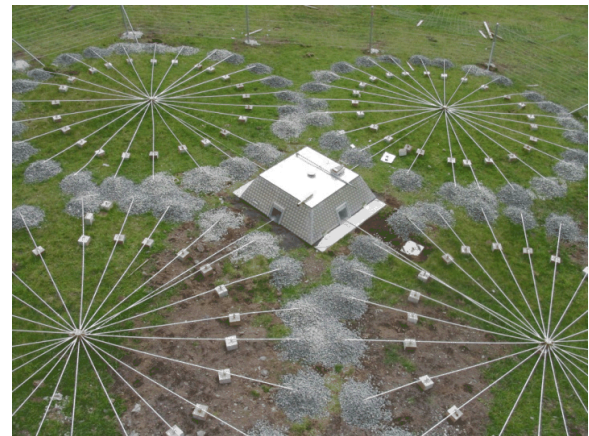- Ocean Surf
- Aurorae
- Severe Weather

Man-made

- Aircraft
- Diesel Engines
- Explosions

Infrasound Monitoring

- We can passively detect and locate infrasound sources using arrays of infrasound microphones.

- This can be done for large events (such as nuclear explosions) on a global scale, or smaller events on a regional scale.
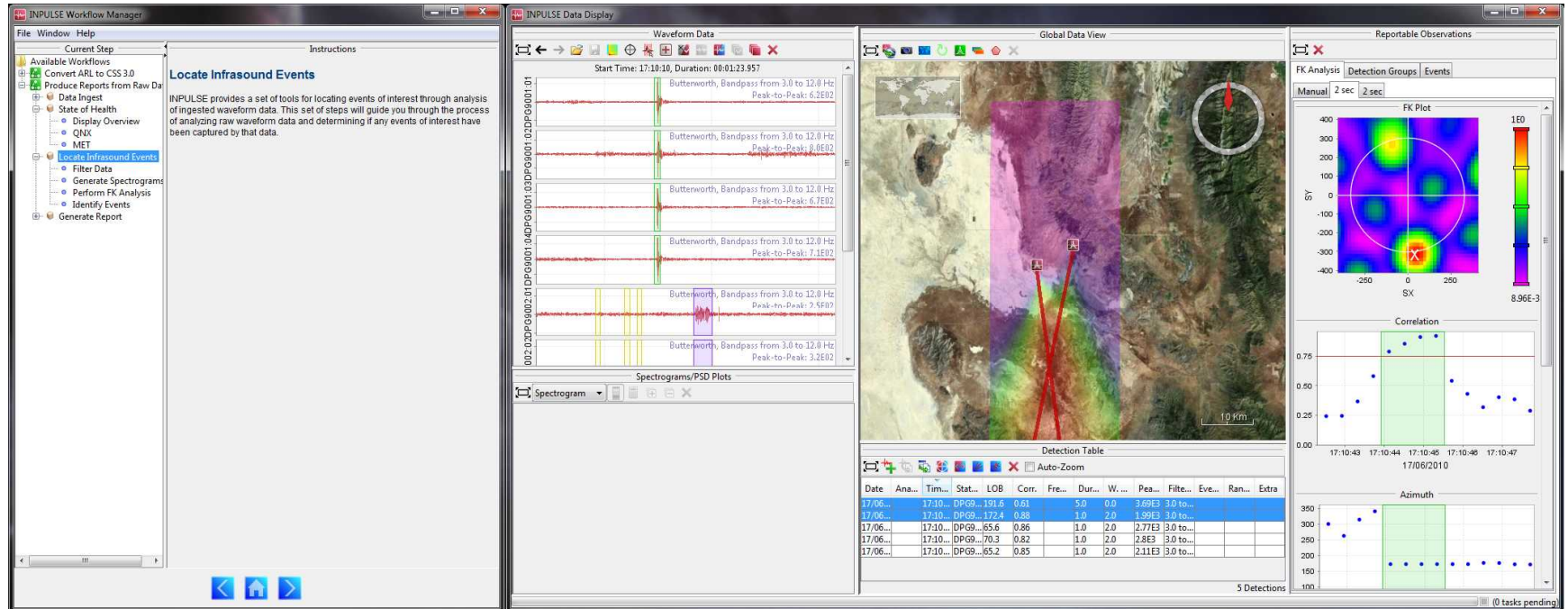
Why INPULSE?

- Infrasound data analysis is complicated.

- Only a very limited set of tools are available and all are geared towards the highly-technical user.
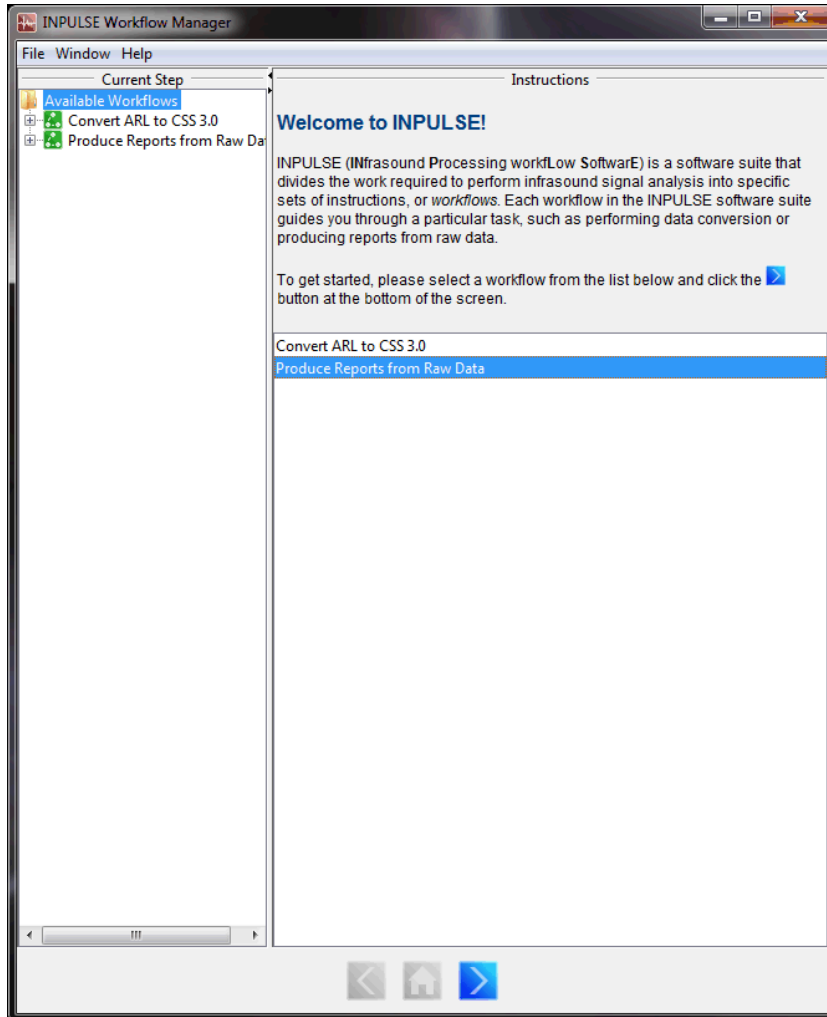
- We need something simpler to use.
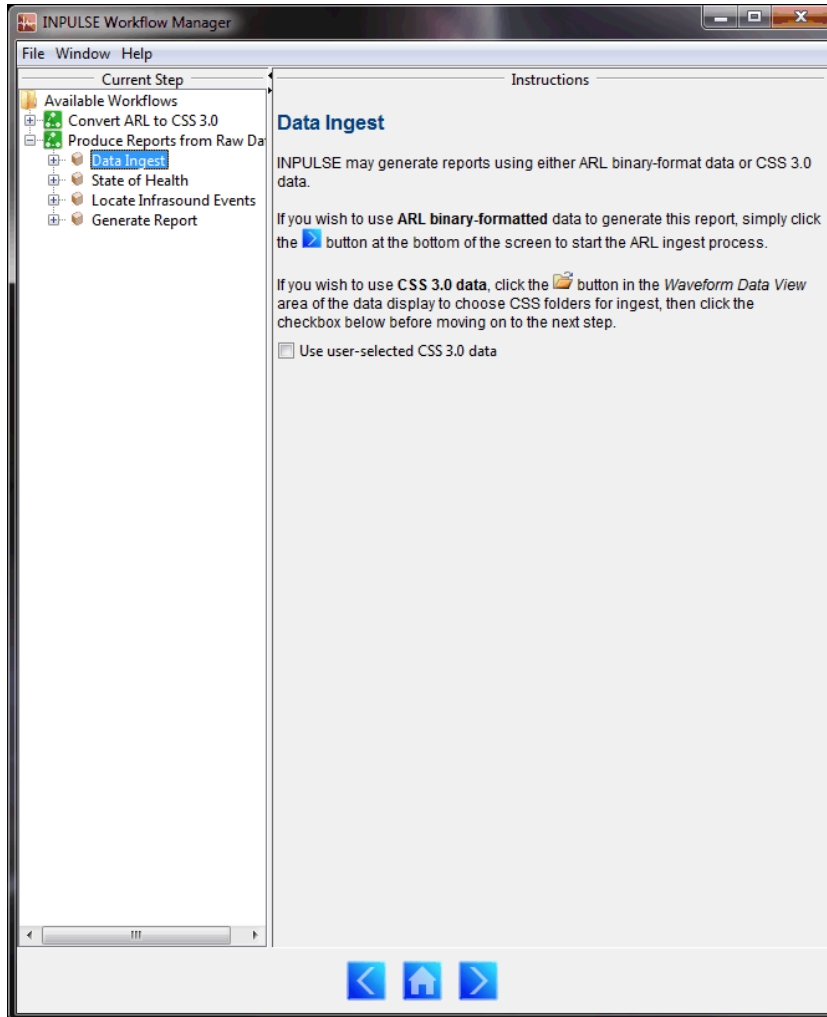
INPULSE Demo

User Interface

- Workflow Manager (left) provides step-by-step instructions for producing reports from raw data.

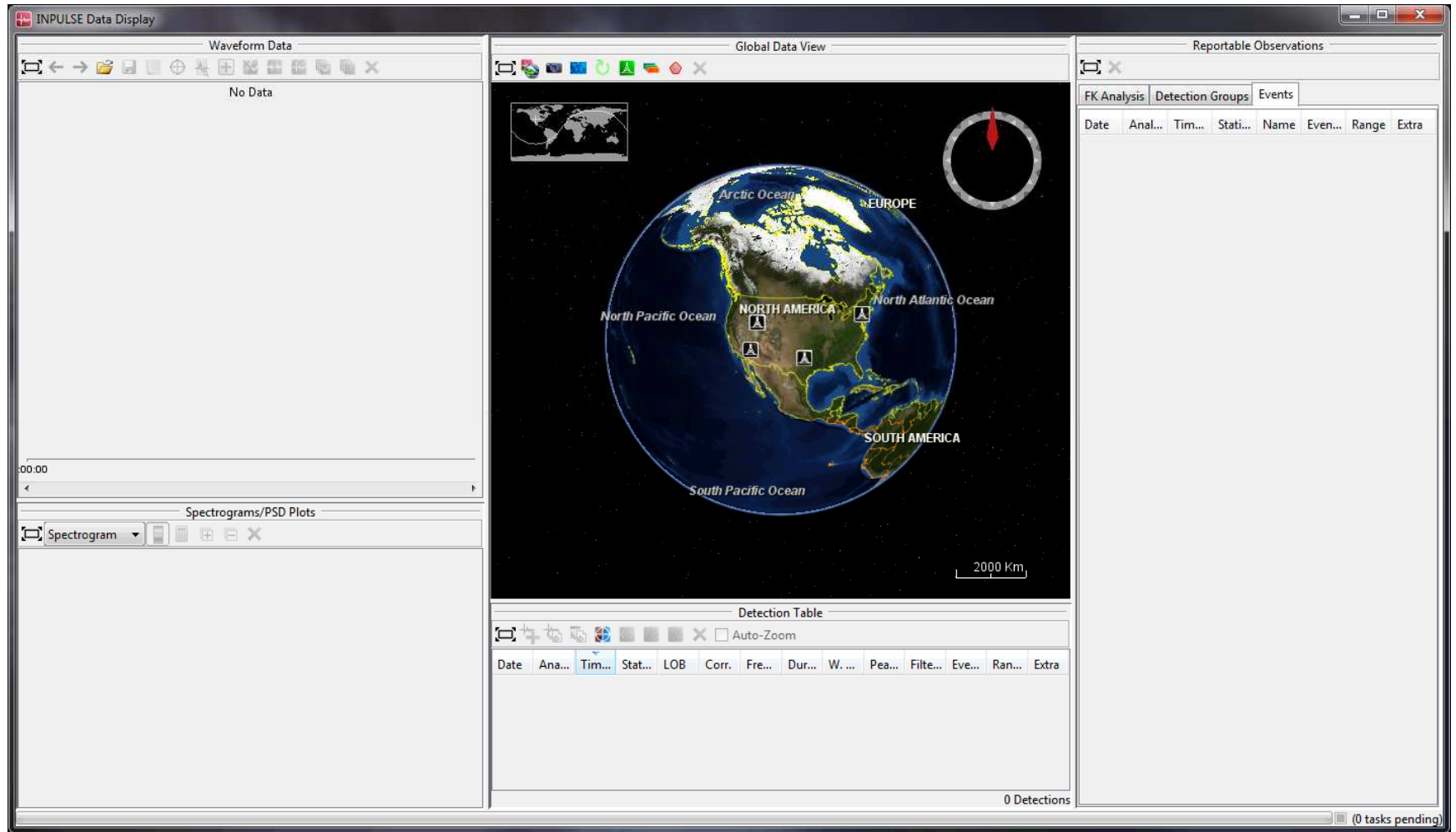- Data Display (right) shows analysis results.

Workflows

- Guides the user through complex tasks.

- Instructions include embedded controls.

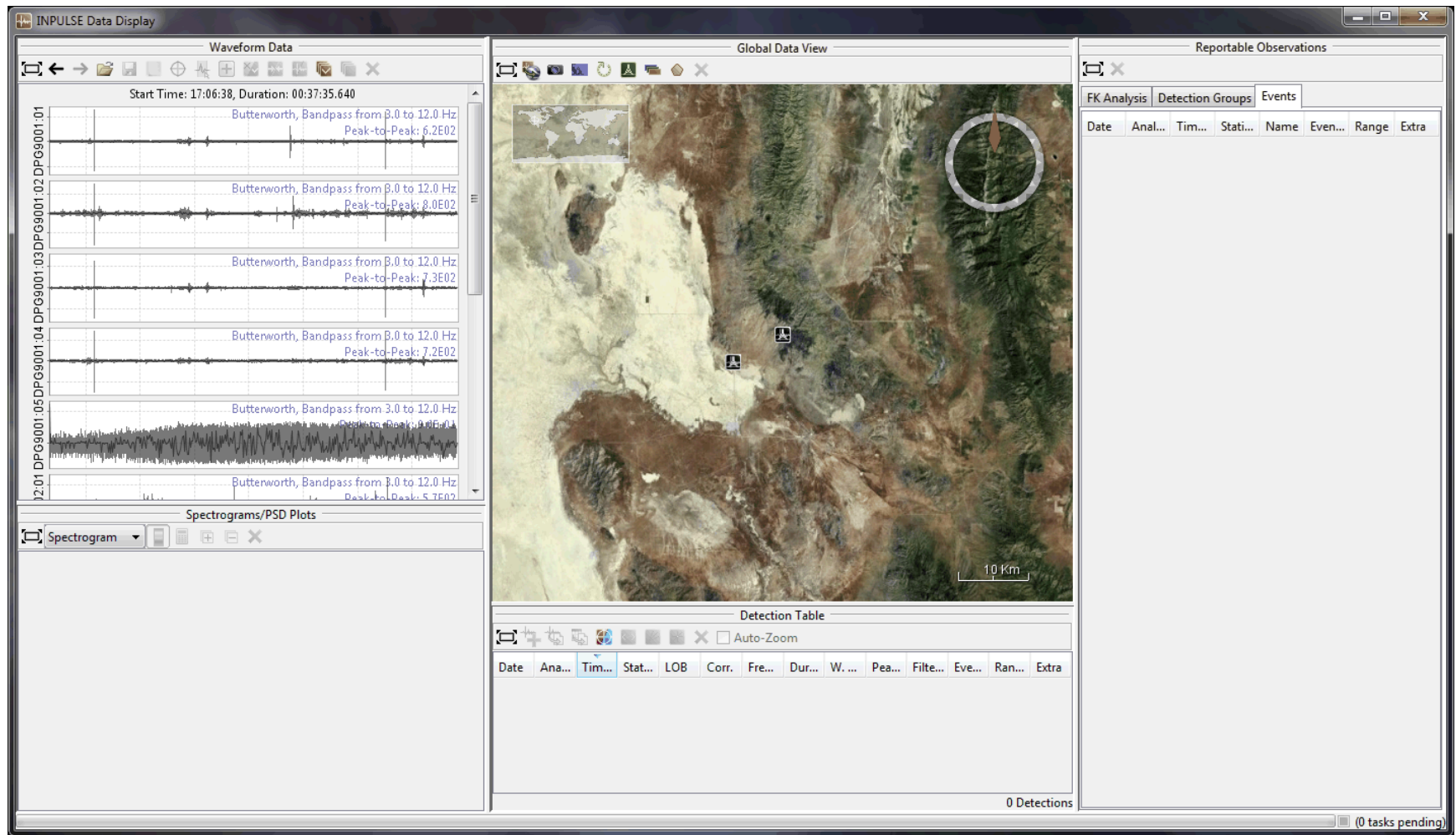- Prevents the user from skipping important steps.

Report Generation

- First step is to load waveform data from disk.
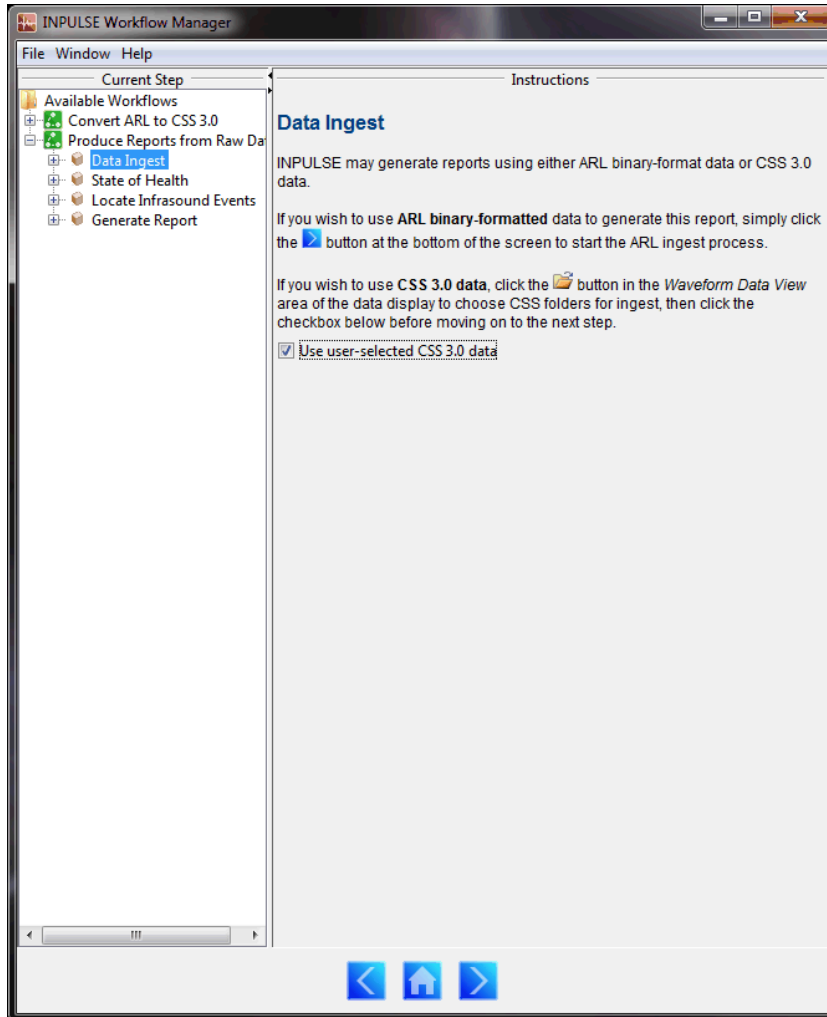
- Supports CSS3.0 and ARL binary format.
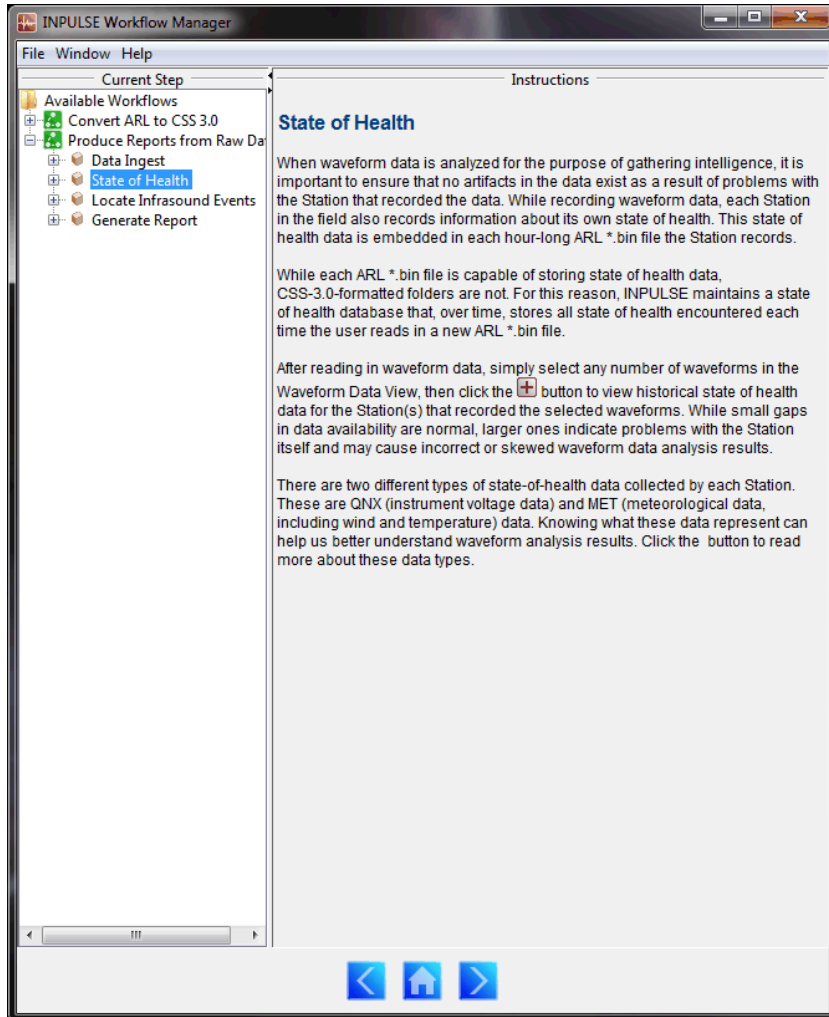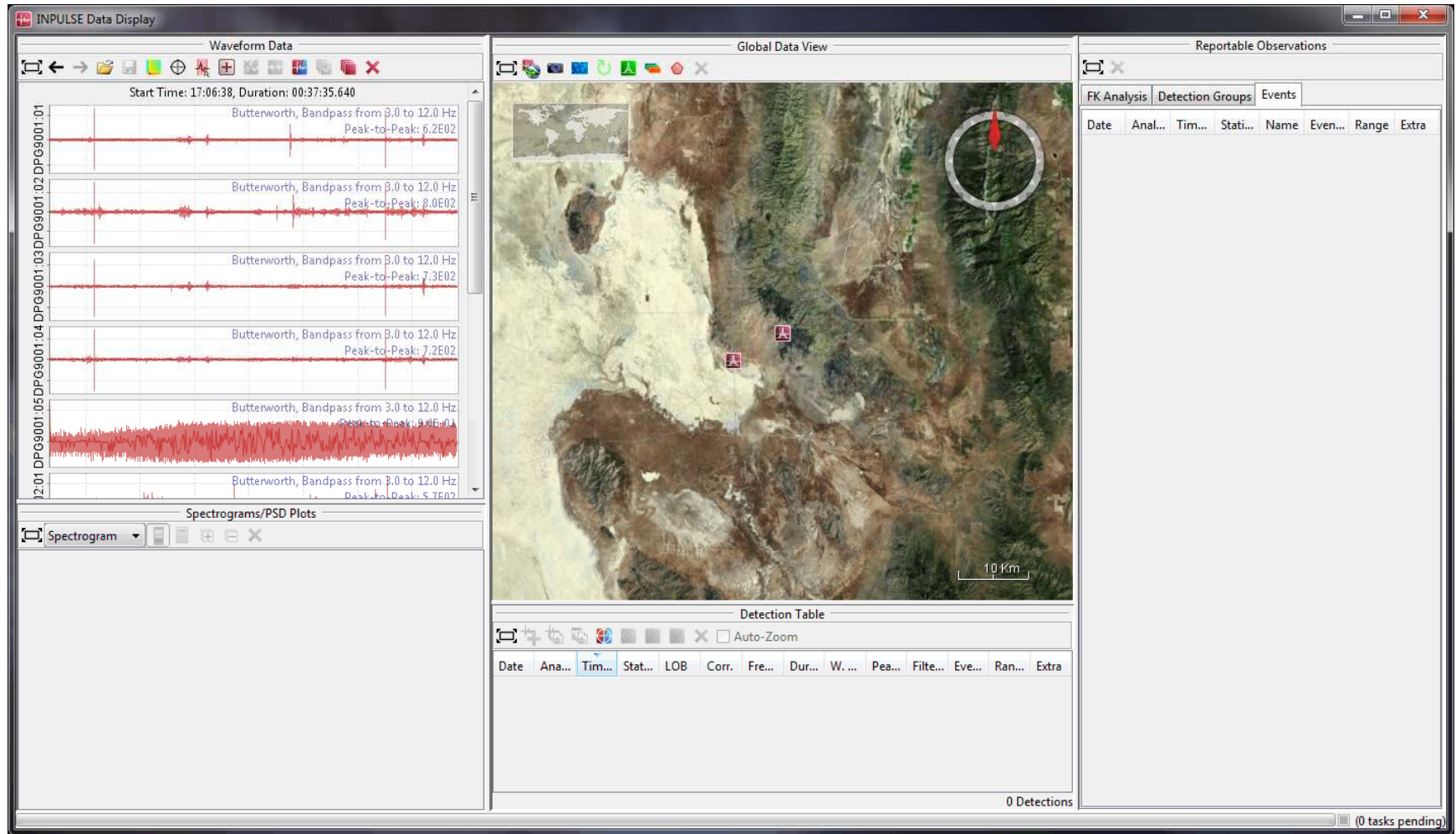
Data Display

Data Display

Data Ingest

- Now that we have CSS data loaded into the data display, we can continue to the next step.
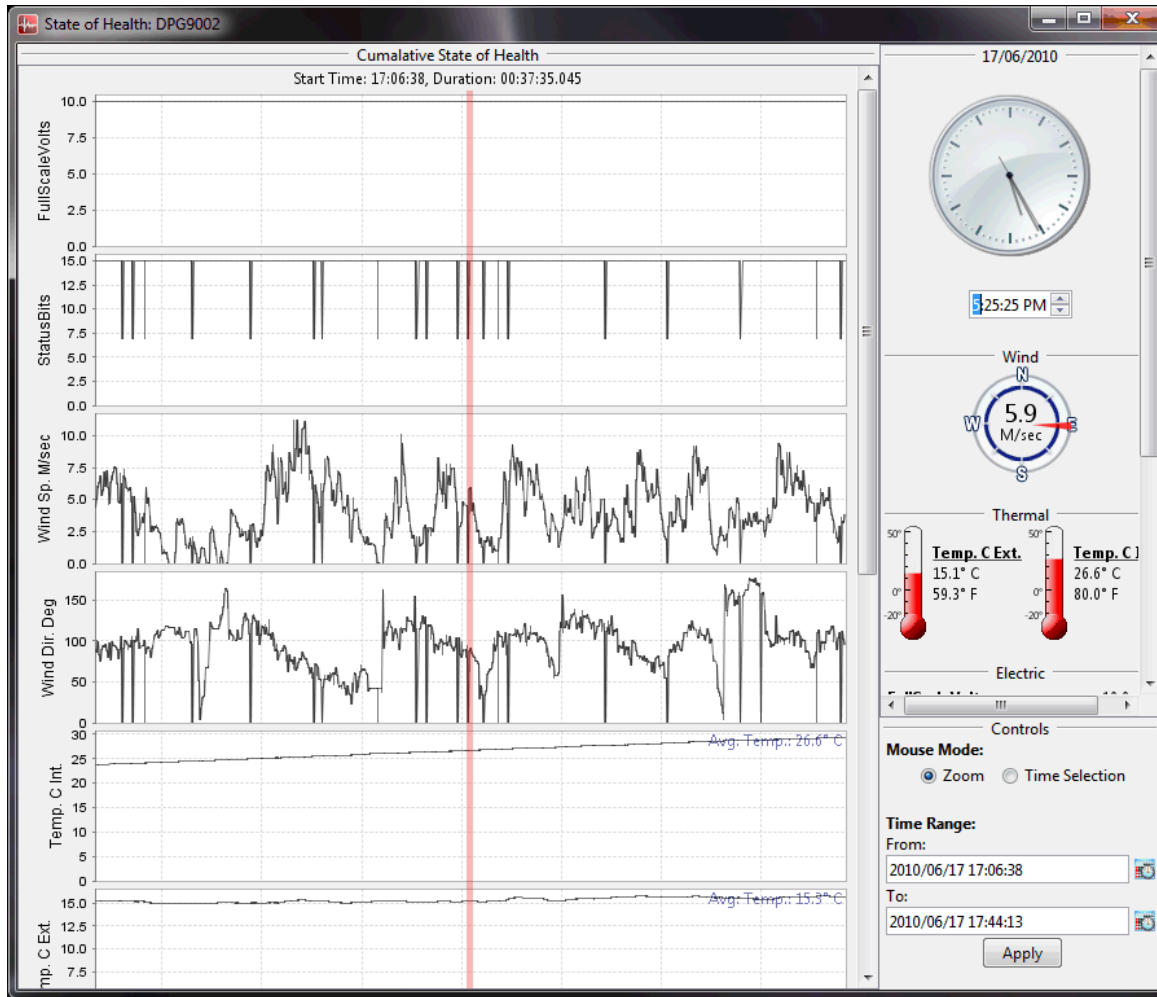
State of Health

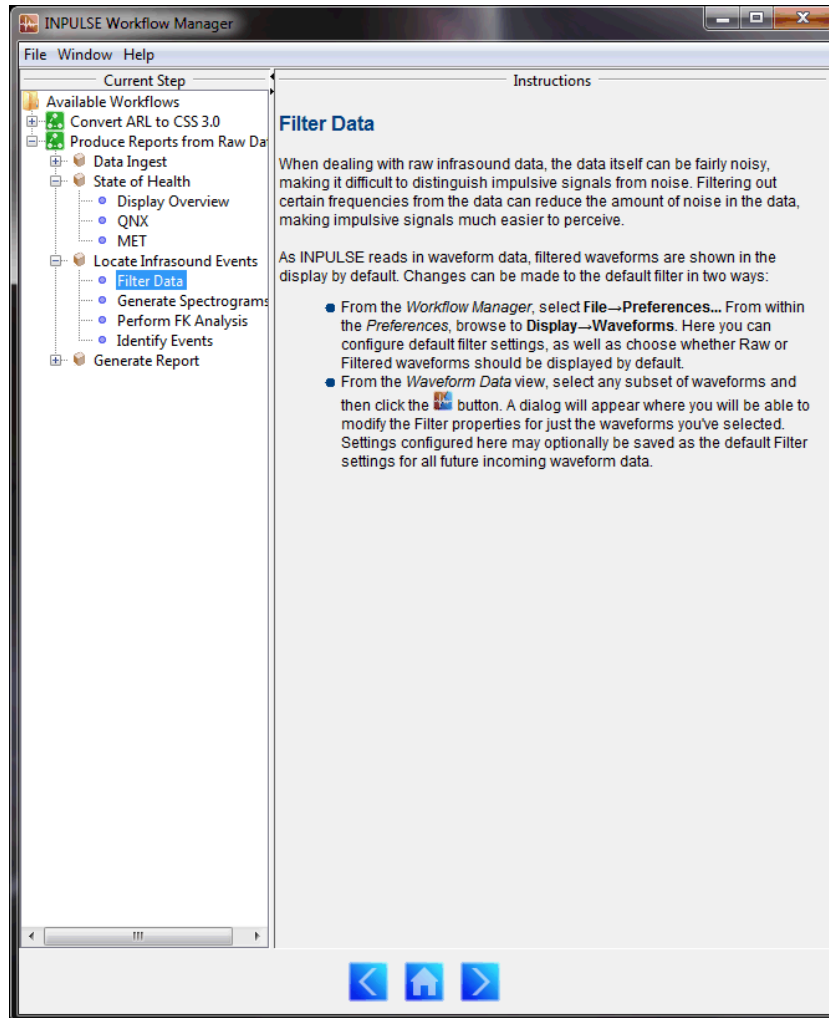- We can now check the state of health of the data we just loaded.
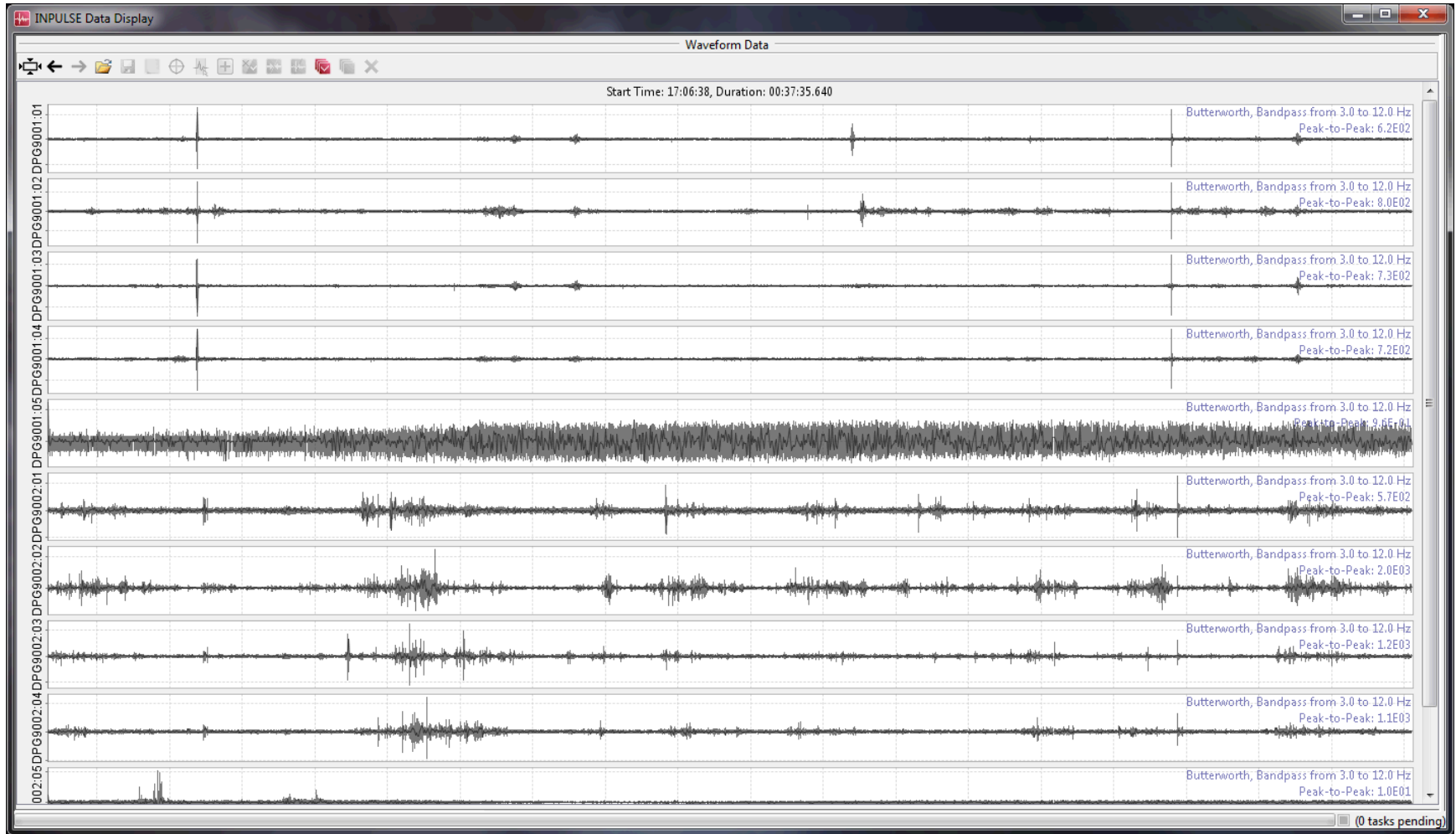
State of Health

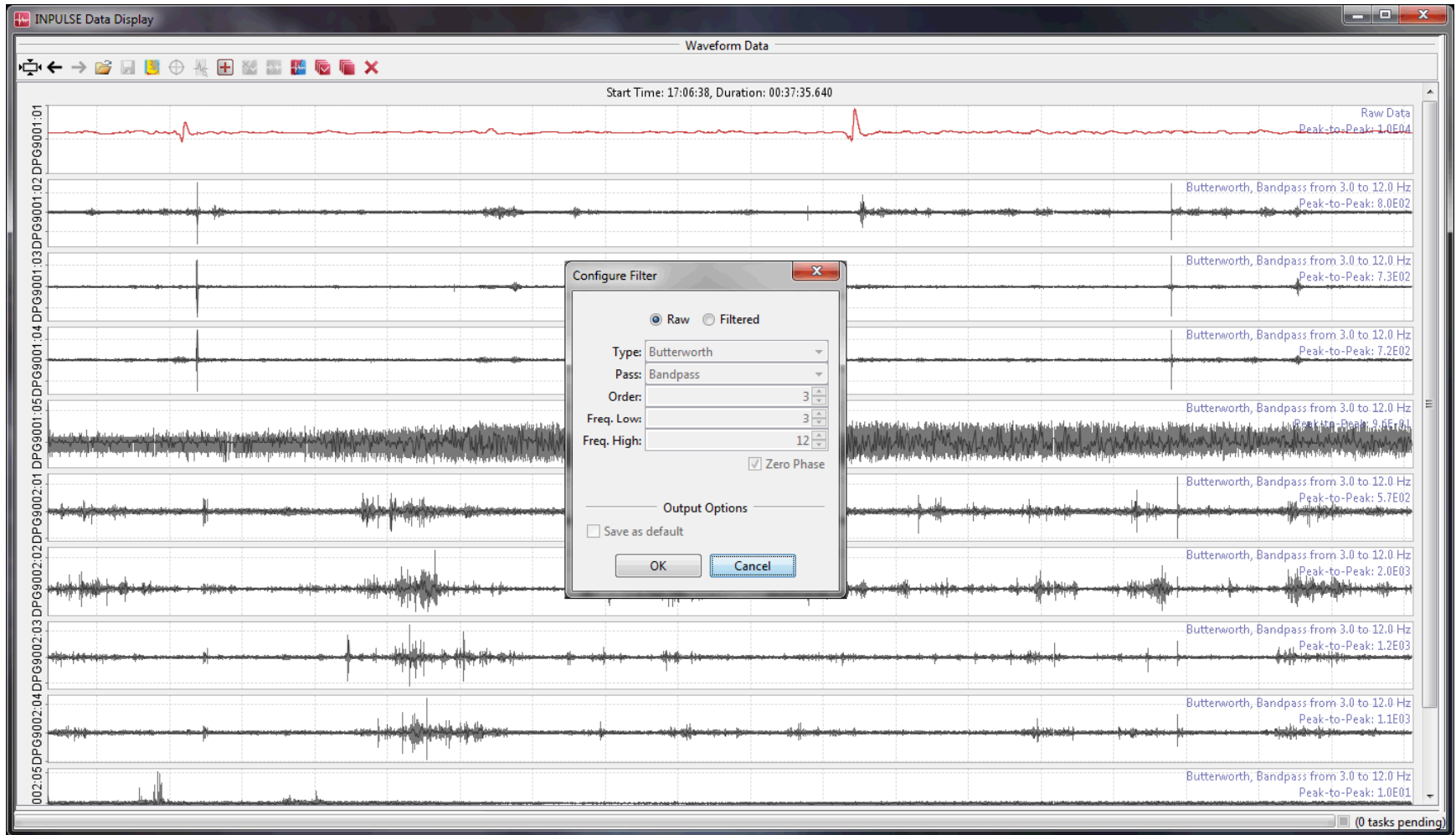# State of Health

Waveform Filtering

- Raw waveform data can be very noisy!

- If we know what frequencies should be present in the kinds of events we're looking for, they will be easier to spot if we filter the data first.
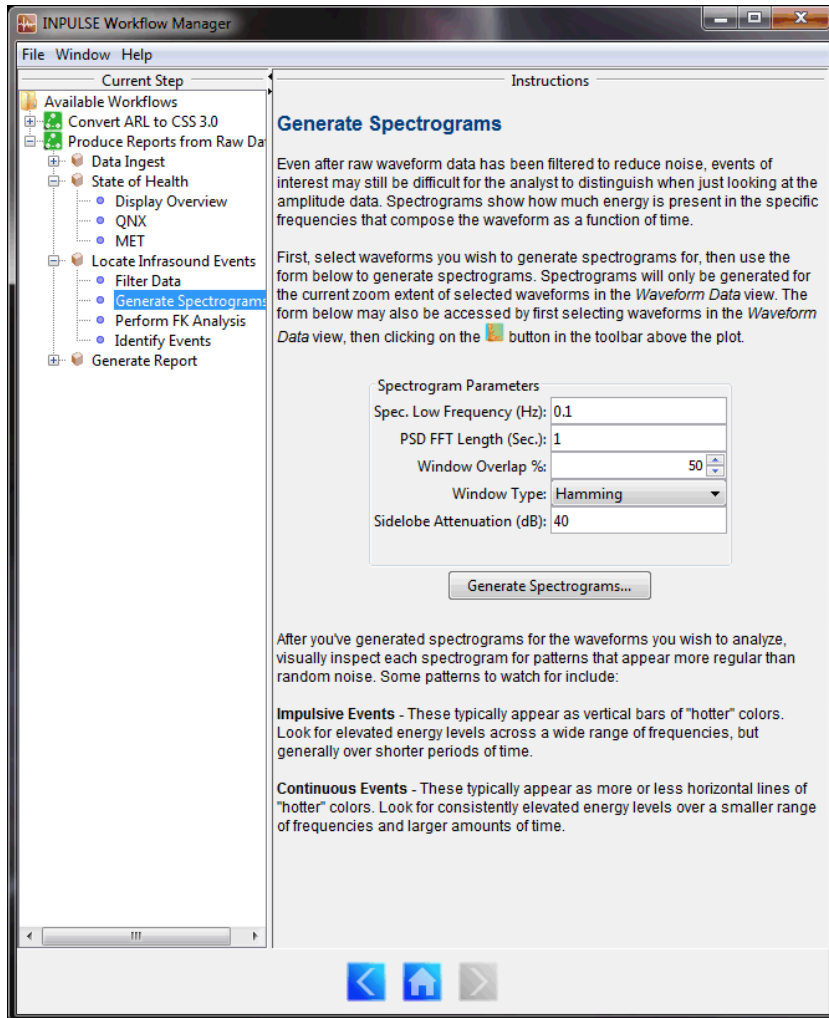
Waveform Filtering
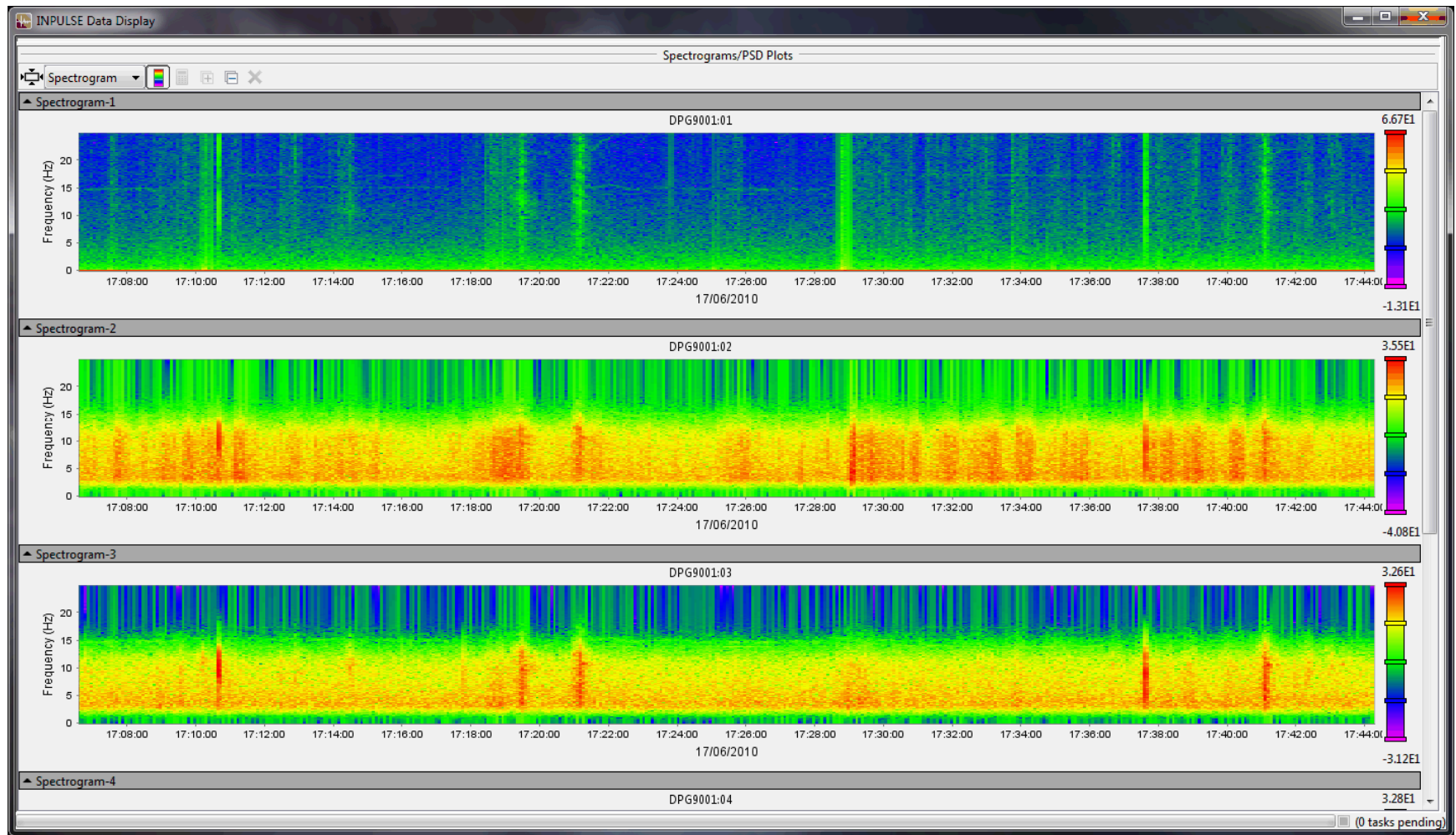
Waveform Filtering
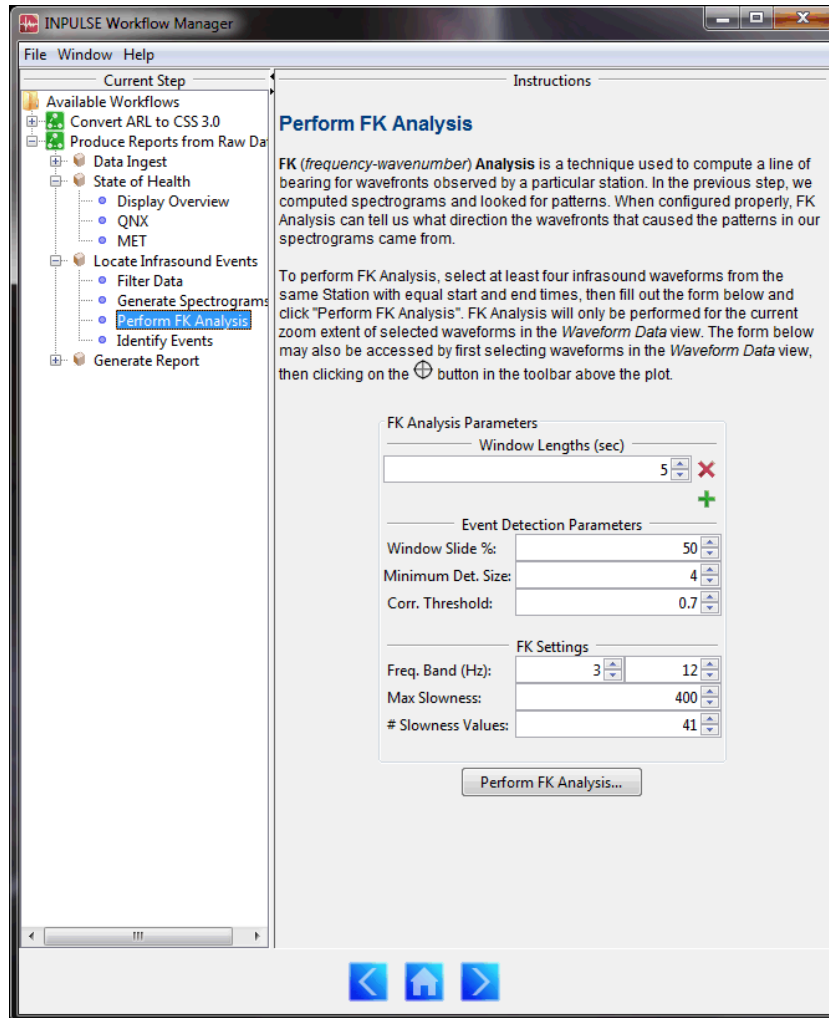
Generate Spectrograms

- In order to characterize events we see in the amplitude display, we need to examine their frequency content.

- We can do this by generating spectrograms.
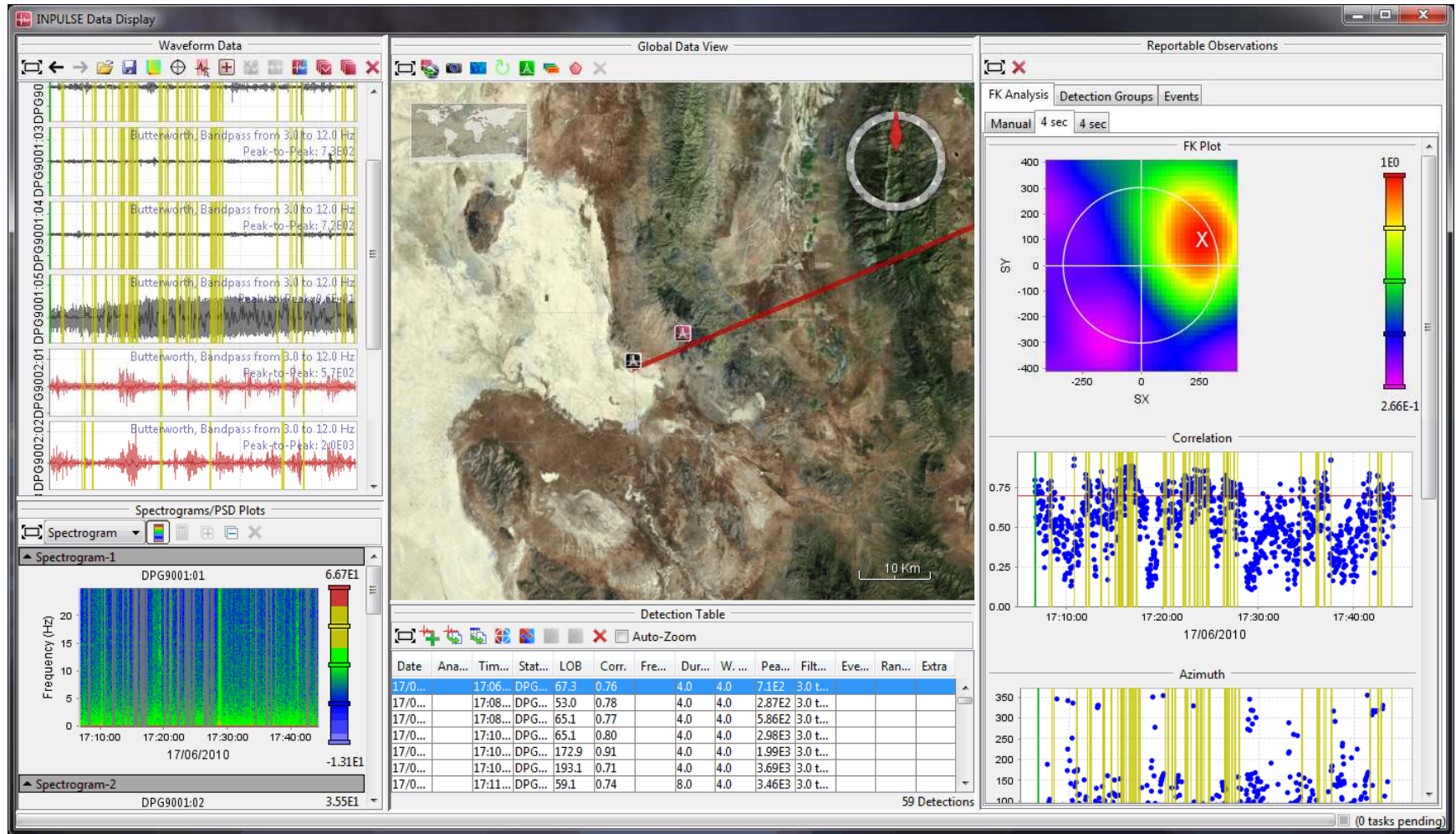
Generate Spectrograms
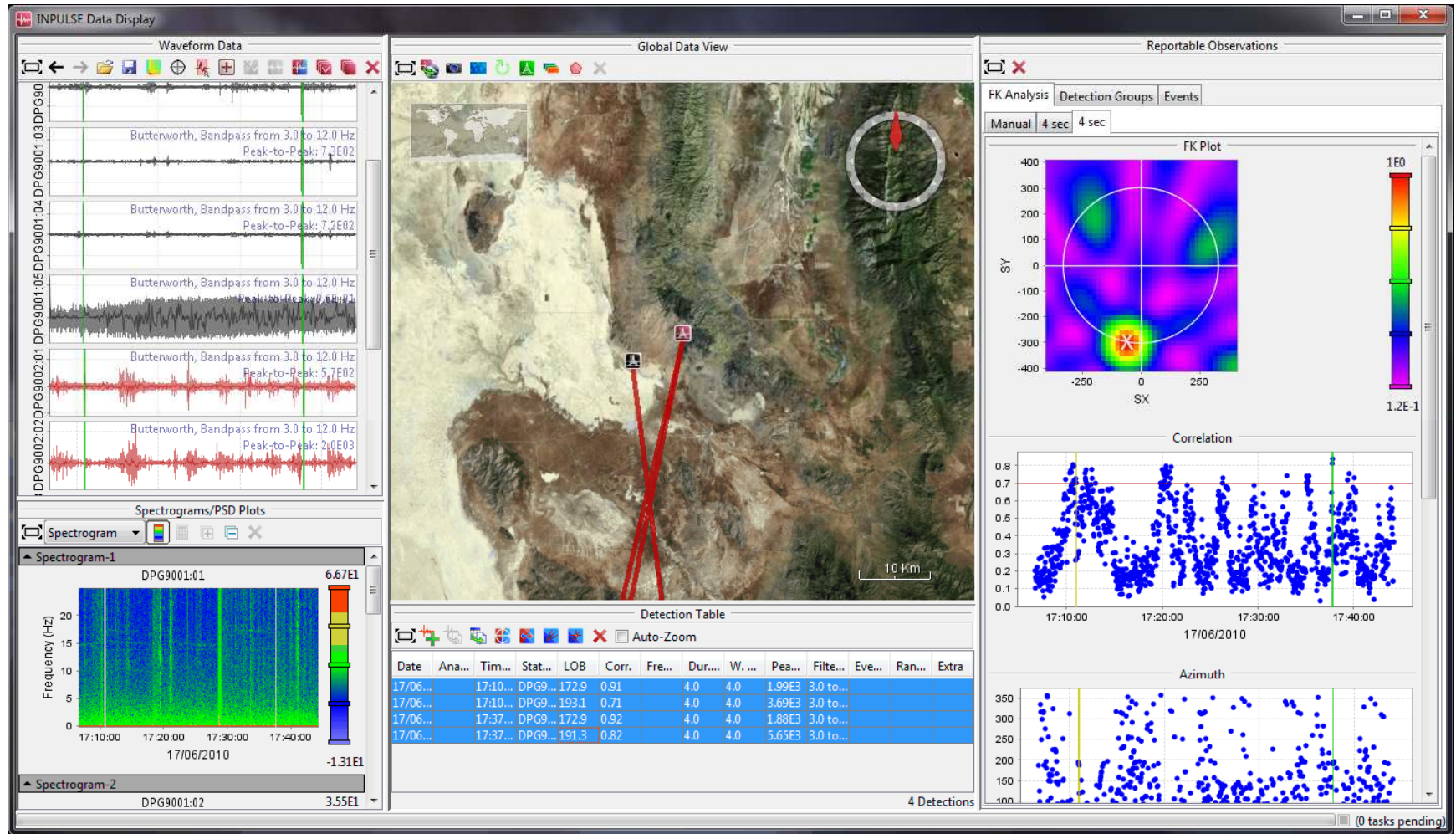
Perform Fk Analysis

- Fk (*frequency/wave-number*) analysis gives us a line of bearing for a given signal.

- Stations that "heard" the same thing will give us crossing lines of bearing and a rough location for the source.
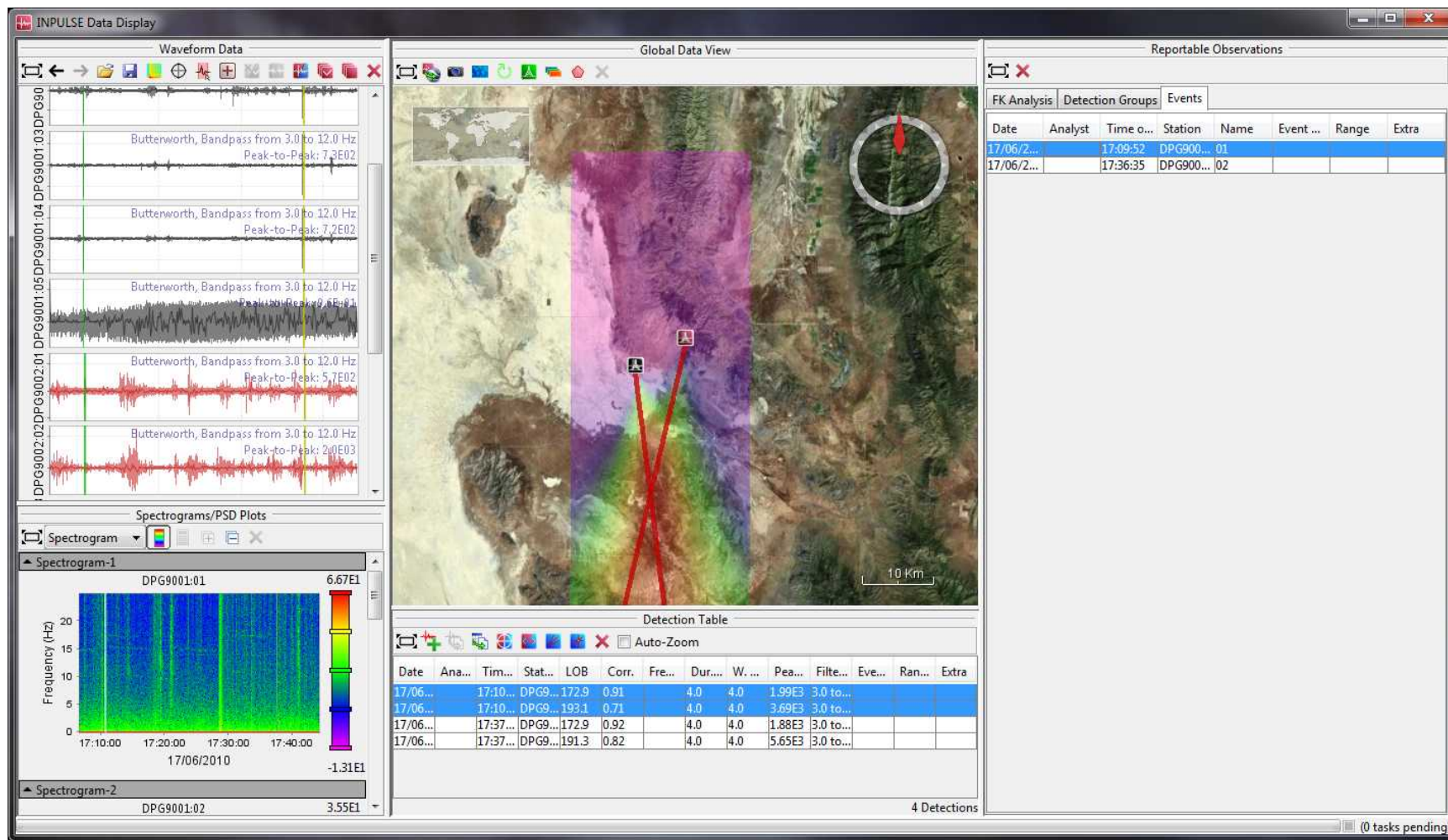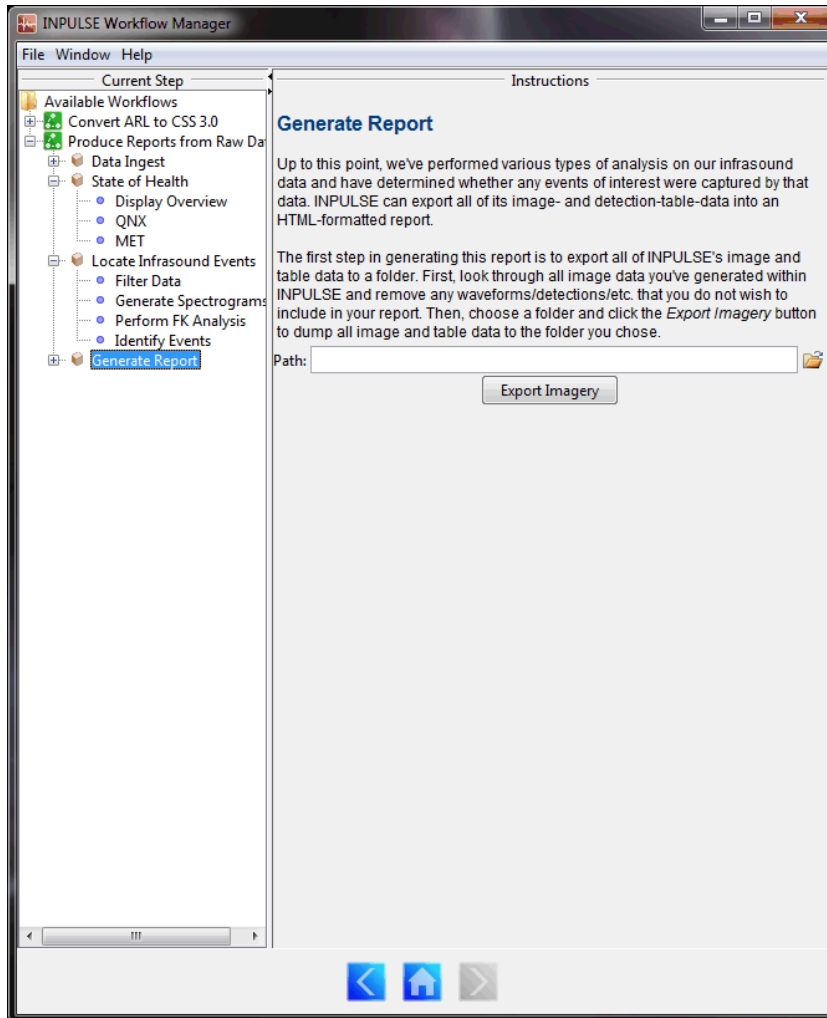
Fk Analysis Results

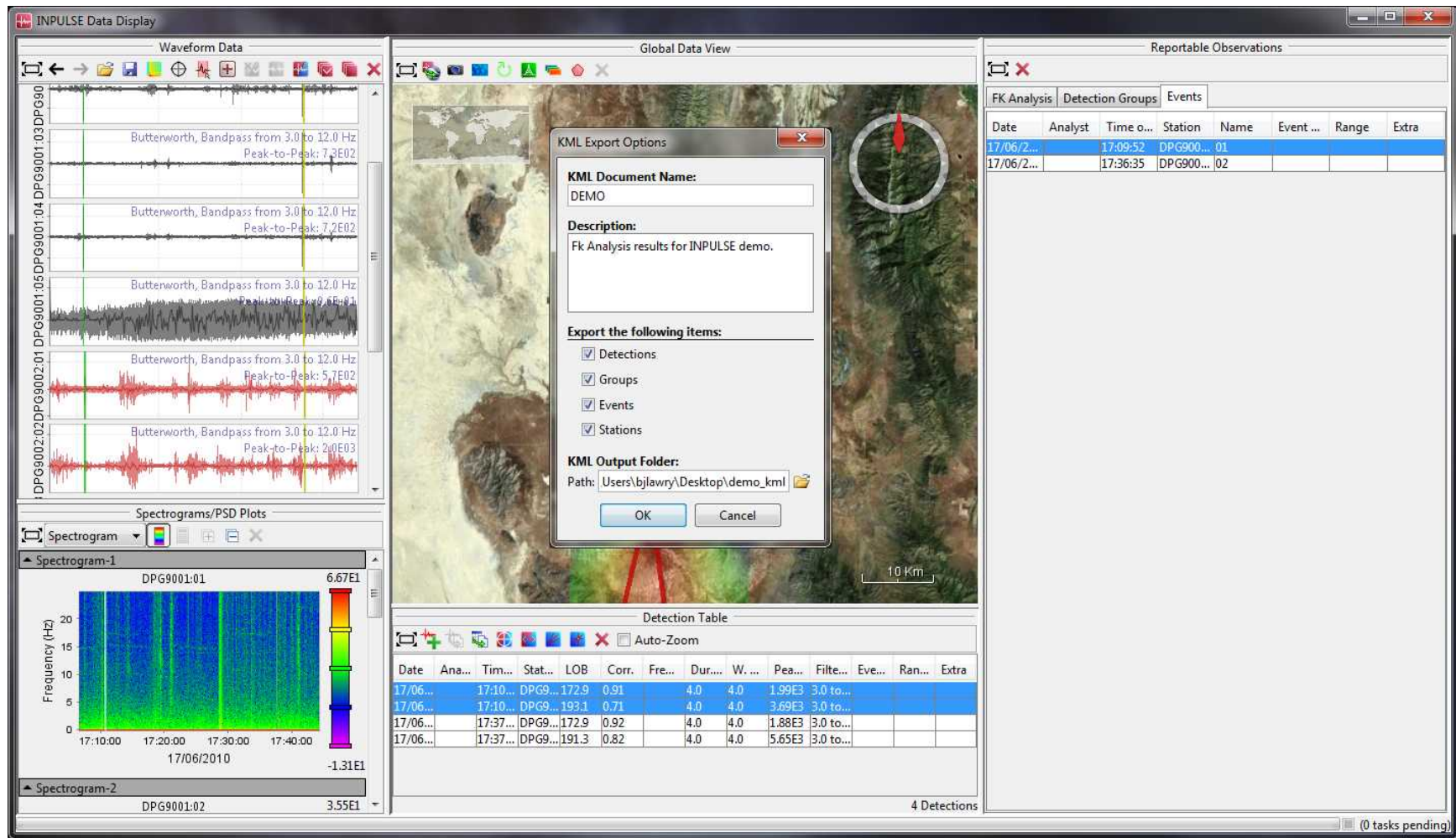# Refine Results

Associate Arrivals

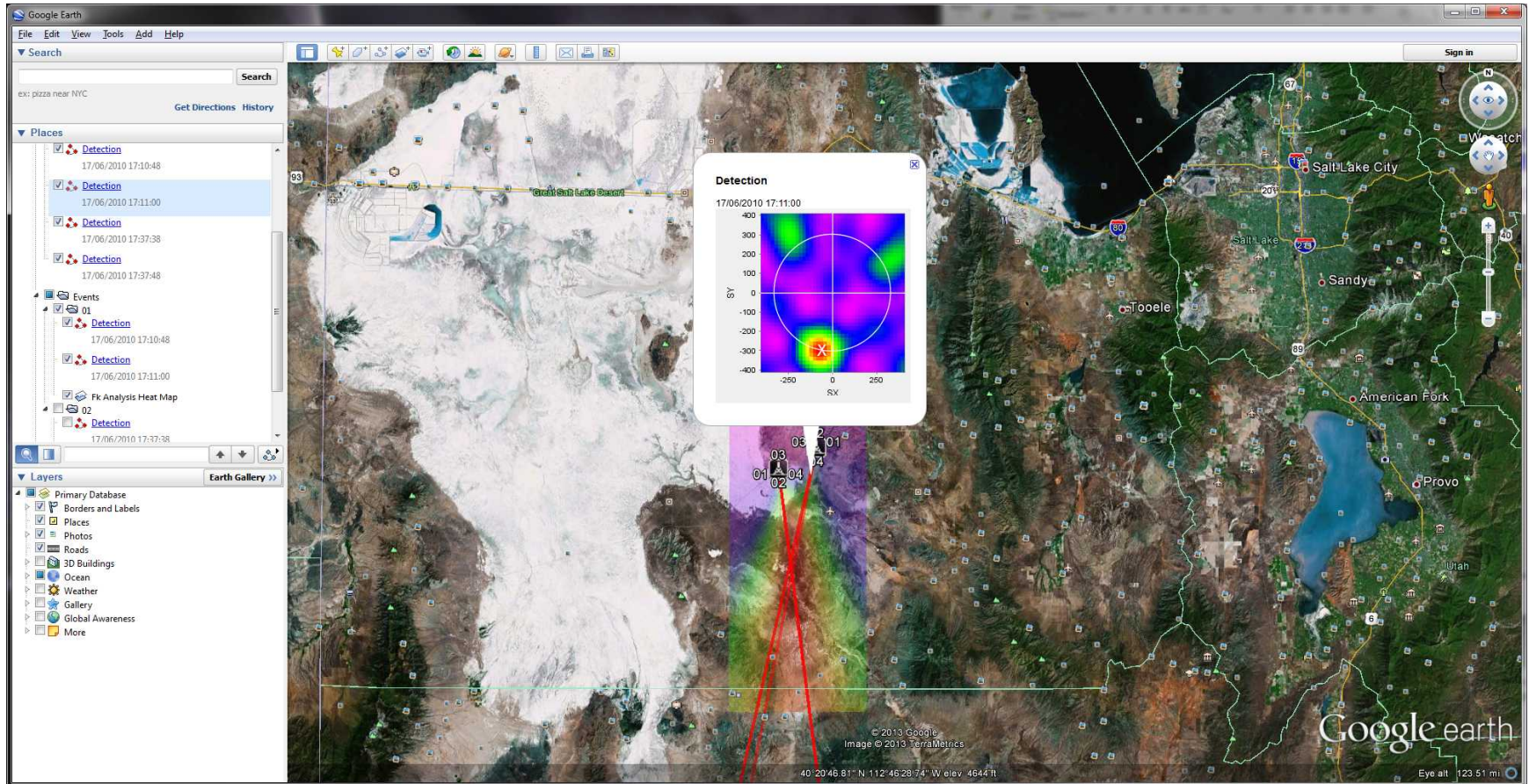# Export Report: Imagery

- Dumps all plots, map views, and the entire detection table/events list to a folder of images.

Export Report: GoogleEarth KML

Export Report: GoogleEarth KML

Summary

INPULSE Provides:

- Simplified approach to infrasound signal analysis
- State-of-the-art mapping utilities for geographic context
- Rapid generation of reports from raw data