Why We Study Infrasound

The Department of Geological Sciences at Southern Methodist University is conducting local and regional seismic and acoustic experiments in the western United States. The sources of seismic and acoustic energy will be from explosions to fragment rock in the copper mines in Arizona. The array is near the mines. Near source instrumentation within the mine provides the chance for combined studies with mine engineers to study the relationship between near source seismic signatures, fragmentation efficiency, and explosive charge.

What is an Array?

An array is a combination of instruments working in harmony to record atmospheric and solid earth waves. Arrays are unique to areas depending on what is being measured. An array is generally compact and designed to be shipped easily. They are standalone, which means they can be operated for months without attendance. Arrays play an important role in quantifying source and propagation characteristics for both atmospheric and ground waves. Acoustic properties are measured by their frequency. The characteristics of the waveforms generated by sources, such as mining explosions, is the main purpose for installing arrays. The Wupatki Array was installed on April 30 through May 3, 2001 to ensure the detection and determination of mining explosions as a source with comprehendible waveform characteristics.

Microbaragraph and Manifold

The black hoses connected to the manifold are the noise reduction hoses. The white cylinder object is the microbaragraph. The microbaragraph serves as a sensor for all incoming noise.

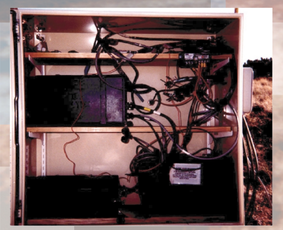
US Seismo-Acoustic Network

Map illustrating the existing and proposed stations that will make up the Western US seismic-acoustic network. Seismic-acoustic stations are shown as red flags, seismic only as purple triangles, and sources as blue pins.

Instrumentation

A total of 500 pounds of equipment was shipped from Dallas to Albuquerque for this array. It was transported by pick-up to Flagstaff, close to the final installation location. The instruments include an anemometer, digitizer, cables, solar panel, microphones, and sensors. Data archival is possible due to a Refraction Technology 72a-06 6-channel 24-bit digitizer equipped with a 4 Gbyte disk. There are four infrasound channels which, are sampled at 40 samples per second. Chaparral microphones are used to record signals. A Texas Electronic anemometer is used to measure amperage and is connected to channel 5. "The data logger and power supply are housed in a standalone solar powered enclosure" (Hayward, 2000). Solar power is provided by a small solar panel, which maintains a 12-volt battery. Soft cables connect the central element of the infrasound array. These cables are rodent proof and steel armored for maximum protection from animals and harsh weather conditions. The cables connect each infrasound sensor to the digitizer. "Each element of the tripartite infrasound array consists of a surface array of ten, 25-ft. porous hoses that connect through a manifold to a Chaparral Model 2 microphone modified for 12-volt operation" (Hayward, 2000). A seismometer is key when propagation of waves are through the ground. The geometry of the array resembles a star. This allows the cables to remain untangled.

Enclosure



This is a safe enclosure, which contains the digitizer, disk, and battery charger. This enclosure is solar powered.

Stand Alone Solar Module

Installation

The installation of an array can be taken in steps. The garden soaker hoses need to be connected to the manifold. The hoses are in a star pattern on the ground. The hoses reduce noise so to put them to better use; they can be placed under shrubs for protection from the wind. The manifold is then connected to the Chaparral sensor. It has to be placed within ten feet of the sensor for best results. The sensor is connected to a digitizer, which is stored inside an enclosure. Also in the enclosure is a 12-volt battery and battery charger. The battery is connected to a solar panel, which gives it energy. In case of a sunless day, energy can be stored for days without running out. This is not usually a problem in the western U.S.

Wind Speed

Preliminary Data

This is preliminary data from the Wupatki array. The high frequency noise on traces 4 and 5 are either aircraft or vehicle noise. The single high frequency noise on trace 1 is either a footstep or a a slam from a vehicle door.

Wind Speed Data

Wind speed recordings for three different hours. The top trace shows several minutes of no wind movement. The bottom trace was recorded during high winds.