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# Combined Interpretation of Seismic and Infrasound Data for Source Characterization and Propagation Path Assessment at Regional Distances

**B. Stump**(1), C. Hayward(1), T. S. Kim(1), R. Burlacu(2), and K. Pankow(2)

(1) Department of Geological Sciences, Southern Methodist University, Dallas, Texas (bstump@smu.edu/+1-214-768-275) (2) University of Utah Seismograph Stations, Salt Lake City, Utah

Historically seismic signals have been used to characterize sources and propagation paths through the solid earth while infrasound signals have focused on sources and paths through the atmosphere. This presentation focuses on the complementary nature of the two types of observations in jointly characterizing signals, noise, sources and propagation paths in the two media. Co-located seismic and infrasound sensors provide the basis for this assessment. Optimally co-located arrays of seismometers and infrasound gauges provide the opportunity to characterize signals in terms of array coherence and thus estimation of phase velocity and back azimuth. The nearly order of magnitude difference in regional phase velocity between seismic and infrasound signals in the same frequency band motivates unique seismo-acoustic array designs. Coupling of infrasound signals to seismic channels is both a noise source on seismic channels as well as an additional source of signals that can be identified on seismic channels. Combined analysis of seismic and infrasound data can identify such signals and provide a mechanism for noise reduction techniques for seismic channels.

Seismo-acoustic arrays provide data for incorporating seismic and infrasound phase velocity, back azimuth and arrival time for location purposes. Combined analysis illustrates the primary value of seismic arrival time and phase velocity and infrasound back azimuth in location. Heterogeneity in the solid earth results in relatively poor seismic back azimuths while those for corresponding infrasound signals can enhance the lo-

cation. Infrasound travel times are quite variable because of the temporal variation of the atmosphere. These temporal variations are shown with empirical data to have an even greater effect on infrasound amplitudes with variations in excess of a factor of ten for common paths and sources on different but closely spaced days. Recent infrasound experiments with enhanced numbers of gauges are beginning to characterize atmospheric propagation at regional distances in a manner similar to that employed for years in seismology. Infrasound wave-guide effects along the solid earth - atmosphere boundary will be demonstrated.

The combined observation of seismic and infrasound signals can be used to assess sources such as explosions that occur at the interface between the solid earth and the atmosphere. These tools will be shown to be useful for identifying small explosions that are used for engineering purposes. Infrasound observations from small earthquakes are not as common although large earthquakes and their strong ground motion can result in infrasound signals. Observations at combined seismic and infrasound stations, the number of infrasound signals can eclipse the number of seismic signals by one to two orders of magnitude suggesting that infrasound sources in the atmosphere are common.