Analysis of long-period atmospheric and seismic waves
recorded by the USArray Transportable Array

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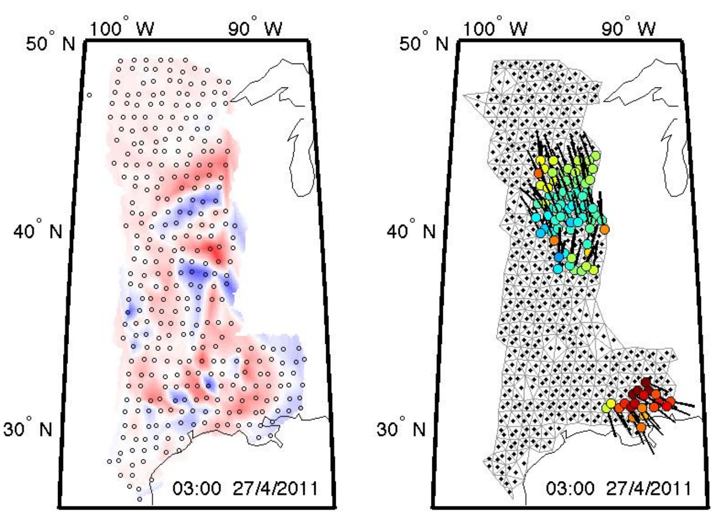
We have developed a method to examine the propagation characteristics of long-wavelength signals crossing the USArray Transportable Array (TA). Both long-period atmospheric gravity waves and seismic surface waves have wavelengths over 100 km, greater than the average 70-km inter-station spacing of the TA stations. For this reason, the TA is sufficiently dense that the wavefronts of these long-period signals are coherent between neighboring stations but, with a total area of about 2,000,000 km^2, the TA is generally too large for signal coherence across the entire network. Our analysis method involves dividing the network into many elemental sub-arrays consisting of clusters of neighboring stations. Our preliminary work involves triads of stations but this approach is easily modified to accommodate larger arrays. Coherent analysis of the data at each elemental array provides a robust local estimate of the basic parameters of a signal – *i.e.* the signal's amplitude, direction and speed. The results from all sub-arrays are combined to follow the progress of long period signals as they move across the TA, allowing for observation and study of fine-scale variations of these basic parameters across the full footprint of the TA. When applied to atmospheric signals the detector yields raw data for the study of diurnal and seasonal trends in the signals and the nature of the correlation of some of these signals with significant atmospheric events such as tornado swarms.

We will present our work on the application of the technique to pressure data recorded over the full year of 2011, which shows several interesting correlations between our results and those made by satellite detections of convective gravity waves. The analysis shows the spawning and long-range propagation of a very large gravity wave coincident with a severe swarm of tornadoes in southern states in April, 2011. We also present preliminary work on its application to the analysis of surface waves recorded on seismic sensors, which allows for study of fine-scale variations in surface wave velocities across the TA. The upgraded TA allows us to not only monitor severe weather phenomena on a local scale but also put these events in a much larger context. Given press coverage of climate change and severe weather events in recent years we expect the new broadband pressure data will provide opportunities to inform the general public.



Caption: (left) Pressure data, recorded on LDM channels and bandpassed from 2-4 hours, are interpolated across the TA.

(right) The network is divided into many 3-station sub-arrays, shown in gray. Black dots indicate triads where gravity waves were not registered. Colored circles mark the centers of triads where gravity waves were detected. Cool and hot colors represent slow and fast velocities respectively. The black line attached to each circle shows the propagation direction.