A study of atmospheric pressure and crustal tilt beneath the USArray Transportable Array

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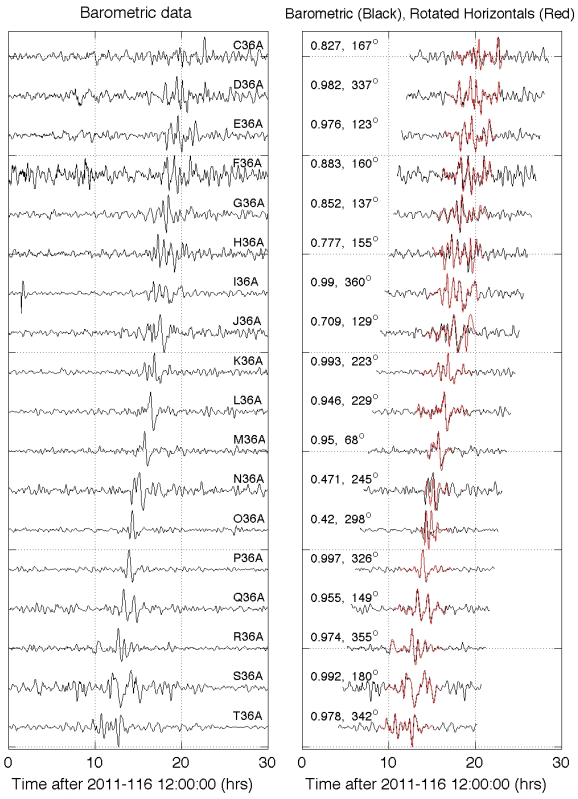
Abstract

The USArray Transportable Array (TA) provides broadband atmospheric pressure measurements and broadband 3-component seismic measurements at 400 points on a 70-km spaced Cartesian grid across an area of ~ 2,000,000 km^2. This dataset provides an opportunity to study the interaction between the atmosphere and solid Earth in unprecedented detail. We report preliminary observations of crustal tilt as recorded by the horizontal seismic channels that is highly correlated with atmospheric pressure variations. We present results from April, 2011 which included the generation and propagation of a large 2-6 hour period gravity wave across much of the TA. We observe the progression of the gravity wave on both pressure and horizontal seismic channels even though the signal is well below the corner frequency of the seismometers. We will present our preliminary work on studying the correlation between seismic and pressure data, and the potential for using the pressure data to reduce seismic noise, at frequencies relevant to global seismic studies. This work is part of our larger effort to inform the public about the Earth system; specifically, in this case, how the atmosphere and solid Earth are not independent parts of the Earth but continually interact.



Left panel: Low-frequency (8,000 to 1,800 seconds) band passed MEMS recordings of a northward propagating gravity wave from a significant, tornadic, atmospheric disturbance near Oklahoma. The record section begins at 12:00:00 UT on April 26. We used data from the 36th column of the TA from near the Canadian border (at the top) down to Oklahoma (at the bottom). This figure shows a complex wavetrain moving north at roughly 40 m/s. The pressure traces have been differenced for comparison with the seismic records. Right panel: We show the pressure data and the best-fit rotated seismic traces in red. We also list the maximum coherence with each trace and the azimuth of the rotated record. Although we see some adjacent records have tilted at a similar angle overall we see a large spread in the azimuths.