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shaking intensity and source mechanism passively retrieved from remote infrasonic signals

The ShakeMap is a key component in the initial relief e_orts following an earthquake disaster. It depicts the distribution of shaking intensity in the epicentral region and is used to guide emergency responders to the region. In regions where seismic instrumentation is limited, such ShakeMaps are poorly constrained and can take days to generate. We show, that pseudo-ShakeMaps that indicate the relative shaking intensity, can be generated, within minutes, from enhanced processing and modeling of infrasound. Furthermore, the source mechanism can be retrieved. This is illustrated with infrasound from the 2010 MW 7.0 Port-au-Prince, Haiti earthquake, detected in Bermuda, over 1700 km away from Haiti. The pseudo-ShakeMap and focal mechanism retrieved in this study are in good agreement with the USGS estimated ShakeMap and the Global CMT moment tensor.

Such observations are made possible by: (1) An advanced array processing technique that enables the detection of coherent wavefronts, even when amplitudes are below the noise level, and (2) Backprojection of observed pressure perturbations to ground motions in the epicentral region while accounting for advection e_ects in the atmosphere. We support our observations with an example using the Rayleigh integral to generate synthetic waveforms from four quadrants of an earthquake focal mechanism. Synthetics are then processed to retrieve the relative sense of motion in each quadrant.

The current infrasound networks routinely detect earthquakes and allow for an unprecedented global coverage. This makes infrasound as an earthquake mitigation technique feasible for the first time.

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