

Title: Levy models and Hurst models applied to seismic data

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This work is devoted to the study of the ASARCO demolition seismic data.

In April 2013 two old smaller smock stacks leftover by the ASARCO company were demolished in the City of El Paso. The University of Texas at El Paso (UTEP) deployed a series of one-component seismometers in downtown El Paso between 0.5 and 5.5 km from the stacks, with the objective to record the seismic waves generated by the demolition. In the present study we use the seismic signals recorded by some of these seismometers. A seismogram is a time series that records the displacement of the ground caused by passing seismic waves.

In the general approach, a seismogram is considered to be the result of the convolution of a function characteristic of the seismic waves' source processes and a function characteristic of the structures of the ground where the seismic wave propagate. Thus, if a source function can be defined, the characteristics of the ground can be estimated by de-convolving the source function from the seismogram. In our study case, the seismic waves were generated by the explosions, but also by the impact of the stacks on the ground during the demolition, resulting very difficult to define a source function. The lack of an appropriated source function to investigate ground parameters motivates this study. In this study, we investigate the use the Levy models as an alternative approach for identifying ground-related parameters.

In principle, the differences between two seismograms, recorded at similar distances from the source, are mainly a consequence of the differences in the characteristics of the mediums of propagation (structure and physical properties). Thereafter, the differences in seismograms recorded by consecutive stations, located close to each other and far from the source, will depend on the characteristics of the propagation medium between the two recording stations. Thus, the objective is to use statistical methods for identifying differences between seismograms that might represent differences in the propagation medium between stations.

We applied different stochastic models like the Levy models, DFA and Hurst methods to study the presence of memory effects in this time series. We conclude that the three models may be used to estimate characteristic parameters of the propagation medium for seismic waves, and that the data presented long range correlations and memory effects.