

Application of multifractal analysis to seismic reflections from a velocity model

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Abstract: The use of multifractal analysis to detect reflections on seismic signals is an active research area. Here we propose to use a multifractal approach, based on the Hurst exponent and the rescaled range (R/S) analysis. The Hurst exponent is calculated as a local parameter for each sample of the signal. This approach allows using the local Hurst exponent (LHE) as an indicator of changes on the signals behavior. One particular feature of this method is that it is insensitive to signals amplitude; therefore, the method can be used to better detect frequency or phase changes.

The method has been tested on seismograms derived from a synthetic shot record of a velocity model, which simulates three layers with different speeds. The figure below schematically illustrates the velocity model and the derived seismogram. Also, a single trace and its correspondent LHE are highlighted. On these, it is possible to observe that changes on the signal (frequency or phase) have a correlation with the LHE trend. Our results show that this method can be used to detect changes on seismic signals, which may lead to better detect seismic reflections.

