# Seismological Applications of the Stockwell Transform

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Time-frequency analysis has a long history in seismology, beginning with the use of the Hilbert Transform for computing seismic pulse distortion (Choy and Richards 1975) of teleseismic events and for computing the instantaneous phase and frequency in exploration seismology (Taner, Koehler and Sheriff, 1979). In the early 1990's computational algorithms shifted away from Fourier based time-frequency techniques to wavelet-based methods, introduced by Daubechies (1988, 1990). more recently a variant of the continuous wavelet transform, the Stockwell transform was developed by Stockwell, Mansinha and Lowe (1996) and converted to a dyadic representation in a very general setting by Brown, Lauzon and Frayne (2010). This generalized version of the Stockwell transform we shall refer to as the GST.

In this presentation we will apply the GST in two different ways. First we will show how the GST can be used as a possible discriminant between controlled quarry blasts set off in the Negev and earthquakes. The GST analysis clearly demonstrates the impulsive character of the controlled blasts. A second application focuses on using the GST as a frequency-based travel-time picker. This application will compare the travel-time picks obtained using the first moment of the GST with those obtained using the instantaneous frequency computed via the analytic signal. The second application demonstrates the robustness of the GST-based travel-time picker, which does not have the stability issues inherent in the computation of the derivative of the instantaneous phase of the analytic signal.

References
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