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Imaging rock deformation while drilling wells: a seismic coda perspective

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We investigate the potential of using seismic reflection data acquired within the sub-basaltic North-Eastern Atlantic margin to monitor deformation at wells. Attenuation estimates of three seismic lines is computed using the logarithm of the spectrum of the coda decay curve. A total of 551 stacked signals from a seismic reflection survey with a trace interval of 50 traces in each line are employed in the analysis. A multiple scattering model is adapted assuming the contributions due to intrinsic absorption are dominant over scattering effects within a large lapse time. Optimal parameters are established to investigate the capability of the dataset to quantify attenuation. The inferred low Qc estimates within the region is summarised through the following frequency relationships: Qc = 9.70 f 0.74, Qc = 7.16 f 0.85 and Qc = 9.94 f 0.71 for the mentioned seismic lines.

The frequency dependent coda Q models are jointly interpreted using the images of the seismic sections, well data and the documented regional geology of the underlying rock sequences. The consistency of coda Q with the interpreted seismic sections affirms the fitness of the optimal parameters. In an attempt to substantiate the coda Q approximations, peak delay times of the Pwaves are measured. Apart from the relationship with the geology of the region, resonance scattering of seismic energy caused by deformation of the rocks on the wells adjacent to the seismic lines manifests within certain frequencies. We infer this is a new mxlti-scalle seismic method to monitor rock defamation while drilling wells.