# FULL WAVEFORM INVERSION USING ADAPTIVE QUASI-NEWTON METHOD

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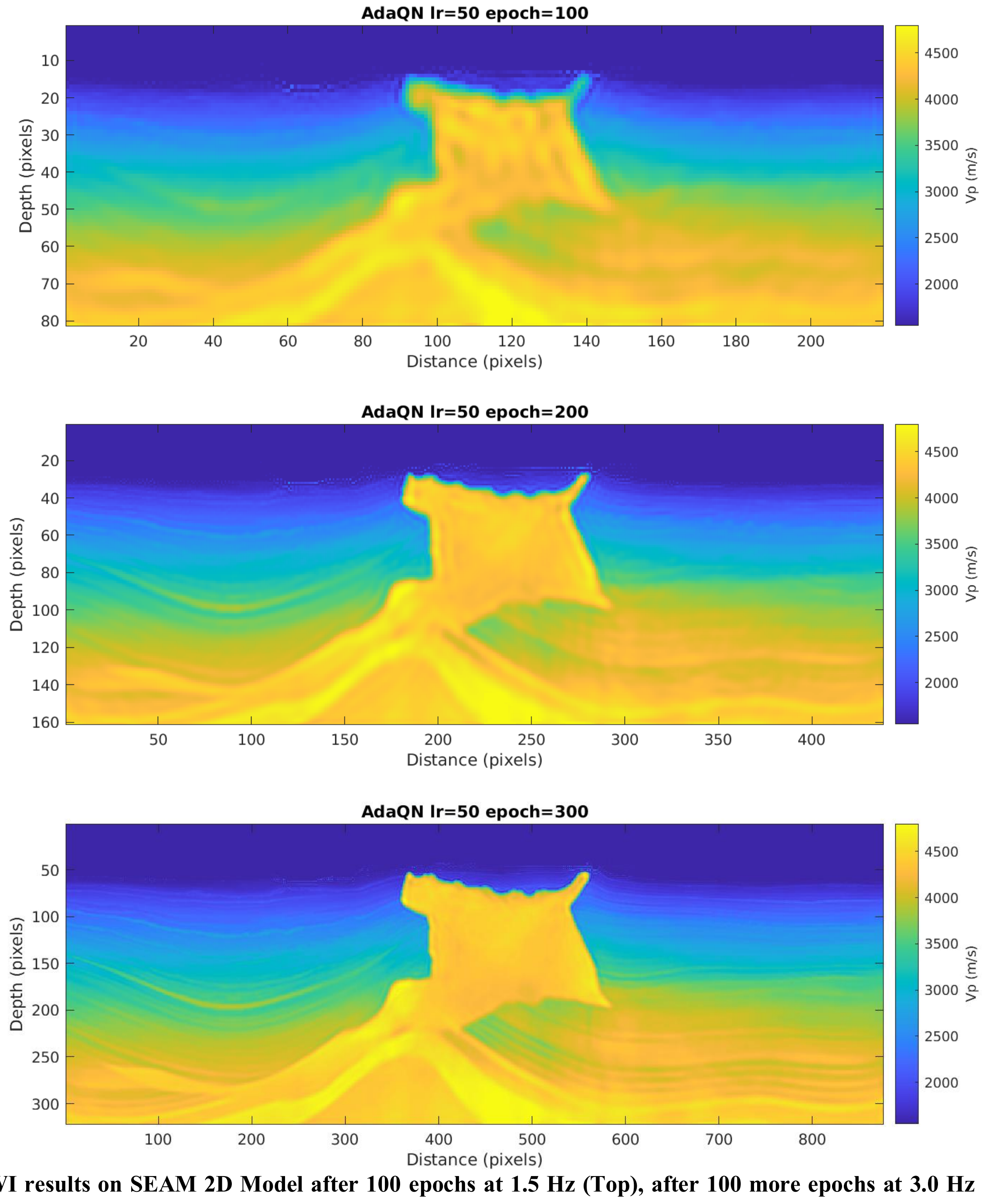
**ABSTRACT**

Full Waveform Inversion (FWI) is a technique that aims to obtain high-resolution earth model parameters using all the information available in seismic data and can provide valuable information about subsurface properties. It is a very computer demanding algorithm and subject to local minima issues. Recently several machine learning techniques are emerging that can be applied to FWI with promising results. In this work, we successfully solve the FWI problem using a recent machine learning optimization technique called Adaptive Quasi-Newton optimization (ADAQN) that was developed for training recurrent neural networks. Like other second order algorithms, this technique incorporates curvature information in the inversion but without the need to store or compute the expensive Hessian matrix thus, leading to a computational cost similar to that of first order methods. The algorithm is able to deal well with the erratic gradient commonly occurring in minibatches, allowing the inversion to be performed in the stochastic regime. Thus, it is more robust to local minimum issues. We tested the algorithm on the SEAM 2D model with excellent results. We also used a stochastic approach by randomly shuffling the sources coordinates, improving the convergence.




**FWI results on SEAM 2D Model after 100 epochs at 1.5 Hz (Top), after 100 more epochs at 3.0 Hz (Center) and after 100 more epochs at 6.0 Hz (bottom).**