# A comparison of transient and conventional approaches to AMT : 2D inverted results on line WAS-4

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**Abstract**

This report is supplementary to the 2012 Natural Fields EM Forum (NFEM) paper and contains two-dimensional inverted results of both transient and conventional AMT data-sets.

The transient impedance estimates with our Adaptive Polarization Stacking (APS) algorithm are quite bi-modal, the TE and TM mode impedances are significantly different. In contrast, the conventional Remote-Reference (RR) TE and TM mode estimates are very similar, especially the phases.

Fitting difficulties were encountered during inversion with the conventional TM mode phase estimates, they were not well replicated by the 2D OCCAM code. On the other hand, the transient TM mode data, resistivity and phase, was fit very well, as was the TE mode transient data.

As a test of the RR error bars, the conventional TE mode data was inverted with the RR error bars "as is". The 2D OCCAM code was unable to fit the conventional TE mode data to better than an RMS misfit of 10.

By comparison, the transient TE mode estimates from our APS algorithm, with APS errors bars "as is", were fit by the 2D OCCAM code to a misfit of 1.3 and the TM data to a misfit of 1.0.

Since the RR error bars were unrealistically small, an inversion of the conventional data proceeded with 10 percent uniform error bars on resistivity and tipper with 3-5 degrees on phase. This is most likely overfitting the data in some frequency ranges and possibly underfitting it in others, an unavoidable consequence of having to use "guessed" error bars.

The transient tipper data had a benenficial impact on the 2D inversions whereas the conventional tipper data did not overly help the inversion of the conventional AMT data.

The best result with the transient data is arguably the TM-Tipper inversion (Figure 4), which gives the highest resolution of shallow sandstone structure in addition to gently west dipping graphitic basement structure. As discussed in more detail in the NFEM paper, a gravity low of 1.8 mGal (Figure 5), almost 1000 m wide, was interpreted to be due to a shallow wedge like body in the sandstone with a sharp eastern edge and a more gradational western edge. This agrees very well with the transient tipper data where a large high frequency anomaly is seen on $T_y$ at 20W, a weaker tipper anomaly is seen on $T_x$ at 29W. This also corresponds with an acoustically disturbed area as evidenced by the highly fragmented reflectivity in the reflection seismic data (Figure 5), kindly provided by Dr. Z. Hajnal.

The best result with the conventional data is arguably the TE mode inversion, in comparison to the transient TM-Tipper inversion, enhanced shallow resolution is evident with the transient data, due mainly to the higher quality tipper data.

Both the transient and conventional inversions resolve the gently west dipping conductive basement structure, which is seen in the seismic data as well. However, the transient data is better able to resolve shallow structure in the sandstone, mainly due to enhanced tipper data quality. There appears to be an issue with the conventional TM mode phase estimates, perhaps due to a slightly malfunctioning $H_x$ coil, this would also explain the especially noisy conventional $T_x$ data (see NFEM paper).

# List of Figures

# 1 Results of 2D Inversion

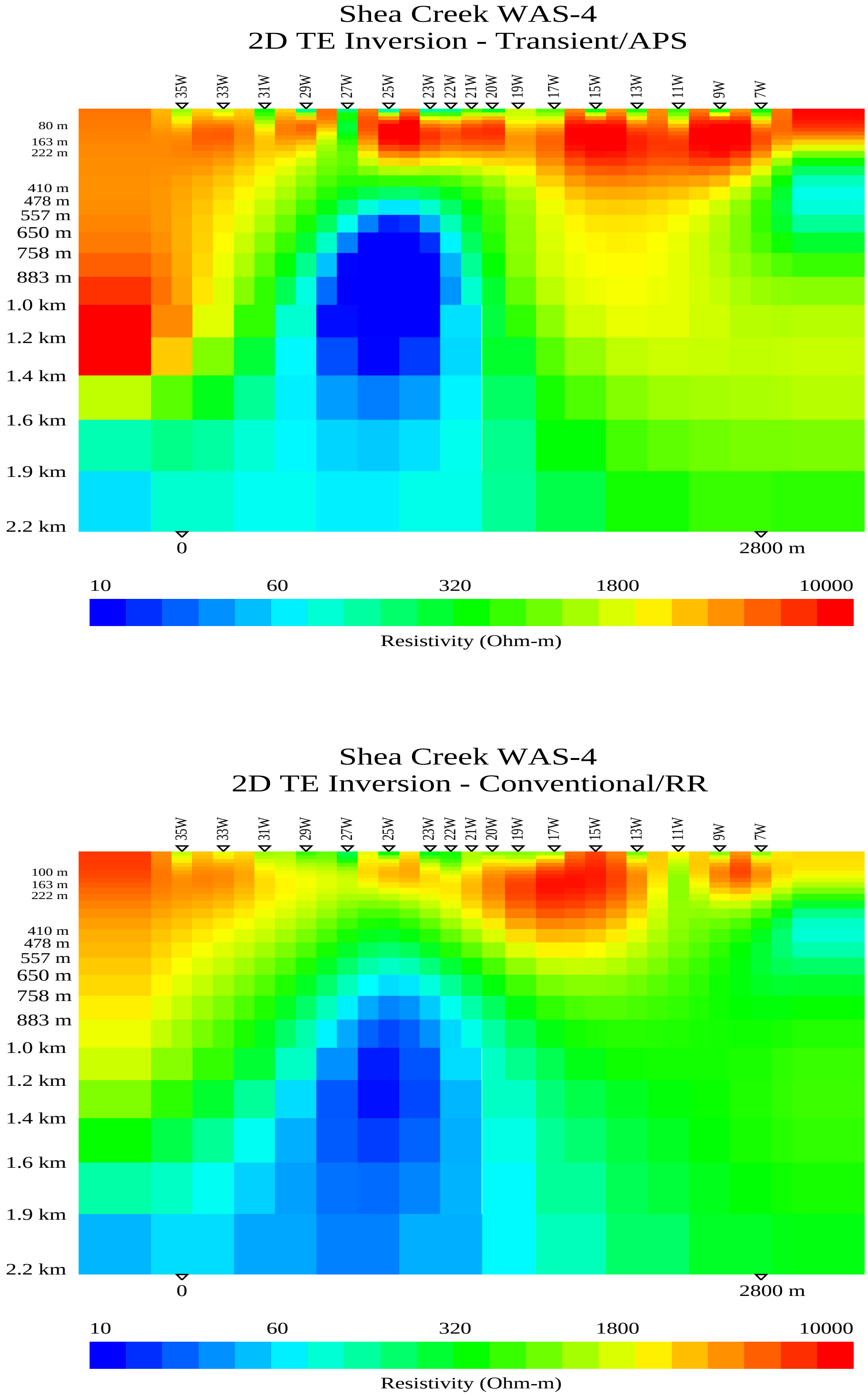



Figure 1: 2D Inversion (TE Mode)

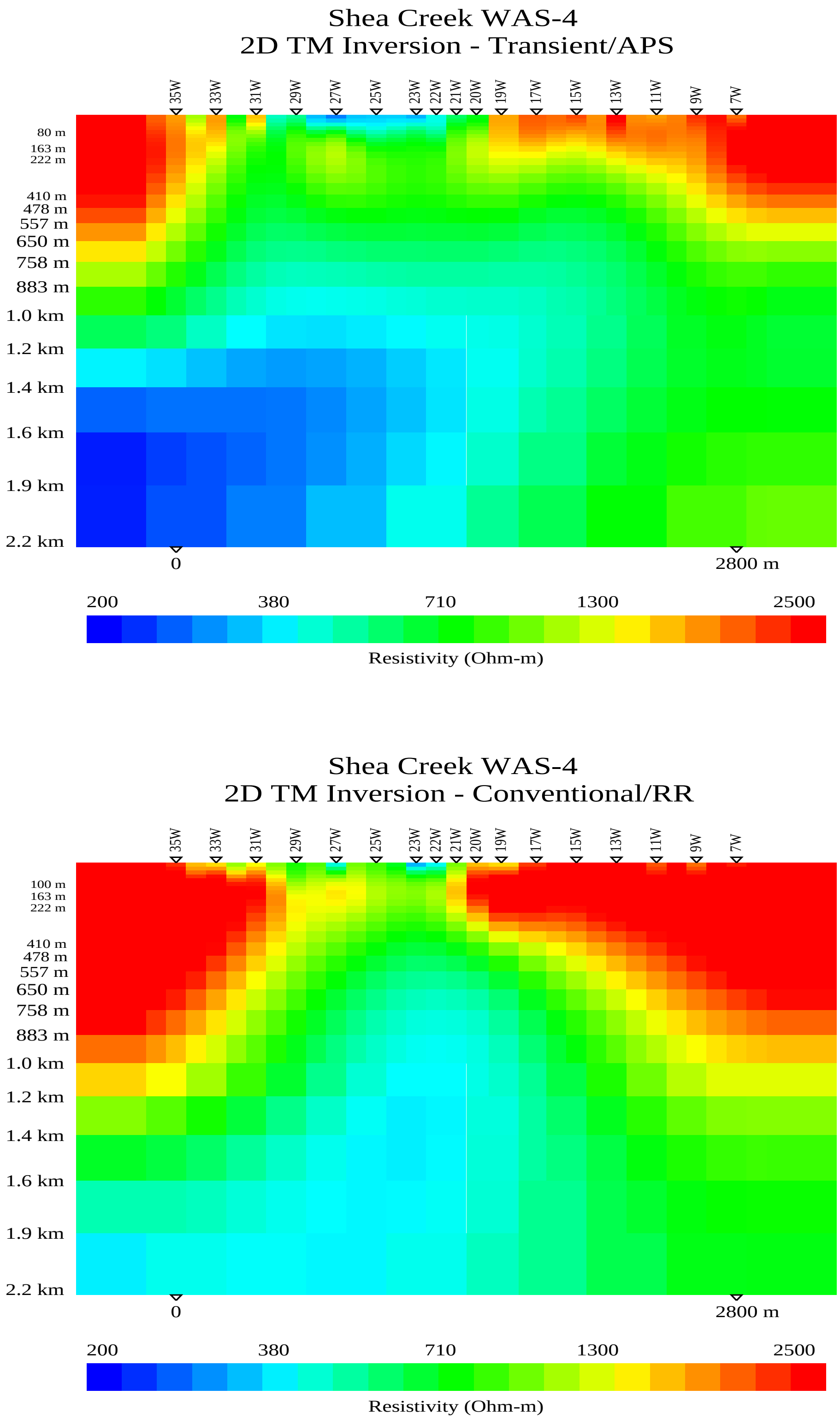
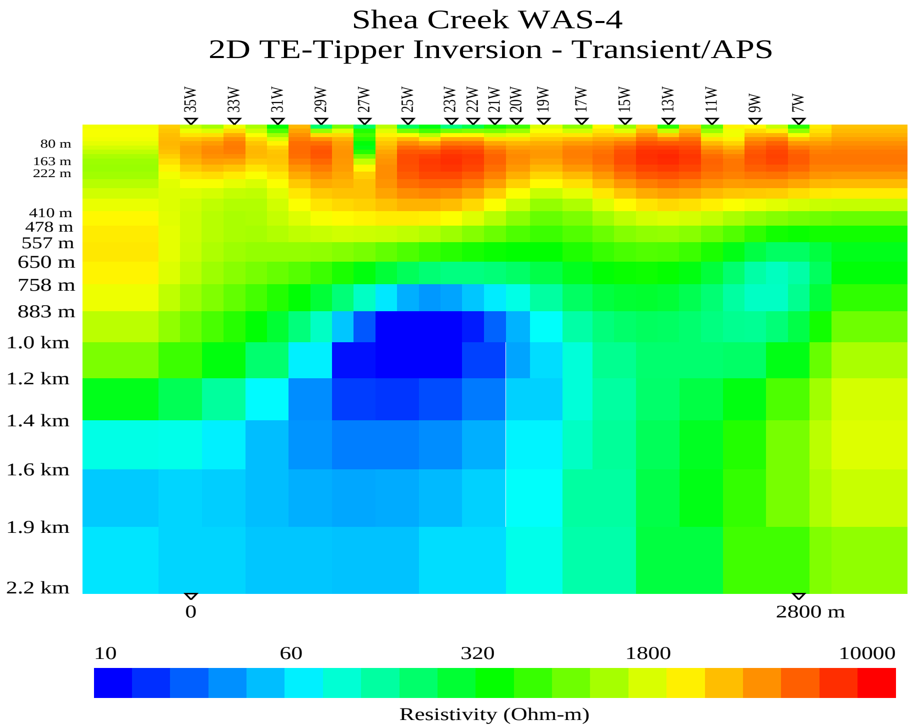



Figure 2: 2D Inversion (TM Mode)



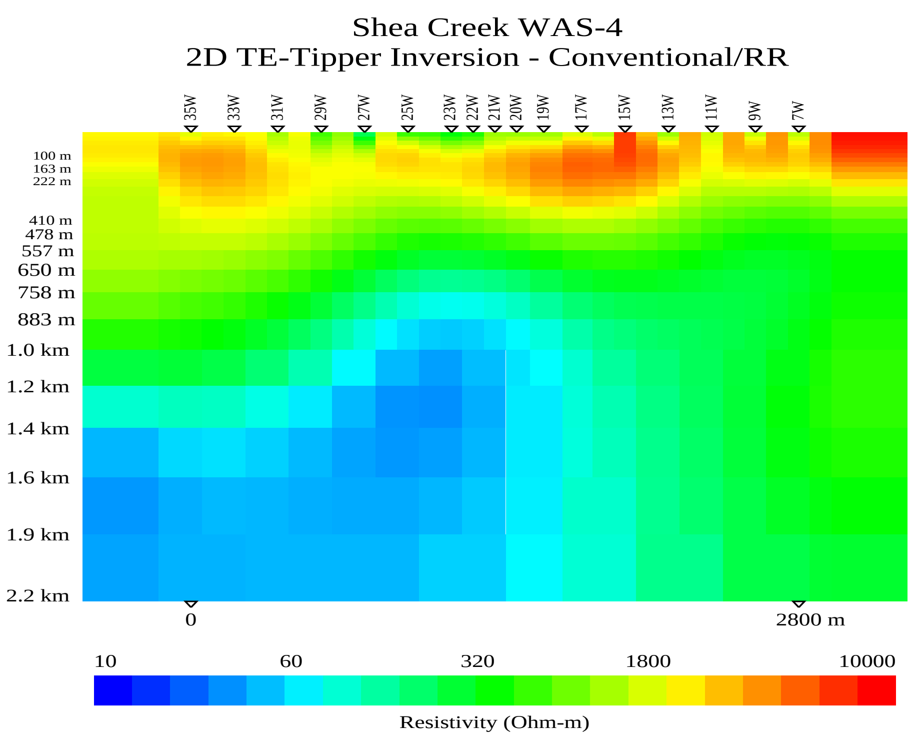
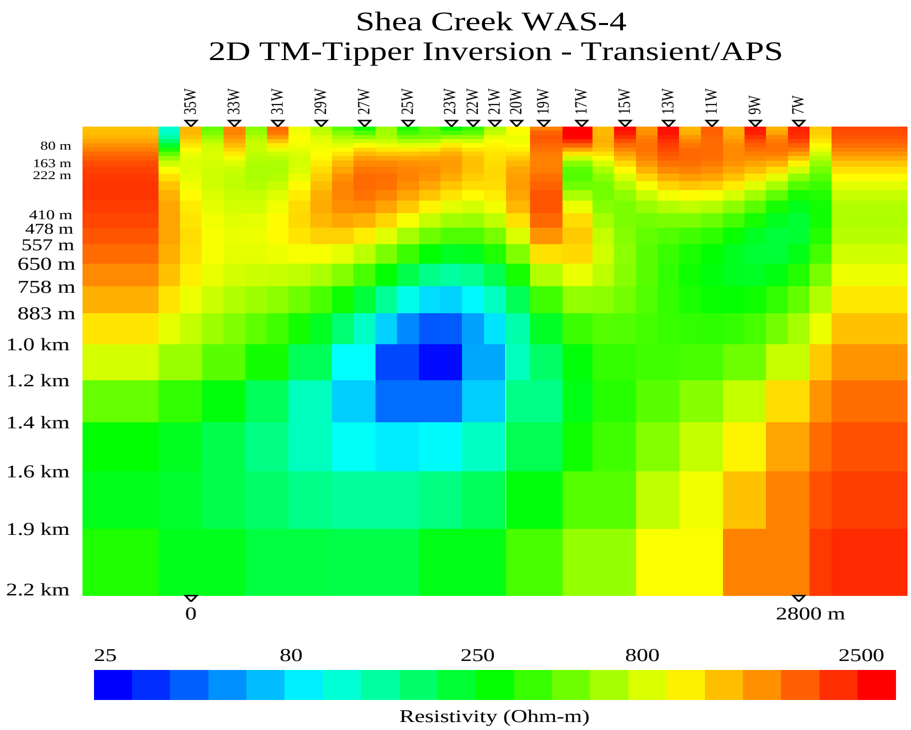




Figure 3: 2D Inversion (TE-Tipper)



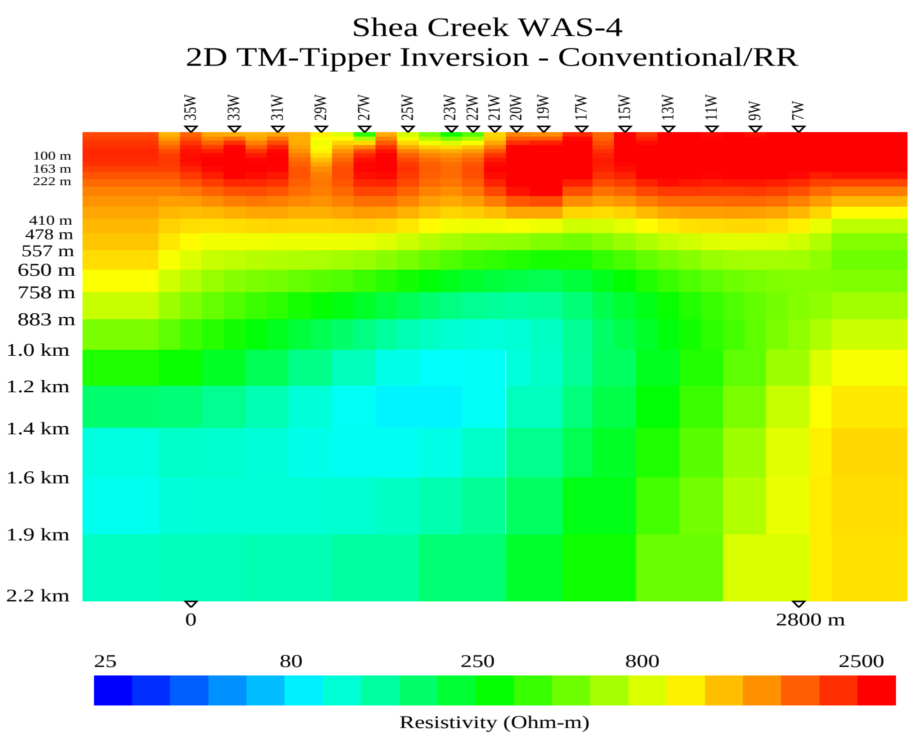




Figure 4: 2D Inversion (TM-Tipper)

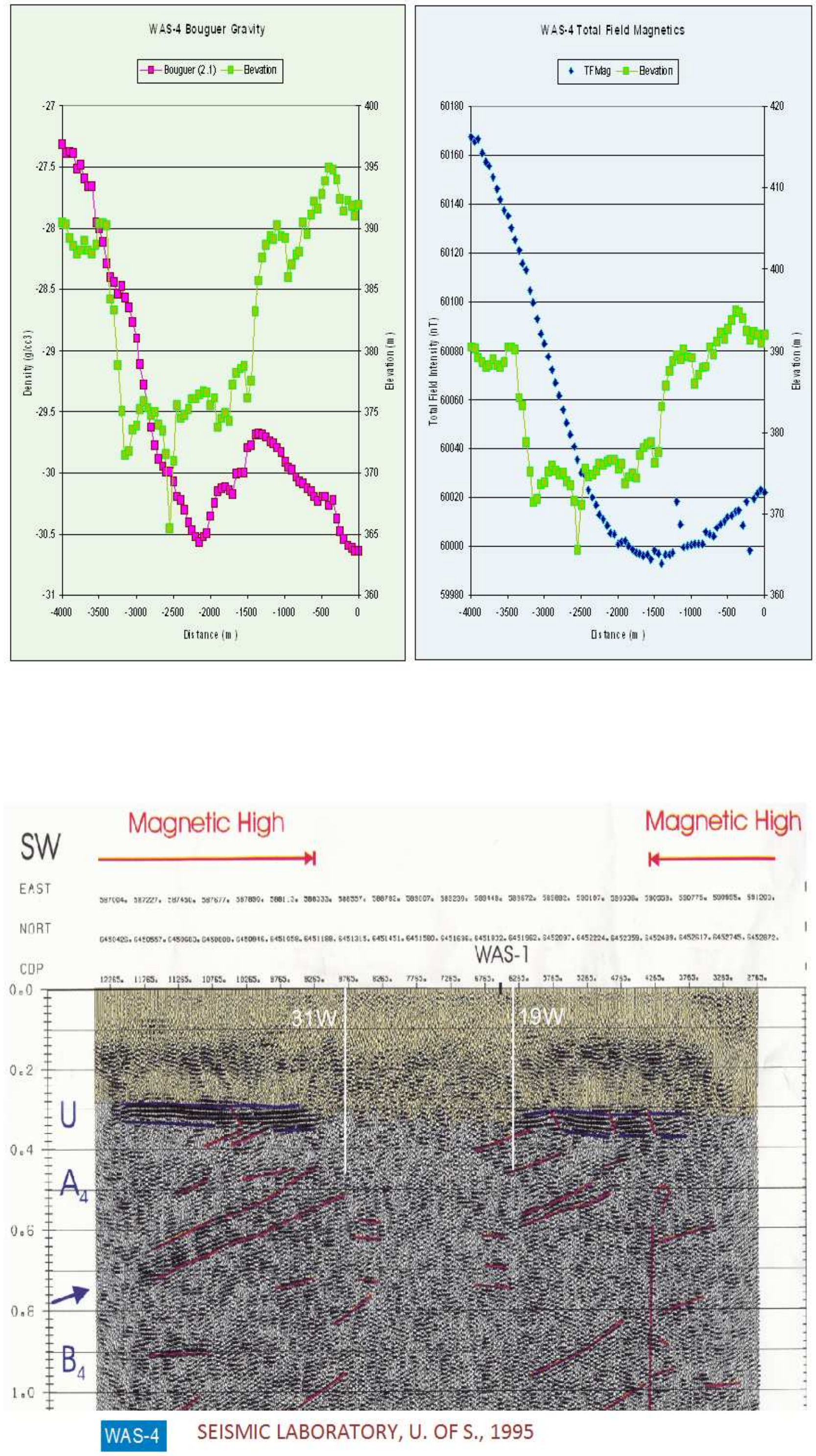



Figure 5: Potential Field and Reflection Seismic Data (WAS-4)