

Imaging the Wairarapa Basin, NZ, using airborne electromagnetics and magnetotellurics

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SUMMARY

Magnetotelluric (MT) and airborne time domain electromagnetic soundings (e.g., the SkyTEM system) have complementary sampling densities and depth sensitivities. SkyTEM provides rapid coverage at dense spatial resolution (<50 m along line) and is sensitive to the top ~300 m. Magnetotelluric data has greater penetration depth so can be used to image the deeper (> 0.5 km) structure. By combining these data, we can make use of the strengths of both. An extensive program of SkyTEM data collection has recently been undertaken in New Zealand as part of regional groundwater mapping programs. One such program aims to map the distribution of aquifers within the Wairarapa Basin. Laterally constrained 1-D inversions of SkyTEM data were extracted along the profiles of closely spaced MT sites collected previously in the same area. The 1-D SkyTEM inversion models and the 2D MT inversions agree remarkably well in the depth range where both methods have sensitivity, which provides higher confidence in imaged structures in this depth range. The SkyTEM models image fine scale (>10 m thickness) layering within the sedimentary units, which are not visible in the MT models, and generally sharper resistivity contrasts. The additional depth penetration provided by the MT allows the aquifers to be seen in their geological context; a compressional thrust belt formed in response to oblique subduction off the east coast of New Zealand's North Island.

Keywords: inversion, airborne electromagnetics, magnetotellurics, sedimentary basin
