Delineating resistive paleochannels with Transient Audio-Magnetotellurics: Implications for oil/gas exploration

David K. Goldak, EMpulse Geophysics Ltd., Saskatoon, Saskatchewan, Canada

2005 CSEG National Convention

ABSTRACT

Thunderstorm activity produces large amounts of electromagnetic energy which is trapped within the earth-ionosphere waveguide. The random sum of energy from activity on a near global scale produces a low-level quasi-continuous source field. Very large, or equivalently, relatively nearby lightning discharges produce *individual* transient events whose amplitude are significantly larger than that of the low-level background field.

Therefore, substantial increases in signal-to-noise ratio can be realized by recording exclusively sources of a transient nature. However, the transient events are strongly linearly polarized, the polarization diversity of which can affect the estimation of earth response curves.

It has been shown that an adaptive time domain averaging of the transient waveforms results in earth response curves whose bias converges to zero super-exponentially in stacked signal-to-noise ratio (Goldak et al., 2001).

The efficacy of our algorithm is shown in the results of a transient audio-magnetotelluric (TAMT) survey conducted over a buried valley system in southern Manitoba, Canada. Twenty-three sites at 200 m spacing were collected with the impedance tensor **Z** and the magnetic field tipper **T** estimated over the bandwidth 8 Hz – 32 kHz.

Two dimensional OCCAM inversion of the TAMT data reveal the buried valley to be approximately 1 km wide, 80 m deep with a resistivity of approximately 12 Ohm-m, incised into conductive Cretaceous sediments of approximately 4 Ohm-m resistivity