Japan Geoscience Union Meeting 2012
(May 20-25 2012 at Makuhari, Chiba, Japan)

STT03-05 Room:102A Time:May 23 10:45-11:10

CONDUCTIVITY RESOLUTION BY VARIOUS HELICOPTER BORNE TEM SYSTEMS

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The helicopter borne TEM (HTEM) survey technology is fast, effective, and in true sense a technology of the 21st Century as its genre and wide-ranging applications have increased exponentially since the year 2000. Most of the HTEM systems comprise a large transmitter loop source and a small receiver coil located concentrically or at a point above the transmitter loop that is flown below the helicopter. A couple of exceptional systems are GREATEM and FLAIRTEM that respectively employ a grounded cable and a large loop on ground as transmitters. Contemporary HTEM systems employ a wide variety of primary pulse shapes and transmitter moments to stimulate the subsurface in order to elicit response of geological targets. Frequency contents of these pulses determine the nature of decay response of various types of conducting terrains ranging from highly resistive Archaean granitic gneisses to highly conducting coastal regions with saline water. Numerical modeling is carried out to particularly examine and compare the dB/dt response of these terrains as seen and distinguished by various HTEM systems flying airborne transmitting loops (FLTx) and the GREATEM (GRTx) system. For FLTx systems we have also computed the response considering an ideal rectangular pulse for the purpose of comparison. It is found that the HTEM systems employing rectangular pulses yield fastest decaying transient response and provide the best conductivity discrimination among the FLTx systems. The next to follow are the systems that employ trapezoidal pulses. In this case the decay rate is somewhat slower and the conductivity discrimination is reduced slightly. Similar behavior is observed for the HTEM systems employing sinusoidal and triangular pulses with the latter showing the slowest decay rate and the least discrimination capability. It may also be noted here that slower decay rates also imply that as compared to the HTEM systems employing rectangular pulses, those employing trapezoidal, sinusoidal and triangular pulses see the same geological terrain as increasingly more conducting. Computations for the GRTx system reveal that for highly resistive terrains the decay rates for the FLTx and GRTx are found to be comparable. However, for increasing terrain conductivity, the decay rates for the GRTx slow down considerably and are distinctly separate for various conductivities. Thus the GRTx system provides much better conductivity discrimination as compared to various FLTx systems. The results underscore the advantage of GRTx system that uses the galvanic stimulation of the ground at a fixed spatial location in comparison to the FLTx systems that employ a flying transmitter loop in inductive mode with continuously varying location.

Keywords: AEM