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Combined Magnetic - VLF Remote Operated Vehicle Multi-Altitude Observations: A Powerful Tool for the Transport Infrastructures Geophysical Monitoring

L.V. Eppelbaum

Tel Aviv University, Faculty of Exact Sciences, Dept. of Geophysical, Atmospheric and Planetary Sciences, Tel Aviv, Israel (levap@post.tau.ac.il, +9723 6409282)

A necessecity of operative and effective geophysical monitoring of the various transport infrastructures and their surroundings is obvious (Proto et al., 2010). Unmanned or so-called Remote Operated Vehicles (ROV) geophysical survey is based on the application of the ROV of a new generation. The new unmanned generation of small and maneuvering vehicles can fly at levels of a few (even one) meters above the Earth's surface (following the relief or at some adjusted level) while simultaneously making geophysical measurements. ROV geophysical investigations have an extremely low exploitation cost (comparing with conventional airborne and land surveys) and high accuracy. Finally, measurements of geophysical fields at different observation levels can provide new, unique geological-geophysical information. ROV integration of magnetic and Very Low Frequency (VLF) electromagnetic fields is one of the most effective combinations (taking into account both similarity and mutual supplementation of these fields). The use of GPS with improved wide-band Kalman filtering enables to provide exact topogeodetic relations (e.g., Eppelbaum and Mishne, 2011). A nonconventional interpreting system developed for complex environments includes methods for localization of targets in noisy backgrounds (Khesin et al., 1996; Eppelbaum 2007a, 2007b), filtering temporary variations from the VLF field (Eppelbaum and Khesin, 1992) and secondary variations effect from magnetic field (Eppelbaum and Mishne, 1995), eliminating terrain relief influence (Eppelbaum, 1991; Khesin et al., 2000), estimation of the magnetization of the upper part of geological section (Eppelbaum et al., 2000; Eppelbaum, 2010), quantitative analysis of the observed anomalies (for conditions of oblique polarization, rugged relief and unknown level of the normal field) (Eppelbaum and Khesin, 1992; Eppelbaum et al., 2004; Eppelbaum, 2005, 2011; Eppelbaum and Mishne, 2011) and their integrated examination (by the use of informational and wavelet approaches) (Khesin and Eppelbaum, 1997; Eppelbaum et al., 2003; Eppelbaum et al., 2011). This system could be successfully applied at various scales of the ROV geophysical data analysis for the aim of geological-geophysical mapping (including delineation of faults, undeground karst and rockslide areas), solving various environmental problems and performing geophysical monitoring of dangerous geological phenomena.

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