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Near-surface geophysical monitoring: From the past to future

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All humanity activity (initial learning, infrastructure development, buildings and roads construction, transport communications, sport and recreation, etc.) and human health somehow or other is associated with the earth's near-surface structure. Therefore, careful investigation of this near-surface layer (0-20 m) is of high significance. Such examination may be performed using grounded geophysical sensors, sensors placed at the earth's surface or located at some levels over it. The overall aim is to achieve a high resolution, detailed and reliable quantitative information about the studied near-surface scenario. Such monitoring can be applied for geological, ecological and environmental mapping, investigation of searching economic minerals, protection of some important industrial constructions, and military monitoring.

The beginning of the near-surface geophysical monitoring may refer to the fifties of XX century. As a rule there were observed disembodied data obtained with low-stable geophysical equipment and poor (frequently – hand) data recording.

In the early eighties of XX century were appearing first integrated sets of geophysical ground based equipment with comparatively high precision and direct output to specialized databases.

Lastly, opening of a new epoch in the near-surface geophysical monitoring is associated with the development (a few years ago) of advanced Remote Operated Vehicles (ROV) and arrangement at ROV combined geophysical equipment with GPS navigation. The modern ROV generation – small and maneuvering vehicles – can fly at

levels of few (and even one) meters over the earth's surface (flowing the relief forms) with simultaneous performing integrated geophysical measurements and their transferring (in the real-time operation mode) to 4D remote databases. Such investigations may be realized in areas of any topographic complexity, in marshlands, forest-covered and other out-of-the-way regions. Besides this, geophysical investigations observed at the vehicles, should have an extremely low exploitation cost (the exploitation ratio of *ROV* / *conventional* investigations may consist of $1/20 \div 30$). Finally, measurements of geophysical fields at different observation levels could provide new unique geological-geophysical information. It is proposed that the most prospective geophysical integration for ROV should include measurements of magnetic, gravity and VLF (electromagnetic) fields (actual geophysical method integration is depending on the concrete aim of examination). GPS (with utilization of the developed improved wideband Kalman filtering) will assure an exact topogeodetic relation for the proposed observations. The nonconventional interpreting system developed for complicated environments is an effective analytical tool for analysis of the ROV observed geophysical data. Undoubtedly, ROV observations should be skillfully integrated with the available ground, underground, borehole and satellite measurements.