Geoelectrical monitoring station

The geoelectrical monitoring station is designed for long-term (up to 10-15 years) automated measuring of artificial low-frequency electric fields in order to detect dangerous geological processes developing inside the rock mass and man-made structures.

Specifications

block master-switch controls block switches;
signals are excited and received by a block switch;
block switch switches AB and MN electrodes in accordance to operational protocol of the station;
industrial type control computer processes the incoming information, visualizes the measurement result, accumulates the entire amount of data as time series and writes logs of the whole system, faults and failures;
each of the two separate stranded cable braids consist of two segments with 256 as a maximum number of receiving and measuring electrodes accordingly;
electrodes are made of stainless steel;
switches, input amplifiers and temperature sensors are located within the electrode case;
source of power - electrical network of 220 V / 50 Hz;
frequency band signals from 1 to 25 Hz;
excited and received signals in sinus form;

Generator specifications:

current from 50 mA to 2 A;
output voltage up to 20-500 V;
maximum output power 400 watts

Receiving unit specifications:

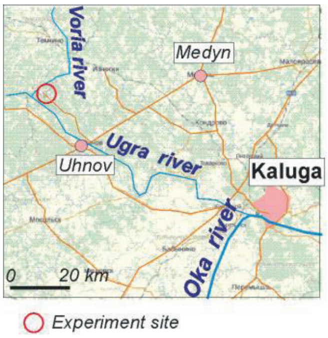
input resistance 700 MOm;
high-speed 24-bit ADC for data collection (time series);
4 simultaneous measurement channels;
synchronous detection signal measurement;
time series recorded for both measured signals and current;
arbitrary configuration of the setting

Restrictions:

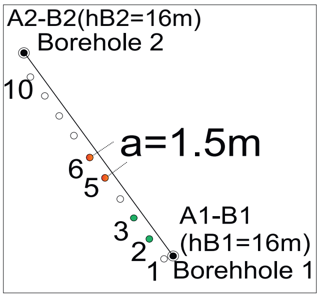
Works ought to be carried out on a surface free of hard pavement at a range of temperature variations from -40 to + 40 °C. The earth's surface should not be frozen, dry or covered by snow or water.

Russian Geotechnical Institute (LLC «RGI»)
60 bld., Elektrozavodskaya str., Moscow, 107076
www.igiis.ru, mail@igiis.ru
+7 495 366-31-89

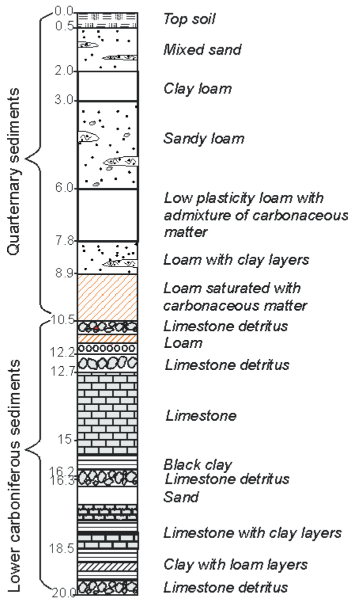
First tests of the geoelectrical monitoring station



First tests were carried out in winter 2013 on the Moscow State Lomonossov University geophysical testing site in the Kaluga region, near Yukhnov. Measurements were performed within 7 days in the end of January - beginning of February. At this point, a steady snow cover with a thickness of 35 cm was already formed. Despite rather severe frosts to the winters begin, the snow prevented freezing of the upper section and all electrodes were installed in the thawed ground.



Measurements were conducted in a space between two 20 m deep boreholes with a similar geological cross-section. The upper part of the section to a depth of 10 m was composed of quaternary conducting clastic rocks with a limestone stratum below. Two current dipoles AB were used for measuring. The current electrode A was placed near the hole-mouth, the second electrode B was inserted into the borehole to a depth of 16 m, where it was submerged into water. Ten measuring electrodes were placed with increments of 1.5 m on the surface between the two boreholes. The measuring electrodes were covered with snow before the experiment. With every 1.5 hours measurements being taken, a total of 113 measurements was carried out throughout the cycle of experimental works at the site.



It was discovered, that the current at the current electrodes and the signals at the measuring electrodes experienced daily variations in accordance with temperature changes in the range up to 1%. The maximum current was observed at night at the current electrodes, the maximum voltage across the measuring electrodes – in the second half of the day. The low-frequency temperature trend, that was observed due to the gradual warming of the air, had virtually no impact on the measurement results, which is apparently due to the strong damping effect of the snow cover.