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Tidal impact on geophysical fields registed in GPO "Mikhnevo" area

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Geophysical observatory “Mikhnevo” is situated in the centre of Russian Plate and characterized with stable response to lunisolar tides. Since February 2008, regular precision measurements of groundwater level are carried out in a measurement well synchronously with atmospheric pressure measurements (sampling interval is 1 s, the measurement accuracy is 0.1 mm for the level and 0.1 gPa for atmospheric pressure). According to the results of hydrogeological sampling, the pressure head in the aquifer under study is 8.1 m, its transmissivity is 3.0 m2/day, hydraulic conductivity was 0.13 m/day, the pressure conductivity factor and elastic water yield are 1.3 $\times$ 104 m2/day and 2.3 $\times$ 10–4, respectively. Using flow measurements and telemetry of the open part of bore hole, major intervals of water inflow were detected at depths of 92–94 m and 99–100 m. Rock transmissivity in the fissure-conducting zone increases to 5.0 m2/day.

Based on tidal component analysis in the filtered hydrogeological data, five main kinds of tidal waves were extracted (1, 2, Q1, 1 and 2). STS-2 and KSESh-R seismometers registration range extension made it possible to extract tidal waves from Z-component of ground displacement. Similar methodology of data processing was used for tides analysis in hydrogeological, seismic and barometric data. It should be noted that barometric component extracted from water level variations can, in some cases, lead to misrepresentation of the data in frequency range under consideration. That is why two variants of data were analysed - with included and excluded barometric component. To extract tides from water level variations, long-period and barometric components were excluded from original precise monitoring datum. Data series obtained in this way were used for monthly spectrum realization, which, in turn, allowed finding out amplitudes of main tidal waves 1, 1 and 2. The most significant luni-solar 1 wave annual variations cycle correlates with hydraulic head. Maximum amplitudes of 1 wave for the whole 4 year observation period are observed then the ground-water level is high. Variation range of 1 wave amplitude is stable and reaches 2.9 mm per year. Most significant variations take place in spring-summer period. Main lunar waves amplitude variations do not exceed 1.1 mm.

The phase shift increase between luni-solar tides response in seismic and hydrogeological data was found. Diurnal O1 wave variations analysis should be done with barometric component excluded datum because of amplitude difference. During period under consideration M2 and K1 waves amplitudes are comparable and about 4.1 mm, O1 amplitude is on it minimum about 3.7 mm. Maximum diurnal and semi-diurnal wave amplitudes of water level variations confine with minimum values of luni-solar attraction. On the contrary on the same periods we can see decrease of ground displacement amplitudes as a result of tidal forces. Main tidal waves were extracted from atmospheric pressure datum too. Luni-solar K1 wave has the most amplitude there and exceeds O1 and M2 values 5-7 times.