

VARIATION OF GEOPHYSICAL PARAMETERS DURING PREPARATION OF SEISMIC EVENTS IN GEORGIA (2023)

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Abstract. The article contains information about several hydrodynamic and geomagnetic anomalies observed during February 2023–October 2023 on the multiparametric monitoring network of M. Nodia Institute of Geophysics. Data were analyzed by the special program which gives possibility to exclude the influence of geological factors by the common value of tidal variations. Was analyzed reaction of parameters to the earthquake preparation process. More than 20 years were operating a special network of hydro-geodynamical (water level, Atmosphere pressure and air temperature) observation on the territory of Georgia [1,2,3]. Ten deep boreholes located basically on the main geo-plate and open deep aquifers. These wells as sensitive strain-meters recorded all kinds of deformation caused by exogenous (atmospheric pressure, tidal variations and season variation), as well as endogenous processes. During observation on the territory of Georgia has observed various anomalies by water level before seismic events [4,5]. Revealing of the mechanism of interrelation between the deformation processes, forestall strong earthquakes, and a hydrodynamic variation of underground waters, would allow to explain such preliminary behavior of hydrodynamic effects and to develop scientifically proven methods of the forecast of earthquakes.

Key words: Hydrodynamic field, earthquake indicator.

The article contains information about several hydrodynamic anomalies observed during earthquake (2023, $M_{ag} > 4$) in Georgia on the multiparametric monitoring network of M. Nodia Institute of Geophysics. Data were analyzed by the special program which gives possibility to exclude the influence of geological factors by the common value of tidal variations. Was analyzed reaction of parameters to the earthquake preparation process.

Measuring on all stations is taken every one minute. For data recording we use datalogger XR5-SE-M and the program LogXR. Data transferring is made by GSM modules Siemens and Wavecom-type. Data processing and figures creation is realized by program Stations Many [6].

Therefore, were analyzing the value of stress field by hydrodynamical parameters [20-21] and geomagnetic field variations during preparation of several earthquake processes on the territory of Caucasus ($M_{ag} > 4$ in the period from 01.02.2023 to 14.10.2023) were calculated and analyzed:

1. Earthquake in City Mtskheta, Village Lelubani. 24.09.2023 04:00, $M_{ag} = 4.1$, Depth = 10km.

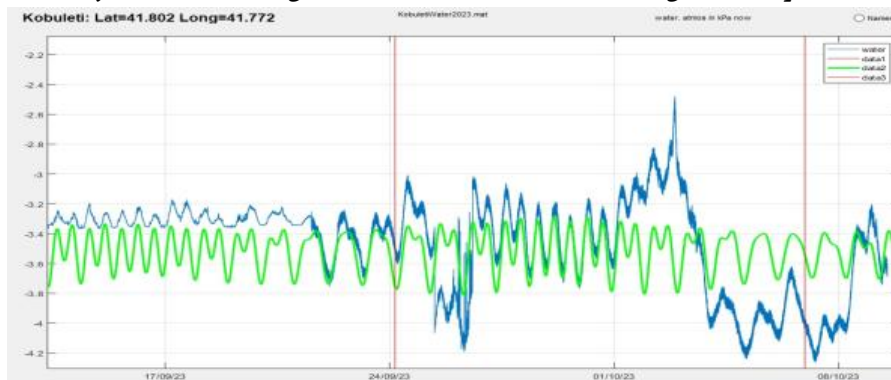


Fig. 1. Water level and tidal variations at the Kobuleti borehole. Vertical line marks an earthquake.

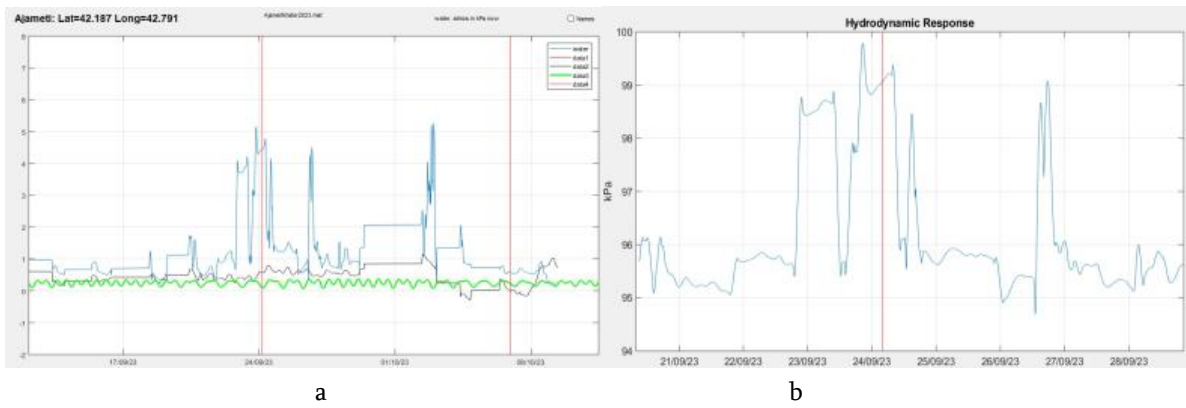


Fig. 2. a - Water level, atmospheric pressure and tidal variations at the Ajameti borehole. Vertical line marks an earthquake. b- Hydrodynamic Response

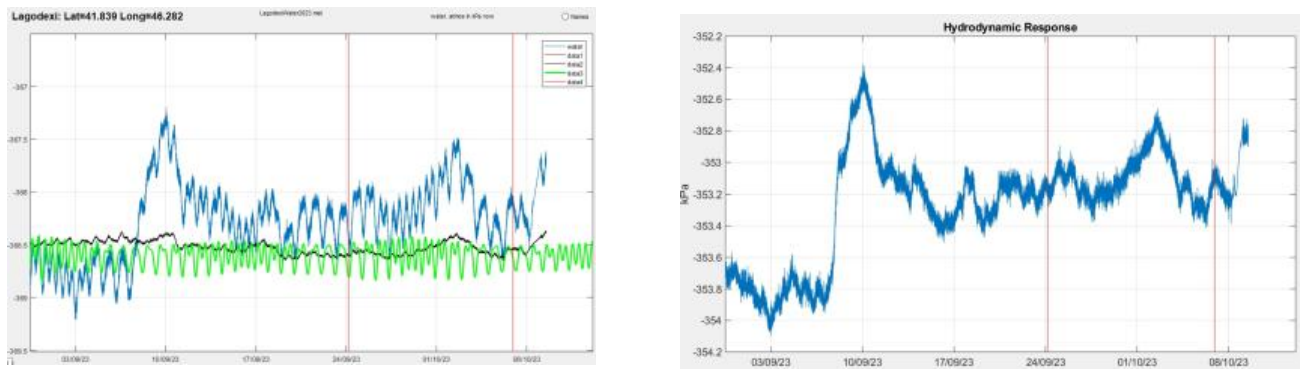


Fig. 3. a - Water level, atmospheric pressure and tidal variations at the Lagodekhi borehole. Vertical line marks an earthquake. b- Hydrodynamic Response

The first of them - "Kobuleti", is located 263 km from the epicenter, the second, "Ajameti", is located 184 km from the epicenter and Lagodekhi - 110 km from the epicenter.

The earthquake of 24 September 2023 (Mag- 4, Mtskheta), anomalies were observed at Dusheti Geomagnetic Observatory.

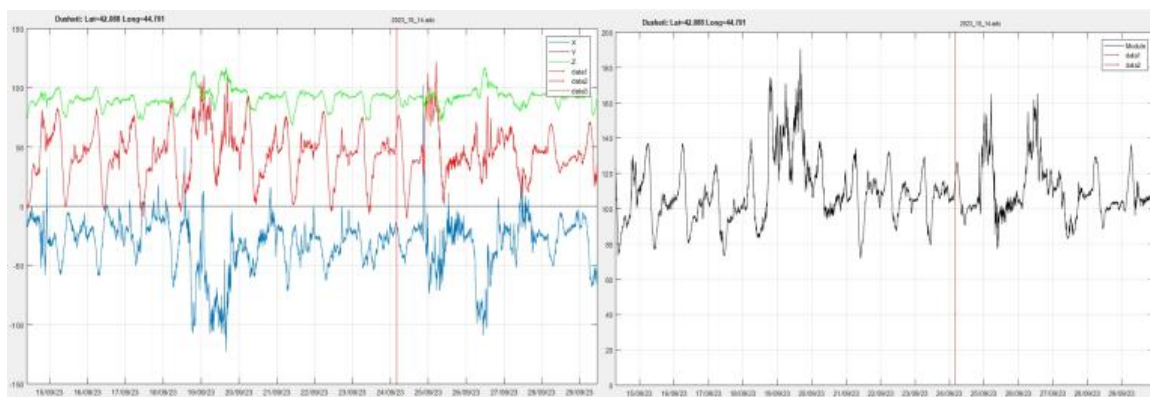


Fig. 4. a- Variation of x,y,z components of the magnetic field at the Dusheti Station. b- Variation of the module value.

Anomaly was revealed on "Lagodekhi", and "Nakalakevi" stations before 06 October 2023 earthquakes, 14 days earlier. Anomalous change of water level can be seen on the graph (Fig.1, and Fig. 2 a, b, Fig. 3. a, b and Fig. 4. a, b). The duration of the anomalous period is fixed on figure.

2. Earthquake in City Telavi – Village Shakriani. 06.10.2023 22:28 Mag=4.1, Depth=10 km.

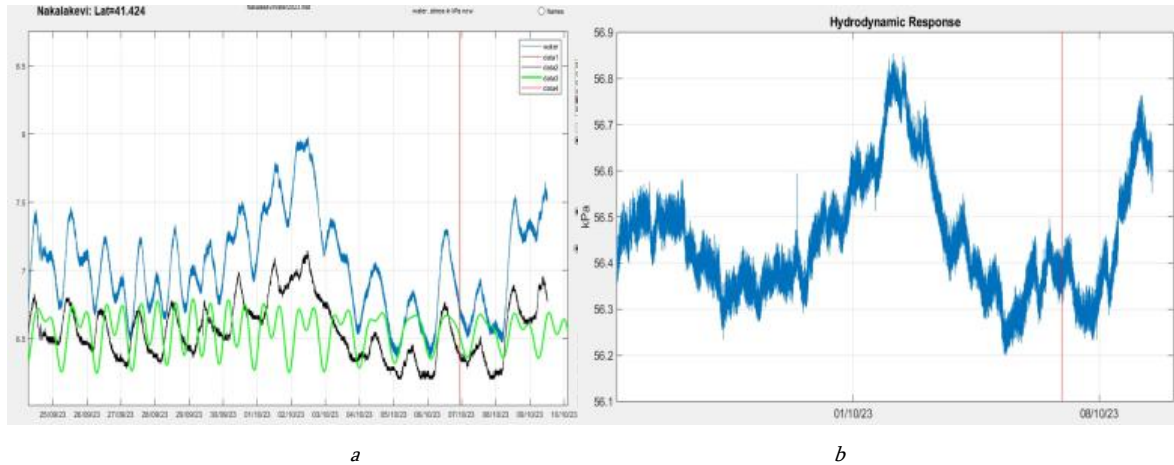


Fig. 5. a - Water level, atmospheric pressure and tidal variations at the Nakalakevi borehole. Vertical line marks an earthquake. b- Hydrodynamic Response.

In Nakalakevi, which is 195 km away from the epicenter, we observed an anomaly that continued for 5 days. The duration of the anomalous period is fixed on figure.

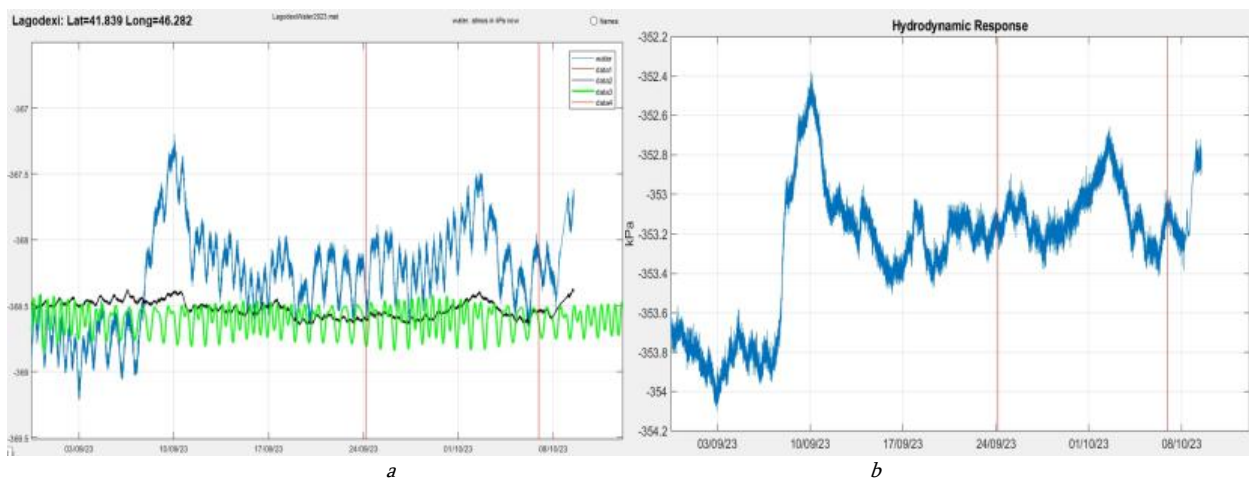


Fig. 6. a - Water level, atmospheric pressure and tidal variations at the Lagodekhi borehole. Vertical line marks an earthquake. b- Hydrodynamic Response.

Anomaly was observed in Lagodekhi borehole 5 days earlier before event of 06 October 2023. The Earthquake occurred in 60 km far from a station.

Conclusions:

Results of data analysis demonstrate the informatively of water level as an indicator of tectonic activity. Variations in hydrodynamic parameters are caused by the earth stress. During normal period it change according tidal variation and has “background” value. Before seismic event character of variation changed above “background” value, as indicator of tectonic activity. During the observed time period were fixed earthquake with Magnitude >4, between 50-200 km from the station, occurred on the territory of Caucasus.

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