

## HYDRODYNAMIC ANOMALIES RELATED WITH PREPARATION OF EARTHQUAKES MAG>4 IN GEORGIA (2022)

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**Abstract.** In terms of geodynamic life, territory of Georgia is one of the most active region. More the 20 year was 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 contain information about several hydrodynamic anomalies were observed during earthquake (2022, Mag>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 StationsMany [6].

Let us consider the changes in parameters during the preparation of the earthquakes for Mag>4 (in the period from 01.01.2021 to 31.07.2022 for four stations.

### 1. Earthquake in City Dmanisi - South-West - 26km. Village Sameba-9km. 13.02.2022 18:25, Mag = 6.1, Depth = 10km.

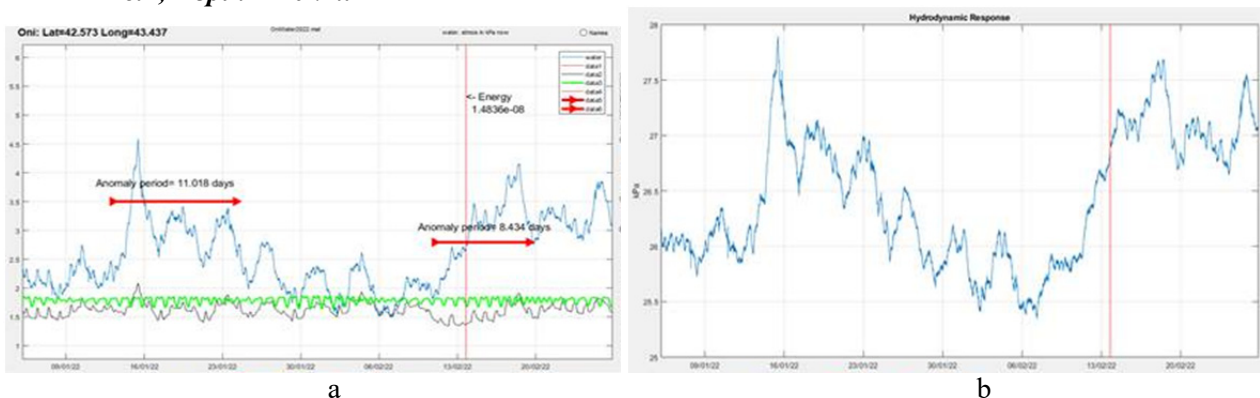


Fig.1. a - Water level, atmospheric pressure and tidal variations at the Oni borehole. Vertical line marks an earthquake. b- Hydrodynamic Response.

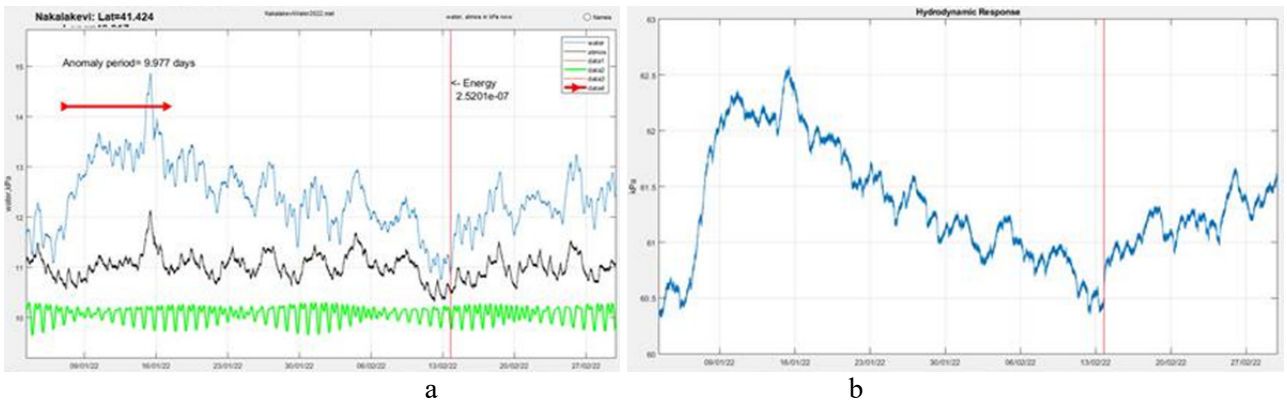


Fig.2. a - Water level, atmospheric pressure and tidal variations at the Nakalakevi borehole. Vertical line marks an earthquake. b- Hydrodynamic Response.

The first of them - "Oni", is located 165 km from the epicenter, the second, "Nakalakevi", is located 64km from the epicenter.

Anomaly was revealed on "Oni" and "Nakalakevi" stations before 13 February 2022 earthquakes, 14 days earlier. Anomalous change of water level can be seen on the graph (Fig.1 a, b and Fig. 2 a, b). The duration of the anomalous period is fixed on figure.

**2. Earthquake in City Vani - South-East - 18km. Resort Sairme-6km. 15.03.2022 12:25 Mag=4.8, Depth=13 km.**

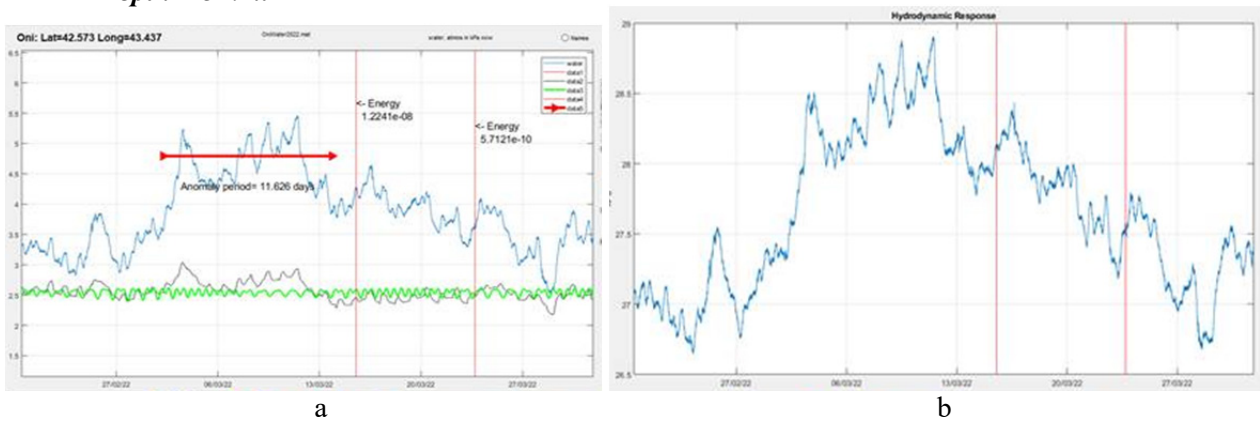


Fig.3. a - Water level, atmospheric pressure and tidal variations at the Oni borehole. Vertical line marks an earthquake. b- Hydrodynamic Response.

In Oni, which is 87 km away from the epicenter, we observed an anomaly that continued for 10 days. The duration of the anomalous period is fixed on figure.

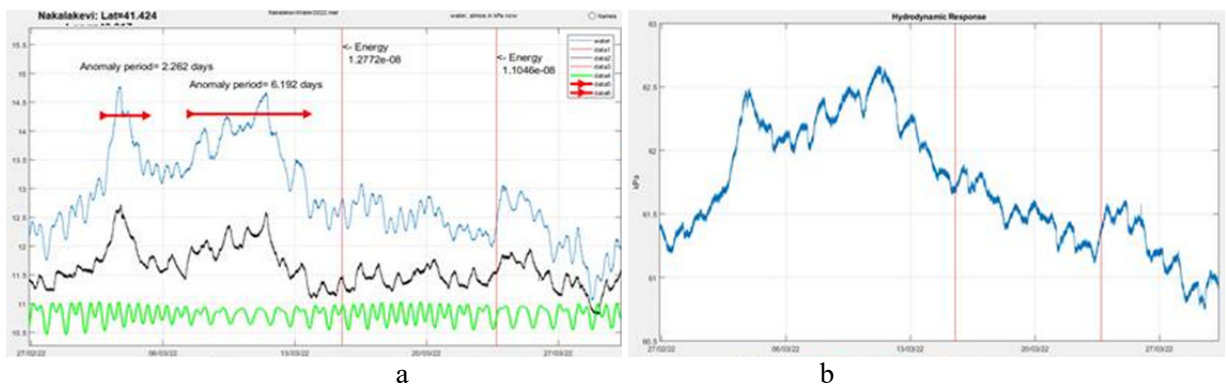


Fig. 4. a - Water level, atmospheric pressure and tidal variations at the Nakalakevi borehole. Vertical line marks an earthquake. b- Hydrodynamic Response.

Anomaly was observed in Nakalakevi borehole 10 days earlier before event of 15 March 2022. The Earthquake occurred in 86 km far from a station.

**3. Earthquake in City Dmanisi - South-West - 26km. Village Sameba - 8km. 14.05.2022 17:14 Mag=4.4, Depth=9km.**

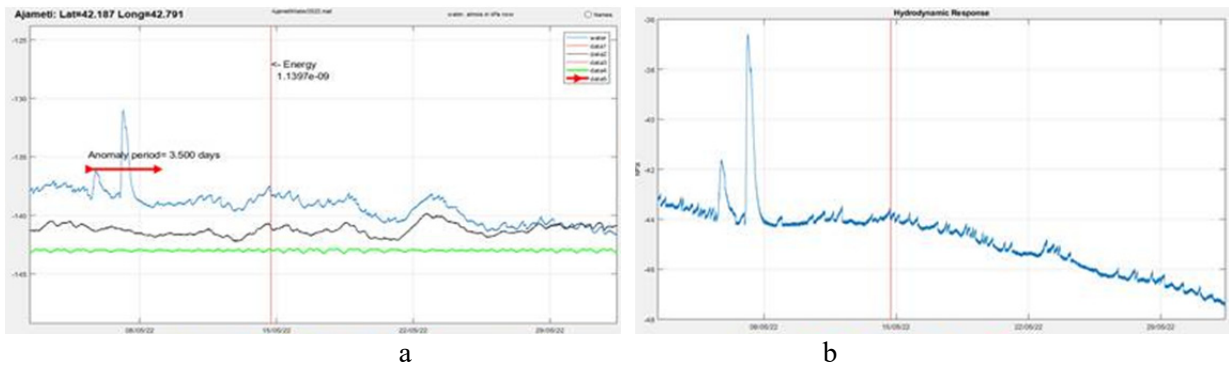


Fig.5. a - Water level, atmospheric pressure and tidal variations at the Ajameti borehole. Vertical line marks an earthquake. b- Hydrodynamic Response.

At Ajameti station anomaly behavior was 7 day earlier before the earthquake and continued for 3 days. Earthquake epicenter was located in 143 km far from the station.

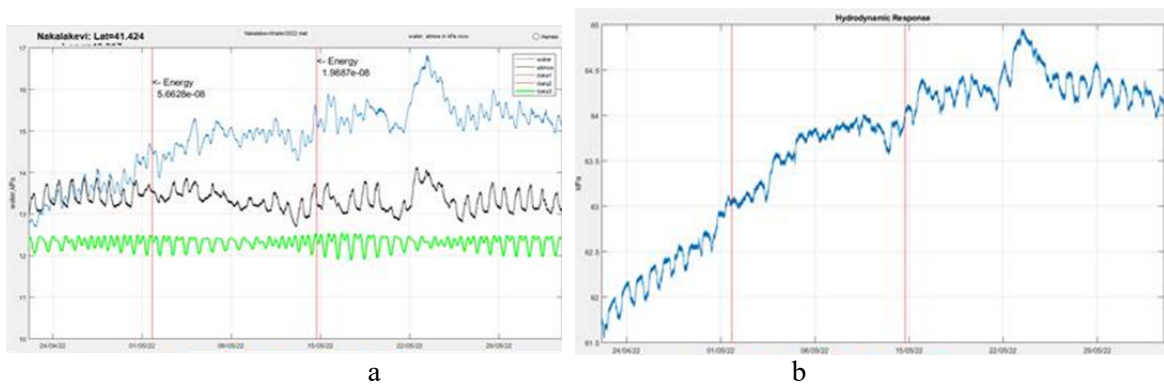


Fig. 6. a - Water level, atmospheric pressure and tidal variations at the Nakalakevi borehole. Vertical line marks an earthquake. b- Hydrodynamic Response.

In Nakalakevi, which is 55 km away from the epicenter, we observed an anomaly that continued for 10 days.

**4. Earthquake in City Dmanisi - South-West - 25km. Village Sameba - 9km 11. 07.2022 03:36, Mag=4.4, Depth=10km, Georgia**

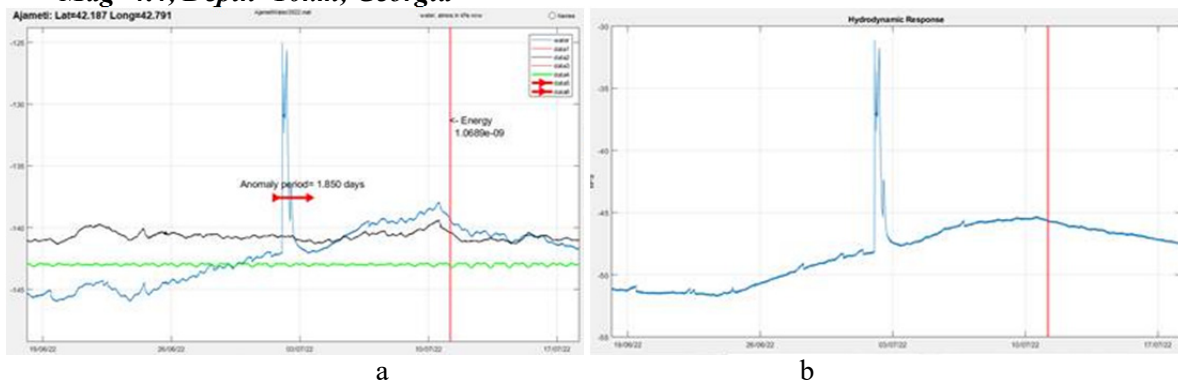


Fig.7. a - Water level, atmospheric pressure and tidal variations at the Ajameti borehole. Vertical line marks an earthquake. b- Hydrodynamic Response.

Anomaly was revealed on Ajameti Station before 11 July 2022 earthquake, 7 days earlier and continued 2 days long. The earthquake was in 146 km distance from the station.

## **Conclusion**

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 50-170 km from the station, occurred on the territory of Caucasus.

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