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About the ways of hydrodynamic observations informativity enhancement

D. G. Taimazov, T. I. Sharapudinov, M. G. Magomed-Kasumov, and M. S. Sultanakhmedov
Dagestan branch GS of the Russian Academy of Sciences

It is well known, that hydrogeodynamic observations, including measurement of production output of blowing wells and water level registration in wells with negative level, are one of the most accessible means of Earth crust deformation monitoring, which usually used for seismic forecasting. Practically the most informative of them is observation of blowing wells flow rate. However instrumental and methodical supply of flow rate registration is behind such supply in the field of water level observation. That is why the opportunity of penetration of rocks change estimation with the use of observations of water level in wells is the subject of concern. Thereto practically functions of water level response to atmospheric pressure change are used [Lyubushin A.A., Malughin V.A., "Physics of the Earth", 1993, №12, p.74-80; Lyubushin A.A., Leghnev M.Yu., "Physics of the Earth", 1995, №8, p.79-84].
In the forth development of this approach, we proposed the method of response function research (RF Patent № 2316027, Taimazov Dj.G., 2008). This method includes the following steps:
– the harmonic analysis of time sequence of atmosphere pressure and water level synchronous observations in the well by the hour by the method of sliding time window in 30 days and 1 hour step;
– in time sequence of atmosphere pressure observations the stable harmonics (semidiurnal and diurnal) and the harmonics consistent with them in time sequence of water-level observations in a wells are being chosen;
– by comparison of amplitudes and phases of the found coherent harmonics, relative amplitudes response are determined (RAR) as amplitude ratio of the chosen harmonics in water-level observations to the atmosphere pressure observations, and response timeout (RTO) as phase shift between them. We get two new time sequences RAR and RTO with the discretization equal to the step of the sliding window in our case it is 1 hour;
– obtained time sequences are subjected to the repeated harmonic analysis for the isolation of diurnal and long-period tidal harmonics in them (e.g. half-monthly and monthly). By these time sequences the harmonics amplitude calibration in deformation terms is made. These harmonics may be used for monitoring of stress-strain of the Earth crust.
For realization of this approach software product "PeriodSearcher" was developed. With the use of this application we have handled data arrays of several years' observations of water level in "Serebryakovka", "Kaspiysk-115M" and "Aidy" wells in Daghestan, so as data arrays of atmospheric pressure parallel observations. As the result stable 12- and 24-hours harmonics were found in the time sequences of atmospheric pressure. Dominating 12-hours harmonic, which is determined by variation of cold atmospheric layer at an altitude of 80-85 km, has twice larger order of amplitude value than tidal harmonic S2.
Harmonic analysis of RAR time sequences showed occurrence of 12-hours harmonic and its overtones (8- and 4-hours), so as non-periodical components (anomalies), which probably related with the processes of earthquakes preparation. Revealed variation of harmonic coefficients in the dependence of geological conditions of drilling location and time-to-time variability of RAS interpreted as reflection of spatiotemporal change of Earth crust deflected mode and proposed for the use in seismic forecasting.