

Study of the Dynamics of Deformation of Water-Saturated Reservoirs Under Seismic Impact

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The paper presents the results of a comprehensive analysis of precision measurements of the deformation dynamics of water-saturated reservoirs in observation wells. The research objects are located in natural conditions on the territory of the geophysical observatory of the IDG RAS "Mikhnevo" (Moscow region) and natural-technogenic - in the zone of influence of the developed iron ore deposit of the Kursk magnetic anomaly (Gubkin, Belgorod region). Observation points are equipped with instrumental-measurement complexes. Hydrostatic pressure sensors are installed in the wells, seismometers and barometers are located at wellhead sites. Synchronization of registration at points is carried out using GPS modules.

Long-term hydrogeological data series are used to evaluate the barometric efficiency and tidal sensitivity of the reservoir-well systems under consideration. Filtration parameters - water conductivity and permeability are calculated on the basis of tidal analysis by phase shift between tidal components, identified in ground displacement and level, under quasi-stationary conditions. The intervals of values obtained under the conditions of seasonal and technogenic variations in the groundwater level at a rate of more than 5 cm/day are excluded.

Particular attention is paid to the study of the response of water-saturated reservoirs to the passage of seismic waves from distant earthquakes. Ground displacement velocities are recalculated from ZNE to ZRT coordinate system. Based on the poroelastic model [1], the pore pressure is determined from seismic data, taking into account separately the volumetric and shear components of the deformation of a water-saturated reservoir. The obtained values are compared with the recorded hydrogeological responses [2]. A similar scientific and methodological approach is planned to be used in the future for predictive assessment of the relative deformation of water-saturated reservoirs with different physical and mechanical characteristics.

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1. Hsieh P., Bredehoeft J., Farr J. Determination of aquifer transmissivity from earth tide analysis // *Water Resour. Res.* - 1987. - V. 23. - P. 1824-1832.

2. Shalev E., Kurzon I., Doan M.-L., Lyakhovskiy V. Water-level oscillations caused by volumetric and deviatoric dynamic strains // *Geophys. J. Int.* (2016) 204. P. 841–851. DOI: 10.1093/gji/ggv483.