THE PERMANENT EXISTING MODELS – THE MAIN INSTRUMENT FOR ASSESSMENT OF TRANSBOUNDARY GROUNDWATER FLOWS.

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Study and prediction of hydrogeologic processes, existed in the aquifers of adjacent states, need precise quantitative assessments especially under growing anthropogenic impact on groundwater. The accuracy of such predictions is determined only by considering of hydrodynamic groundwater flow as a whole, which existence and peculiarities are specified by recharge and discharge conditions. It is necessary to mark that these areas can be distributed on territories of different states. At present it is possible to create constant-working groundwater models considering all characteristics of hydrogeologic aquifer schematization (both in plane and cross section) and dynamically changing anthropogenic factors. The methods of mathematical modeling allow predicting peculiarities of interaction between groundwater and surface water with sufficient accuracy. This is especially important in the case of risk of groundwater contamination due to its penetration from adjacent states.

Thus, the rational use of groundwater resources needs creation of regional constant-working models which boundaries are determined by natural boundaries of hydrodynamic flow that can possibly be on the territory of adjacent state. Such approach determines free exchange by as hydrogeologic and hydrologic parameters (some of them can change in time), as parameters and conditions of anthropogenic load. During creation of such models it is necessary to compare model results with natural data that demands exchange by data of regime observations on interstate level. Created constant-working regional models of filtration processes and mas-transfering processes have to be transfed to regional monitoring centers of interested sides and then jointly used on the base of general factographic and cartographic data base.

The main peculiarity of constant-working models is that they can predict the future changes. This possibility is provided by storing of changing in time parameters of water-bearing layers, natural and technogenic sources of disturbance in information system with there the further processing in numerical programs.

Suggested methodology is used for creating of regional models covers the area within the southern part of West-Siberian artesian basin in the interfluves of rivers Ob and Irtysh. The region includes Omsk, Novosibirsk areas, Altai region and Pavlodar area (Kazakhstan). Groundwater on these territories is the part of total regional groundwater flow of West-Siberian artesian basin. The modeled area is 800x550 km. The three-layered hydrogeologic schematizaion was accepted for mathematical model the size of 170 × 140 nodal points. It includes the first from the surface Altymsky aquifer and two aquifers of the Cretaceous age (Ipatovsky and Pokursky). The areas of exposure modeled complex on the surface can be considered as natural boundaries of the aquifers. The aim of the modeling is assessment modern state and possible exploitation groundwater resources of the Cretaceous aquifer used o existed scheme of wells distribution and also for receiving of predicted solutions for determining possible rational exploitation.

The undisturbed filtration regime existed on the beginning of 50-ties was produced on the model. Field data carried out by famous Russian hydrogeologist V.S.Plotnikov in 80-ties for the part of territory were used as a criterion of model adequacy.

The calculation filtration schematization for non-rectangular (tetragonal) blocks of finite-difference area which nodal points have exact geographic tying was taken on the model. It allowed create cartographic data base including initial parameters and resulted groundwater head and balance fields under its intensive exploitation using GIS programs.

The adecvacy of the stationary filtration model was estimated by comparision of calculated data to those obtained from observation wells (tab. 1 and fig. 1).

Table 1. Correlation between regime and calculated data of groundwater levels in the Cretaceous aquifer for some wells (stationary problem for 1964)

Well number	Coordinates		Regime data	Calculated data
7	74.3754	55.370353	113.	110.13
9	74.945985	55.435873	110.	112.44
67	74.632269	54.907825	116.	113.16
128	75.301247	54.551543	118.	116.94
135	71.746933	54.360757	109.	109.51
136	71.732668	54.145455	108.8	108.05
139	72.400731	54.629304	108.4	109.83
180	72.4716	53.991353	109.8	105.02
191	73.558915	54.172040	110.8	110.42
199	74.0269	54.005684	109.8	110.94
254	74.9468	53.929495	111.	112.97
262	74.691826	53.865651	113.5	112.36
377	73.8667	53.766700	108.16	107.79
381	73.857256	53.748895	107.68	109.70
398	73.621551	53.678247	107.52	109.27
409	74.249299	53.639828	108.3	109.73
531	77.348962	54.384114	123.	124.18
569	77.216595	54.171673	125.	124.87

Epignose problem with dynamic of water withdrawal during 50 years was solved on the model of disturbed filtration regime. Existed well-fields exploiting Ipatovsky and Pokursky aquifers (Upper and Lower Cretaceous) were determined as sources of technogenic load.

As an example of predicted variants several variants of existed well-field location and debt operated in Russia and Kazakhstan are considered. Received depression cones are analyzed с точки зрения of maximum possible values of water withdrawal providing minimal lowering groundwater head along the state boundary.

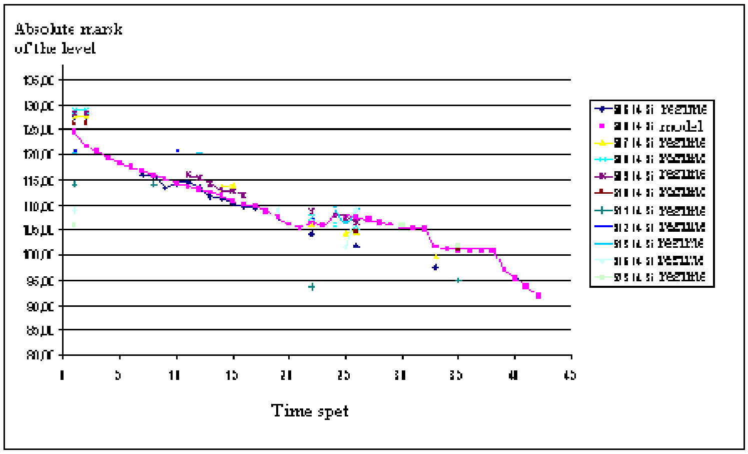

Figure 1. Correlation between calculation and observed data obtained on some wells of Pokursky aquifer

The figure 1 illustrates the correlation betweecalculated data for stationary and one of disturbed filtration regimes.

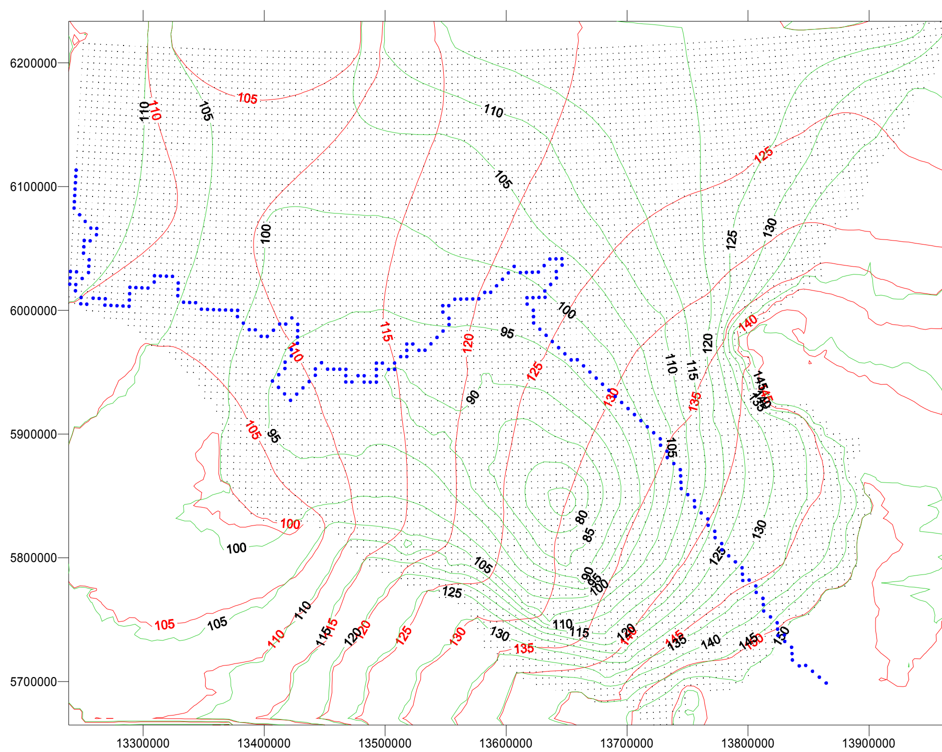

Figure 1. Corelation of hydroisogips in the third aquifer for 1967 (stationary conditions) and 2003 years

Such calculations can be considered as a halpfull instrument in the the field of rational transboundary groundwater use for potable water supply as they can clearly illustrate the contribution of each country exploiting transboundary aquifer in its depletion during the long-term exploitation.