Geophysical Research Abstracts, Vol. 9, 05614, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-05614

Assessment of ecolo-hydrogeological conditions under influence anthropogenic impact using mathematical modeling

I.N.Polshkova

Water problems Institute, Russian Academy of Sciences, Moscow, Russia
(z_irpol1@mail.ru/+7 495 135-5415

Technogenic changes due to anthropogenic activity cause risk of heavy metals penetration which high concentrations were found in the reservoirs of surface water and well-fields exploiting Nekrasovsky aquifer. Investigations of processes occurring on this territory were carried out using mathematical models connected by input information and created on the base of unified discritization in plane of the modeled area. Models reproduce both geofiltration processes with different schematization of natural and anthropogenic conditions and processes of convective mass transfer in groundwater. Geofiltration processes were studied taking into account seasonal surface water levels fluctuation during two flood and three low periods. Moreover processes of seasonal frost penetration and melting of the first groundwater aquifer were considered. This was possible to do by specifying on the models the field of changing in time parameters on each time-step, such as infiltration, surface water levels, parameters describing their connection with groundwater and effective thickness of the aquifer. Vertical hydrogeological schematization was based on three-layered model, considering seasonal-melted and seasonal-frozen layers in hydrogeological section, including flow-land and terraced sediments and also kazantsevsky upper layers. The thickness of frozen and melted layers varies from 10 to 15 meters. Filtrations processes in this layer occur only during seasonal melting. Hydrodynamic processes, occurring on this territory, are first of all determined by complicated water-exchange processes between groundwater and surface water. This territory is also characterized by several types of marshes. The first type (upper-marshes) has a quite weak connection with the aquifer. The recharge from upper-marshes in accordance with seasonal frozen and melting was considered simultaneously with filtration processes in the first groundwater aquifer

only for the periods of this layer melting. The second type (low-land marshes) and also rivers and lakes, heaving stable connection with the aquifer, were determined as a third type boundary condition on the second (not frozen) aquifer. Recharge (discharge) was considered in accordance with seasonal river levels fluctuations, having different values in the periods of two flood and three low periods. Parameters of interconnection between groundwater and river, lake and marshes flow were sort out on the model in accordance with natural conditions. Statical and time-depended problems aimed on reconstitution of natural conditions and forecast of possible changes in hydrogeologic conditions under anthropogenic impact were solved. Groundwater contaminants were analyzed. Sources of soil contamination, contamination points by river section lines and sources of groundwater contamination due to filtration of atmospheric precipitation were determined. Also the areas of groundwater contamination by heavy metals were assigned. Prediction calculations of existed contaminants concentrations in drinking groundwater were carried out accounting flood and low periods. Mathematical modeling of mass transfer processes occurring in geoacological object, was realized both by piston-like scheme and total mixing scheme. Prediction calculations were carried out for time-dependent filtration processes in average annual and average month values of infiltration recharge and levels in the surface reservoirs. The assessment of exploiting supplies of well-fields and calculations of sanitary zones on different time-steps and volumes of water withdrawal was carried out on filtration model considering average annual values of the levels. The assessment of the risk of groundwater contamination of Nekrasovsky aquifer by existing sources of heavy metals (Fe, Al, Mn, Pb ,Zn, Cu, Ni,Hg) was forecasted by use of geomigration model.