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Different methods for the estimation of available water resources in the future under the influence of climate changes

B. Majkic-Dursun, Dj. Boreli-Zdravkovic, and D. Djuric
Institute for the development of water resources "Jaroslav Cerni", Belgrade Serbia (brankica.majkic@jcerni.co.rs)

The paper analyzes different approaches for the calculation of available water resources the under influence of CC, for cases of drinking water sources in the alluviums of the Sava River (Belgrade GW source)and Nišava River (Mediana GW source). Different types of analyzed sources (bank-filtered and artificially recharged) required different approaches, adjusted to the specific characteristics.
The Belgrade GW source (capacity of 4-5 m3/s), is comprised of 99 horizontal wells and over 40 tube wells positioned on the 50 km on the alluvial plain of the most downstream Sava River banks. Deep parts of the water bearing complex are comprised of river-lacustrine polycyclic sediments (from sandy-gravels to silts), while the upper part are alluvial sediments. Main recharge stems from the Sava River by bank filtration process, while due to the layering of the aquifer, recharge from the hinterland in some river bank sections reaches up to 30 %.
Test area covers 240km2, of Sava river valley. Future water availability has to be calculated according to the “new” -expected boundary conditions, vertical water balance on the test area and “estimated” river water fluctuations.
The artificially-recharged GW source „Mediana“ provides water supply to the City of Niš, as one of 6 water supply sources. The concept of this groundwater source is based on surface water abstraction from the Nišava River (catchement area is 4,086 km2 totally, where 1,096 km2 is in Bulgaria), which is transported to infiltration lakes after pre-treatment process. Once in the infiltration lake, the water is infiltrated into the aquifer and abstracted by wells, or collected by a drainage system. This site was used for the analysis of the impacts of climate changes on the discharge of Nisava River, since it feeds aquifer through infiltration lakes (approx. 95-98%) after surface water pretreatment.
Estimation of available water resources was done for period until 2100 for A1B climate scenario. Climate parameters, precipitation and temperature, were calculated using three climate models: CNRM, ICTP and UCLM. Calculated data for future periods 2021-2050 and 2071-2100 were analyzed and compared with the respective data for basic period 1961-1990.
Estimation of available water resources for Belgrade alluvium was performed using calibrated GW model. Empirical formulae was developed for the estimation of pET (based on T and P) while the optimal groundwater level and fluctuation in hinterland was used as ecological criteria.
Future discharge of Nisava River was estimated using VNC model, based on non-linear standardized correlation method. Ecological criteria was established based on the requirements of Serbian Water Law as minimum sustainable flow (calculated as the minimum 95% average monthly discharge of Nisava River) which must be provided downstream from a surface water intake.
Key words: climate change, available water resources, alluvial water sources, A1B scenario