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Climate variability and change and human intervention effects on an over-exploited aquifer

Athanasios Loukas, Katerina Zagoriti, Nikitas Mylopoulos, Pantelis Sidiropoulos, and Lampros Vasiliades
University of Thessaly, Dept. of Civil Engineering, 38334 Volos, Greece (aloukas@civ.uth.gr, +30 24210 74169)

In this paper, the influence of climate variability, change and human intervention on an over-exploited aquifer, is examined under various operational scenarios for water resources management. The aquifer of Lake Karla watershed in Central Greece is in an over-exploitation status due to the intense agricultural activities. The draining of old lake Karla at 1962 and the uncontrolled use of irrigation wells after 1980s has led to serious environmental problems as water scarcity, water and ground pollution and land subsidence. The partial restoration of Lake Karla and the accompanying projects are under construction in order to reverse this situation. A modeling system, consisting of a statistical downscaling component, a hydrological model, a groundwater model, a reservoir operation model and a module for the estimation of water demands, has been developed and applied on Lake Karla watershed. The outputs of the Canadian Centre for Climate Modelling Analysis Global Circulation Model CGCM3 were applied for three socioeconomic scenarios, namely SRES B1, SRES A1B and SRES A2 for the assessment of climate change impacts on water resources. The statistical downscaling module has been applied to estimate monthly precipitation and temperature time series for present conditions and the future climate period 2009-2058. The hydrological model was applied in a semi-distributed mode to simulate the hydrological cycle components, to simulate the reservoir operation and to produce time series of recharge data, which were imported as input to the groundwater model. The last one was applied for simulation of groundwater resources for different climate scenarios under three operational management scenarios: the first being the natural aquifer without human intervention, the second with the human intervention (reservoir simulation and management) and the third is the second scenario plus the future management plans for the urban water needs of the nearby city of Volos, as they belong to the accompanying projects of the restoration plan, in which supply water wells will be installed to cover future water needs. The results of groundwater model were finally used for the estimation and the comparison of climate variability, change and human intervention influence. Climate variability and change does not affect the natural aquifer of Lake Karla in contrast to human intervention which intensifies the environmental problems.