Geophysical Research Abstracts
Vol. 18, EGU2016-14329, 2016
EGU General Assembly 2016

Natural and human drivers of salinity in reservoirs and their implications in water supply operation through a Decision Support System

Eva Contreras (1), Raquel Gómez-Beas (2), and Antonio Linares-Sáez (3)

(1) Abengoa Water, Seville, Spain (eva.contreras@abengoa.com), (2) Abengoa Water, Seville, Spain (raquel.gomez@abengoa.com), (3) Abengoa Water, Seville, Spain (antonio.linares@abengoa.com)

Salt can be a problem when is originally in aquifers or when it dissolves in groundwater and comes to the ground surface or flows into streams. The problem increases in lakes hydraulically connected with aquifers affecting water quality. This issue is even more alarming when water resources are used for urban and irrigation supply and water quantity and quality restrict that water demand.
This work shows a data based and physical modeling approach in the Guadalhorce reservoir, located in southern Spain. This water body receives salt contribution from mainly groundwater flow, getting salinity values in the reservoir from 3500 to 5500 μScm-1. Moreover, Guadalhorce reservoir is part of a complex system of reservoirs fed from the Guadalhorce River that supplies all urban, irrigation, tourism, energy and ecology water uses, which makes that implementation and validation of methods and tools for smart water management is required. Meteorological, hydrological and water quality data from several monitoring networks and data sources, with both historical and real time data during a 40-years period, were used to analyze the impact salinity. On the other hand, variables that mainly depend on the dam operation, such as reservoir water level and water outflow, were also analyzed to understand how they affect to salinity in depth and time. Finally surface and groundwater inflows to the reservoir were evaluated through a physically based hydrological model to forecast when the major contributions take place.
Reservoir water level and surface and groundwater inflows were found to be the main drivers of salinity in the reservoir. When reservoir water level is high, daily water inflow around 0.4 hm3 causes changes in salinity (both drop and rise) up to 500 μScm-1, but no significant changes are found when water level falls 2-3 m. However the gradual water outflows due to dam operation and consequent decrease in reservoir water levels makes that, after dry periods, salinity changes from 3800 to 5100 μScm-1 in the deepest layers are found with a similar daily water inflow. On the other hand, when reservoir water level is low, salinity increases around 1000 μScm-1 are found with a 2 m water level falling. In view of the influence of water level in the reservoir dynamics, this factor should be considered when dam operation decisions are taken by managers in terms of satisfying the water demand.
The results will be implemented in a Decision Support System that is being displayed in the Guadalhorce River and which includes prediction of water quantity and quality in the reservoir in terms of salinity, involving water level and water inflow forecasting as the main factors to control the state of the reservoir and therefore with implications in water management. This methodology could be implemented in other reservoirs with high salinity and be adapted to other substances (such as nutrients and heavy metals) associated to water inflow in water bodies where water quality and quantity are driven by human decisions factors besides natural factors such as floods and dynamics of flows in the reservoir.