Climate Change and Sustainable Water Resources Management

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https://doi.org/10.1061/(ASCE)HZ.2153-5515.0000496

The special collection on Climate Change and Sustainable Water Resources Management is available in the ASCE Library (https://ascelibrary.org/page/jhtrbp/climate_change_sustainable_water_management).

Water is the main medium through which climate change is going to the affect human well-being, economies, and ecosystems. Therefore, sustainable water resource management should be the primary focus for adaptation to the changing climate. Because water is both the part and solution to several problems, effective strategies need to be developed in order to achieve the sustainable development goals. In general, the impact of climate change on water resources have been explored in detail. However, there still exists a wide range of opportunities in research and development to explore the link between climate and sustainable water resource management. Understanding the nonlinearity of climate change and its impact on water demand and supply is necessary to enable better policy making. The key to a resilient and sustainable water resource management plan lies in the its capacity to adapt to future climate change. The primary aim of this special collection of papers is to incorporate the various aspects of climate change impacts on water resources and to present the recent advances in methodology for sustainable and effective management of water resources in the context of prevailing adverse consequences of climate change. The special collection encompasses topics such as downscaling techniques, integration of downscaling with hydrological modeling, multicriteria analysis, and management of aquifer system. There are five papers collected within the theme. The papers will be greatly beneficial to both researchers and water and environmental engineers in this field.

The collection begins with a study of the probable impacts of climate change on water resources through a case study on Godavari River basin by Saraf and Regulwar (2018). Two general circulation model (GCMs), were used in the analyzing the climate change impacts on runoff generation in the basin using the soil and water assessment tool (SWAT). The results of SWAT simulation depict that the increase in runoff will be more than 50% under different climate change scenarios. The study facilitates the understanding of change in runoff over different time scales and provides insights to policy makers to future water resource planning and management.

The prevention from extreme climatic events, such as floods and droughts, depends a lot on the availability of forecasting technology, which requires correct and sufficient hydrometeorological observations. To minimize the impact of such disasters on physical, social, and economic well-being of public, it requires a vast network of sophisticated instruments to properly simulate and forecast the impacts. This not only requires huge installation costs, but also proper maintenance. The study by Feloni et al. (2018) in this special collection suggests a multicriteria geographic information system (GIS)-based approach for the optimization of a station network, with the aim of establishing an optimal hydrometeorological station network in the Florina region of northern Greece, both for developing an up-to-date real-time flood warning system and for water resources management, with special focus on the agricultural areas.

Proper assessment of variability in temporal and spatial changes in the extreme values of climate drivers is necessary for sustainable water resource management. There are numerous downscaling methods that are used to downscale the global projections of climate variables; however, most of them are not suitable enough to incorporate the uncertainty in extreme events. The study by Das and Nanduri (2018) utilizes the change factor method to simulate the changes in extreme events. A comparison of future and past changes in dry and wet conditions was performed using the widely used Standard Precipitation Index (SPI). The results reveal changes in the temporal distribution of the precipitation with an increase in depth for the nonmonsoon season as compared with past data. The highest variations in temperature profile were observed in winter as opposed to summer, with highly frequent warm days and warm nights.

The process of riverbank filtration (RBF) utilizes the natural soil and aquifer media to get rid of pollutants from the water during forced infiltration of river water to pumping wells. Although the method is simple, RBF may not fully solve the problem of pollution as it might not be able to fully separate the emerging pollutants such as personal care products, household chemicals, and pharmaceutically active compounds. Therefore, more efficient methods may be required out of which aquifer storage and recovery may one of those methods. D'Allessio et al. (2018) explains the various aspects of bank filtration and aquifer storage recharge systems as possible solutions during the water crisis. In addition to this, another study by Shende and Chau (2019) discussed one of the effective methodologies of finding the safest distance from the pumping well. A safe distance from the pumping well is a function of water quality, soil condition, and the rate of pumping. A logistic model was used to find the safe distance of a pumping well from a polluted river with respect to specific log cycle reduction in harmful pathogen concentration, whereas the hydrodynamic equation was used to measure the travel time of a parcel of water to decide the specific location of a production well.

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