World Academy of Science, Engineering and Technology
International Journal of Civil and Environmental Engineering
Vol:8, No:12, 2014

An Exploratory Study on the Impact of Climate Change on Design Rainfalls in the State of Qatar

Authors : Abdullah Al Mamoon, Niels E. Joergensen, Ataur Rahman, Hassan Qasem

Abstract : Intergovernmental Panel for Climate Change (IPCC) in its fourth Assessment Report AR4 predicts a more extreme climate towards the end of the century, which is likely to impact the design of engineering infrastructure projects with a long design life. A recent study in 2013 developed new design rainfall for Qatar, which provides an improved design basis of drainage infrastructure for the State of Qatar under the current climate. The current design standards in Qatar do not consider increased rainfall intensity caused by climate change. The focus of this paper is to update recently developed design rainfalls in Qatar under the changing climatic conditions based on IPCC's AR4 allowing a later revision to the proposed design standards, relevant for projects with a longer design life. The future climate has been investigated based on the climate models released by IPCC's AR4 and A2 story line of emission scenarios (SRES) using a stationary approach. Annual maximum series (AMS) of predicted 24 hours rainfall data for both wet (NCAR-CCSM) scenario and dry (CSIRO-MK3.5) scenario for the Qatari grid points in the climate models have been extracted for three periods, current climate 2010-2039, medium term climate (2040-2069) and end of century climate (2070-2099). A homogeneous region of the Qatari grid points has been formed and L-Moments based regional frequency approach is adopted to derive design rainfalls. The results indicate no significant changes in the design rainfall on the short term 2040-2069, but significant changes are expected towards the end of the century (2070-2099). New design rainfalls have been developed taking into account climate change for 2070-2099 scenario and by averaging results from the two scenarios. IPCC's AR4 predicts that the rainfall intensity for a 5-year return period rain with duration of 1 to 2 hours will increase by 11% in 2070-2099 compared to current climate. Similarly, the rainfall intensity for more extreme rainfall, with a return period of 100 years and duration of 1 to 2 hours will increase by 71% in 2070-2099 compared to current climate. Infrastructure with a design life exceeding 60 years should add safety factors taking the predicted effects from climate change into due consideration.

Keywords : climate change, design rainfalls, IDF, Qatar
Conference Title : ICESSE 2014 : International Conference on Environmental Systems Science and Engineering
Conference Location : Sydney, Australia
Conference Dates : December 15-16, 2014