Source: Arizona Daily Star

Pima County Regional Flood Control District Monthly Brown Bag Series

Climate change impacts on stormwater infrastructure design in Tucson, Arizona

Erfan Tousi
NextGen Engineering Inc

The stationary-based Intensity-Duration-Frequency (IDF) curves for rainfall provided by the National Oceanic and Atmospheric Administration Atlas 14 (NA14) are the primary data source of stormwater infrastructure design in the United States. However, studies have repeatedly observed the non-stationary character of climatic cycles. Recent observations show altered rainfall patterns and increased frequency and intensity of extreme events, highlighting a challenge for engineers to adjust design practices under climate change. IDF curves are gradually being compared with climate models to accommodate the adjustment. Yet, many sources of uncertainty remain, including model selection, that can significantly change the final stormwater design. This study updates the IDF curves for the City of Tucson, Arizona, U.S., comparing projections of eight Coupled Model Intercomparison Project Phase 6 (CMIP6) General Circulation Models (GCMs) for the future period (2020–2051). Observed local rainfall data was obtained for the historical period (1970–2001) and used for bias-correcting the models. Utilizing the regional frequency analysis method of NA14, IDF curves were updated for Tucson using the Partial Distribution Series (PDS) as the extreme series. The model selection in this study was based on annual maximum series (AMS) and PDS; however, due to uncertainty associated with GCMs, results for all models were presented, making it clear the extent to which the model selection can affect the design and cost of stormwater systems. Initial results attested to an increase in projected rainfall in extreme events, their underestimation using stationary assumptions, and the need to update IDF curves for Tucson. Moreover, the projected extreme values are greatly affected by model selection and scenarios. An illustrative stormwater culvert design showed that the differences in models' output could double the design size and considerably increase the cost. The model selection approach utilized in this study can facilitate a local engineers' and public works decision-making process by filtering out a wide range of projections to fewer preferred options based on GCMs' historical performance over the extreme series as the primary input of IDF curves.

PIMA COUNTY
FLOOD CONTROL

Wednesday, July 14th, 2021: 12:00 - 1:00 PM
Online via Teams