American Water Resources Association
2009 SPRING SPECIALTY CONFERENCE
Managing Water Resources Development in a Changing Climate
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Anchorage, AK

Tuesday, May 5
1:30 PM – 3:00 PM
Session 19: Changing Precipitation Patterns?

1. Closing the Loop of Climate Feedback in the Design of Large-Scale Water Resources Project - Faisal Hossain, Tennessee Technological University, Department of Civil and Environmental Engineering, Cookeville, TN (co-authors: Indu Jeyachandran, Abebe Sine Gebregiorgis)

Large-scale water resources projects impacting an area larger than 10,000 sq km usually results in increased anthropogenic open-water evaporation. This consequently may result in a positive or negative feedback on the precipitation process depending on the region-specific climate dynamics. However, such large water resources projects (such as dams, reservoirs, and irrigation projects) have never been designed with the climate footprint and the consequential feedback mechanism in mind. In this study, we explore the hypothesis that 'large scale water resources projects can alter the extreme precipitation variability considerably enough to change the design return period within the lifespan of the project'. More specificially, we explore the following questions: 1) How large (areal size) should a water resources project be in order to trigger a feedback mechanism on extreme precipitation variability? 2) How soon can alteration in the footprint of the hydroclimatology be seen after the construction of the water resources project? We explore these questions through the use of a coupled atmospheric-land surface model nested in a coarse-scale global circulation model.

2. Anaylsis of Impact Climate Change on Extreme Rainfall in Korea Using A2 Climate Scenario and Extreme Indices - Byung-Sik Kim, Senior Researcher, Gyeonggi-Do, GG, South Korea (co-authors: BoKyung Kim, Hyun-Han Kwon, Seok-Yong Yoon)

Interesting in climate change and abnormal climate has globally increased. Concerns have been raised about the ways how the acceleration of global warming would change future climate and about the consequences resulting from phenomena that may appear. As if to demonstrate the consequences, Korea Meteorological Administration(KMA) found last year that average temperature in 2007 (13.5 deg C), which was obtained by analyzing meteorological observation data from 60 stations, was the second highest after the one in 1988(13.6 deg C). Moreover, national rainfall l(1498.5mm) in 2007 increased 13.9% from the average year. The administration explained the phenomena by the increase of extreme weather events. High-intensity rainfall, which did not occur in the past, can be explained by the increase in extreme weather events such as the change in rainfall period and these phenomena can appear in the future. However, the weather events do not occur in specific regions in accordance with regular patterns or cycles. It is therefore difficult to carry out quantified evaluation of their trend and frequency. In this paper, extreme rainfall indices that can more objectively evaluate extreme weather events are proposed. In addition, to make a comparison between spatio-temporal distribution of present and future extreme climate events, indices were drawn from past data recorded by 66 observation points throughout the country operated by Korea Meteorological Administration. Using the indices, trends that have appeared to the present were analyzed. Using the climate change scenario data, which are obtained by running simulations from SRES A2 scenario and RecCM3, variation for every indices of future extreme weather events were calculate and their trends were spatially expressed.

3. The Impact of Stochastic Weather Generator Characteristic on Daily Precipitation Downscaling - Pao-Shan Yu, Tainan, Taiwan (co-authors: Shien-Tsung Chen, Chin-Yuan Lin)

Impact studies of changing climate on water resources require climate data over catchment scale. General circulation models (GCMs) provide sound simulations of climate variables at large spatial and temporal scales. Statistic downscaling is one of methods to produce local climate variables with small time interval, in which stochastic weather generator acts as an important tool to produce daily precipitation from monthly GCMs outputs. Therefore, reasonable choice of stochastic weather generator may significant effect on statistic downscaling of daily precipitation. A probability distribution of daily precipitation conditional on a wet

day needs to be decided before using stochastic weather generator. Both exponential distribution and Weibull distribution are common distribution used in stochastic weather generator. This study compared the statistical characteristics of daily precipitations generated by both exponential and Weibull distributions. Daily precipitation over the Tseng-Wen Reservoir basin in Taiwan was provided as database. Analytic results show that the means of generated daily precipitations by two distributions are as accurate as the observations. But the standard deviation of daily precipitation generated by the exponential distribution underestimates, while that by the Weibull distribution well fits the observation. Using Weibull distribution also has benefit on other statistical properties of daily precipitation, such as heavy rainfall events and exceedence probability. This study thus suggested the adoption of a fitted two-parameter distribution, which better describes the daily precipitation than a one-parameter distribution does, in the stochastic weather generator. Finally, future daily precipitations over the study area were projected under various GCMs using the stochastic weather generator. The impact of climate change on flow duration curve is investigated. The study finds that low flow in flow duration curve has decreasing tendency. More flexible operation rules for Tseng-Wen Reservoir may be necessary during dry season in the future.