Hydrological Perspective of Climate Change Impact Assessment

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Global warming has had profound impacts on climate and weather of all scales. From a hydrologic perspective, changes in the frequency and magnitude of extreme weather events are particularly crucial for water resources management. In light of the uncertainties involved in GCM modeling, proactive adaptation measures are being sought after to cope with potential climate changes. However, planning for proactive adaptation measures requires improved knowledge and quantitative analysis of the preparedness goals which generally are in scales not directly achievable by GCMs. To bridge the scale gap between GCM outputs and hydrological parameters required for planning proactive adaption measures, we propose a GCM-stochastic model integrated approach for assessment of climate change impact on extreme rainfalls, namely design storm depths. Two major components of the proposed approach are (1) assessment of changes in physical parameters of storm events using GCM outputs and (2) stochastic simulation of storm rainfalls of the projection period. The former evaluates the effect of climate change on major weather signals in average sense, whereas the latter takes into account the uncertainties in local and event scales which cannot be resolved by GCMs due to their deterministic nature. A continuous stochastic storm rainfall simulation model (SSRSM) was developed and used as a means of downscaling to station- and event-scale rainfalls. The SSRSM is composed of three major components – (1) storm occurrence simulation, (2) (duration, event-total depth) joint simulation, and (3) hyetograph simulation. By setting storm characteristics representative of the projection period, the SSRSM can generate outputs of a large number of simulation runs. Each run yields one annual sequence of hourly rainfalls. From the SSRSM outputs, annual maximum rainfall series of various design durations can be extracted and used for calculation of the design storm depths of various return periods and durations.

Other key issues to be addressed in this talk may include:

(1) Downscaled techniques for deriving hydrological data from climate model outputs

(2) The importance of communication among data providers and users for climate change studies.