Application for the 2011-2012 TWRI Mills Scholarship

Name and ID number

Name: Zengchao Hao Student ID:

Information of the student

Zengchao Hao

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Information of the faculty advisor

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Proposed Research

Urban drainage system design using improved rainfall analysis

The hydrologic design of urban drainage systems is commonly based on frequency analysis of recorded rainfall data. For a specific frequency of occurrence (or return period), the drainage system can be designed. When rainfall is heavier than the designed criteria, sewer backup may occur causing the basement flooding, localized street flooding and large area flooding [*Guo*, 2006].

Several studies have been conducted for rainfall analysis in Texas [*Asquith*, 1998; *Asquith et al.*, 2004]. The commonly used approach for rainfall frequency analysis is based on fitting a certain distribution to the data of a fixed duration and then deriving the relationship of rainfall intensity (or depth) to any return period. However, it is hard for the commonly used distribution to estimate extreme rainfall. Thus, an improved method for the rainfall analysis is need that can accurately estimate the extreme rainfall for urban drainage design.

In addition, it is expected that the probability of occurrence of extreme (or heavy) rainfall will increase due to the climate change in the future [*Trenberth*, 1999; *Trenberth et al.*, 2003]. Several studies based on global and regional models also support the hypothesis of the increase of extreme rainfall in a future climate [*Mailhot and Duchesne*, 2010]. The increase of the extreme rainfall may result in the increase of the standard of drainage and requires that the drainage design from the rainfall analysis should take into account the potential effect of climate change to reduce socioeconomic damages and cost.

In the proposed research, a new method for the rainfall analysis is proposed for drainage design. The proposed method can accurately estimate extreme rainfall. The extrapolation of a certain frequency of occurrance (or return period) from rainfall analysis is more accurate and is also expected to incorporate the effect of climate change. Rainfall analysis based on the proposed method is expected to provide

reliable design standard for urban drainage systems and reduce the risk of damage and cost to the urban infrastructure in Texas.

Asquith, W. (1998), Depth-duration frequency of precipitation for Texas, USGS Water–Resources Investigations Report, 98–4044.

Asquith, W. H., M. C. Roussel and G. S. W. R. Division (2004), Atlas of depth-duration frequency of precipitation annual maxima for Texas, US Geological Survey Water Resources Division, FHWA/TX–04/5–1301–01–1.

Guo, Y. (2006), Updating rainfall IDF relationships to maintain urban drainage design standards, Journal of Hydrologic Engineering, 11(5): 506-509.

Mailhot, A. and S. Duchesne (2010), Design criteria of urban drainage infrastructures under climate change, Journal of Water Resources Planning and Management, 136(2): 201-208.

Trenberth, K. E. (1999), Conceptual framework for changes of extremes of the hydrological cycle with climate change, Climatic Change, 42(1): 327-339.

Trenberth, K. E., A. Dai, R. M. Rasmussen and D. B. Parsons (2003), The changing character of precipitation, Bulletin of the American Meteorological Society, 84(9): 1205-1218.

Academic Qualification

GPR: Undergraduate: Ph.D.**:**

GRE: Verbal: Quantitative: Analytical Writing:

Courses taken

Theory and Application of Water Environmental Engineering, A; Hydrology Across Scale, A; Advanced Hydrology, A; Water Quality Modeling, A; Hydrogeology, A; Environmental Hydraulics, A; Irrigation and Drainage Engineering, A; Stochastic Hydrology, A; Vadose Zone Hydrology, A

Proposed use of funds

Funds from TWRI Mills Scholarship Program will be used to pay for the cost of traveling to conferences and tuition fees.

Intended career path

After completing my Ph. D. degree in the Department of Biological and Agricultural Engineering, I would continue my research in the area of hydrology and water resources. After working as a post-doc for several years, my final goal is to be a faculty member to conduct my research on water related problem.