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# STOCHASTIC DATA ASSIMILATION TECHNIQUE IN REGIONAL HYDROLOGY

AVM. Ines (1), **P. Droogers** (2), K. Honda (1) and A.D. Gupta (1)

(1) Asian Institute of Technology, Bangkok, Thailand. (avmines@yahoo.com; honda@ait.ac.th; adg@ait.ac.th), (2) FutureWater, DH Arnhem, The Netherlands. (p.droogers@futurewater.nl)

Over the past several decades, knowledge on soil water flow and transport processes in the vadoze zone has proliferated significantly. Mathematical models of flow and transport processes, with varying degrees of complexity, in the unsaturated zone have been developed and are available for the studies of strategies that could alleviate environmental and water management problems. However, it is evident that the gap between model development and practical model applications in the field has widened as a result of the increased complexities associated with increased understanding on the processes in the soil-water-plant-atmosphere system. Models require input data that are difficult to measure in the field and much more when the hydrological domain is extended to the regional level. In this regard, inverse modeling (IM) has been found to be robust in deriving model input parameters in field scale applications. Would it be valid also in the regional level?

To address this question, a stochastic parameter estimation technique has been developed for regional hydrological studies. First, the probability density functions (pdfs) of the scoped hydrologic properties are assumed. Knowing the moments (means and standard deviations) of these properties would permit the generation of spatial data that could describe the region. These entities, however, are not easily determined. In this case, regional inverse modeling was used to derive these data using remote sensing (RS) information. A modified-$\mu$ Genetic Algorithm was developed to find the solution of the regional inverse problem. A quasi-regional model (Extended SWAP) was used to simulate the hydrological processes in the system.

This paper will address the issues on the type, quantity and quality of spatial data needed for a successful regional parameter estimation using numerical case studies. The second part of the paper will deal with the application of the stochastic parameter estimation technique to quantify systems characteristics in an irrigation system in Kaithal, Haryana, India. In the case study, two Landsat 7ETM+ images taken on February 4 and March 8, 2001 were used. The results of the theoretical and actual case studies will be presented in this paper.