NOMINATION OF PROF. HOSHIN GUPTA FOR THE EGU DALTON MEDAL

Prof. Hoshin Gupta’s scientific contributions have shaped the evolution of systems approaches for hydrologic and land surface modeling over the last 25 years. His ideas regarding how to merge observations and models across space and time scales, starting with his PhD in 1985, have defined the methods to identify, build and use watershed and land surface models used globally today. I believe that Prof. Gupta is a worthy Dalton Medal candidate for his pioneering work on systems methods for the field of hydrology.

Scientific Excellence and Impact
Prof. Gupta’s scientific impact can best be described in chronological order. It is grounded in his unique ability to dissect complicated problems to understand their essence, and to develop suitable solutions. His ideas, methods and vision set the standard for the last 25 years and have tremendously enhanced our ability to use models for learning and prediction in hydrology. [1] While watershed models increased significantly in complexity with the advent of physically based models in the 1980s, no method was available to find the globally optimum parameter set. This meant that any approach to characterizing watersheds through a unique set of parameters, or any attempt to parameter regionalization was futile. Prof. Gupta’s work in which he and his co-workers developed the first global optimization algorithm specifically suited for the particular characteristics of hydrological models solved this problem overnight (Duan et al., 1992). The SCE algorithm he and his colleagues developed is still a standard in the field. [2] In the mid-90s Prof. Gupta and colleagues brought Artificial Neural Networks (ANN) into hydrologic modeling and demonstrated how they can be used for continuous rainfall-runoff modeling (Hsu et al., 1995). This work provided the core of the global precipitation retrieval from satellite observations (PERSIANN, Hsu et al., 1997). [3] In the late 90s, Prof Gupta refocused the field again by identifying and formulating the need for multi-objective optimization of watershed models. The resulting papers introduced the theory and the methods to implement multi-objective calibration of hydrological and land surface models, hence opening the way for assessing the thus far largely ignored model structural error (Gupta et al., 1998; Yapo et al., 1996; Boyle et al., 2000). [4] Early in the 21st century, Prof. Gupta recognized the limitations of deterministic approaches to identifying hydrological models (Thiemann et al., 2001; Vrugt et al. 2003a; b). The presence of uncertainty had to be acknowledged if robust decisions are to be made and if we want to fully understand the suitability of our models for hypothesis testing. Prof. Gupta and colleagues developed new stochastic approaches that again became the standard for the field of hydrology. [5] However, the advancements in systems methods still exhibited a flaw, i.e. a lack of direct inclusion of hydrological understanding in the model identification and evaluation process. In another seminal paper, Prof. Gupta and colleagues acknowledged this limitation and proposed a new theory of diagnostic model evaluation, which, for the first time, explicitly considered hydrologic understanding in the formulation of objective functions through the use of signatures (Gupta et al., 2008). This strategy has been widely adopted over the last five years and offers tremendous opportunities to better connect process understanding with model identification and evaluation.

Leadership
Besides his scientific papers, Prof. Gupta has had a major impact on many individuals in hydrology. He has collaborated widely and has mentored a large number of young scientists (see for example Prof. Savenije’s Letter of Support). He truly propagates the free sharing of ideas and has previously popularized his ideals in President of the IAHS commission on land surface modeling (ICCLAS) and as an Editor of WRR, among other activities.

Few scientists have left a deeper footprint in hydrology than Prof. Gupta.

Thorsten Wagener, PhD