2024 Tsuan Hua Feng Distinguished Lecture

Hosted by the Department of Civil and Environmental Engineering

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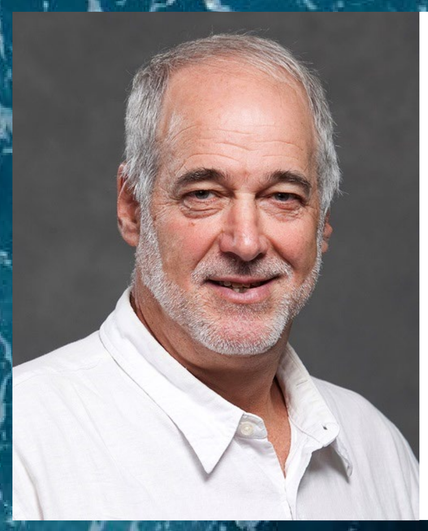
When Heavy Tails Disrupt Statistical Inference, Machine Learning and Hydrologic Modelling



Richard M. Vogel
Emeritus Professor

Tufts University

Tufts University
School of Engineering

Abstract:
Heavy tails (HT) appear in a myriad of hydrologic applications, and their presence can disrupt hydrologic modelling as well as common statistical, big data and machine learning methods. Most prior hydrologic literature on HT distributions focused on their impact on the estimation of extremes (i.e., floods and droughts), whereas I discuss their impact on the performance of a very wide range of common and even ubiquitous hydrologic modelling methods. Examples of extremely HT probability distributions reviewed here include daily series of rainfall-runoff model residuals, river discharge, suspended sediment, phosphorus, total nitrogen loads, residential water use, and saturated hydraulic conductivity of soils. Such HT distributions are shown to induce severe instability associated with a wide class of deterministic and statistical hydrologic modelling methods commonly reported in the literature. Some of the most severe impacts of HT distributions appear to be associated with the calibration, validation, and overall application of deterministic rainfall runoff watershed models. Very simple measures for avoiding such disruption, including aggregation, transformations, robust statistics and the theory of L-moments, are suggested.

Bio:
Richard M. Vogel, now Professor Emeritus has been on the faculty of the Department of Civil and Environmental Engineering at Tufts University since 1984. His research applies statistical and systems approaches to problems in hydrology, water resources engineering and natural hazards. Dr. Vogel has advanced the practice and science of hydrology and water resource planning and management by providing statistical foundations for solving problems for a range of problems related to reservoir operations, water supply, floods, droughts, water quality, watershed modeling, watershed management and environmental statistics. He is Fellow of the American Geophysical Union (AGU), and in 2020 he was elected to be Distinguished Member of American Society of Civil Engineers (ASCE) "for a lifetime of fundamental contributions to stochastic hydrology and its novel applications". Dr. Vogel has also received numerous ASCE awards including: the Walter L. Huber Civil Engineering Research Prize, the Julian Hinds Award, the Ven Te Chow Award, as well as the 2023 Walter Langbein Lecture Award from AGU.

Tuesday, October 15, 2024
4:00 PM

Old Chapel, Great Hall, UMass Amherst
Free and open to all. Reception to immediately follow the lecture.