Most suitable two-parameter distribution for regional rainfall frequency analysis in arid regions

Most codes of practice in arid regions countries stipulate the use of Gumbel distribution (Generalized Extreme Value type I), following in this many codes of practices in humid and temperate countries (such as USA and UK). Another reason for this recommendation is the ease of use of Gumbel distribution since its cumulative distribution function is available in a closed form which simplifies its use. However, Gumbel distribution might not be suitable for many cases, especially due to the high positive skew of the maximum daily rainfall data in arid regions.

An extensive study was undertaken using more than 1000 rainfall stations in the hyper-arid Arabian countries in the Gulf region. The homogeneity of the region is first assessed using tests relying on the coefficients of variation of ordinary moments and also the discordancy and the heterogeneity measures based on L-moments. The best fitting distribution to all region stations is selected comparing several approaches: namely the ordinary and L-moment ratio diagrams, the goodness-of-fit measures based on L-moments, the log-log and the mean excess function plots, and finally the Akaike and Bayesian Information Criteria.

Using the above mentioned approaches, the two-parameter gamma distribution was found to be the best for fitting rainfall daily maximum data for the whole region. Several merits of the distribution are discussed and an attempt to justify this choice on a theoretical basis is also presented.