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A data driven approach for the temporal classification of heavy rainfall using Self-Organizing Maps

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The identification of temporal rainfall patterns is important both in hydrological studies and in water resources management. Computational methods employed for such identification are briefly reviewed with emphasis on design hyetographs. In the sequel, the computational processes of this paper are described and are summarized here as follows:

Raw Pluviograph data were acquired from the Greek National Bank of Hydrological and Meteorological Information for all available stations. A Poisson process hypothesis was used for the division of the raw time series to independent rainstorm events, assuming that their inter-arrival time is distributed exponentially per station and month. Unitless Cumulative Hyetographs (UCHs) were compiled and the null hypothesis of random structures in them was tested. The applicability of Principal Components Analysis, large Self-Organizing Maps (SOM) and t-distributed Stochastic Neighbor Embedding were examined as ways to represent these data. Subsequently, a stepwise procedure that utilized SOM as a clustering technique was applied. In each step a different map was used in order to create a low dimensional view of the data and consequently a limited number of rainfall temporal distribution patterns. Finally, these temporal distribution patterns were presented in a probabilistic way.

In conclusion: a) A monthly temporal pattern for the extraction of independent rainstorm events was found for Greece, b) the hypothesis that the UCHs contains random data was rejected, c) as a result of SOM analysis, a limited number of temporal rainfall patterns emerged, in terms of seasonality and different characteristics and d) the classification of the rainstorm events was made in an unsupervised manner.