



Correlation and covariance of runoff revisited

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The analysis of spatio-temporal variability of runoff goes beyond the application of standard statistical methods on point samples. Runoff observation samples are linked not to points but to sub-catchments ordered in a larger catchment and the organization is defined by the stream network. The Euclidian distance is hence not the natural way of measuring the spatial distance between catchments. Rather a topology that is based on the stream network should be used. It is of outmost importance that this fact is taken into consideration in the analyses to obtain meaningful results. The objective of this study is to develop models for the correlation of runoff with due consideration of the fact that observations represent values with spatial and temporal support and that they are structured along stream networks. A further aim is to search for proper approximate methods to simplify present parameter estimation problem especially for spatio-temporal correlation. The topic is divided into three parts starting with characterization of temporal variability in terms of the variance and correlation functions, then treating spatial variability in the same manner and finally turns to the spatio-temporal variability in terms of cross-correlation functions. The developments in the latter two parts are linked to semivariogram representations mainly by performing the necessary averaging across space and in time-space, respectively to be free from the connection to local mean values and variances. The approaches developed herein have been tested against a data set of 35 runoff time series of 23 years from the French part of the Moselle River.