Homogenization of precipitation series: comparison of methods and recommendations

C. Beaulieu (1), T.B.M.J. Ouarda (1), O. Seidou (1), G. Boulet (2) and A. Yagouti (2)

(1) Hydro-Québec/NSERC Chair in statistical Hydrology, Canada Research Chair on the Estimation of Hydrological Variables, INRS-ETE, University of Quebec, Quebec, Canada, (2) Développement durable, Environnement et Parcs Québec, Quebec, Canada (claudie_beaulieu@ete.inrs.ca / Fax: 418-654-2600 / Phone: 418-654-2530 #4462)

The statistical characteristics of climatic records at a measuring site can undergo artificial disturbances that do not reflect real climate variations: station relocation, instruments upgrade, etc. Such changes can introduce artificial shifts in the data series which may wrongly be interpreted as real climatic changes. To avoid this kind of mistake, data should be homogenized. Homogenization consists in identifying and correcting artificial changes in data series. The objectives of this research project are to identify the most appropriate methods for the homogenization of precipitation series, and to develop new methods which overcome the weaknesses of existing approaches.

The methods investigated in this study are: statistical tests (the Standard Normal Homogeneity Test, the bivariate test, the sequential t-test, the sequential rank-sum test and the Jaruskova test), regressive models (multiple regression, two-phase regression) and Bayesian approaches (univariate for a single shift, bivariate for a single shift and multivariate for multiple shifts).

The comparison of the different methods is based on a Monte-Carlo simulation study on five synthetic data sets: homogeneous series, series with one shift, series with multiple shifts, series with a shift in the variance and series with a trend. Each data set consisted of a series to be homogenized and three correlated neighbour series. The selected techniques were applied to these synthetic series and their performances were compared.

Most methods were found appropriate for detection of homogeneous series (except the univariate Bayesian method for one shift). The methods performed generally well on series with one shift with a magnitude higher than one standard deviation. The Bayesian methods performed better than traditional methods on series with multiple shifts. Neverthless, the Standard Normal Homogeneity Test, the bivariate test, the sequential rank-sum test and the Jaruskova test offered a good performance. Even though most methods are based on a constant variance, a shift of variance does not seem to affect their performance.