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Multifractals for operational hydrology: flood frequency analysis

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The presentation will discuss encouraging results obtained under the first phase of CEATI International Project "Multifractals and Physically Based Estimates of Extreme Floods". This Project is to better statistically predict the floods by using a physically based approach established on systems which respect a scale symmetry over a wide range of space-time scales to determine the relationship between flood magnitude and return period for a wide range of aggregation periods. It aims to resolve several problems encountered with the classical flood frequency analysis related to the data non-stationary, long-range dependencies and the clustering of extremes often resulting in fat tailed (i.e., an algebraic type) probability distributions. The techniques for handling such non-classical variability over wide ranges of time and space scale exist and may be applied to water resources management, technological or operational development throughout the world. The first ambition of this project was to investigate a very large database - that is, daily stream flow data recorded for at least 20 years for about 10000 of gauging stations distributed all over Canada and the USA. We will discuss the results of multifractal analysis performed on the database and their applications for reliable flood predictions. At the same time, one of the main objectives of the Project remains the ability to obtain somewhat similar information and parameter estimates from very scarce historical data, very short or incomplete data records. The goal of the space data analysis is the ability of transferring regional flood information to poorly gauged sites. We will discuss first successful steps made in these directions.