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Assessing the quality of rainfall data when aiming to achieve flood resilience

C.T. Hoang (1,2), I. Tchiguirinskaia (2), D. Schertzer (2), and S. Lovejoy (3)

(1) Water Resource University, Ha Noi, Viet Nam, (2) University Paris-Est, Ecole des Ponts ParisTech, France, (3) McGill University, Montreal, Canada

A new EU Floods Directive entered into force five years ago. This Directive requires Member States to coordinate adequate measures to reduce flood risk. European flood management systems require reliable rainfall statistics, e.g. the Intensity-duration-Frequency curves for shorter and shorter durations and for a larger and larger range of return periods. Preliminary studies showed that the number of floods was lower when using low time resolution data of high intensity rainfall events, compared to estimates obtained with the help of higher time resolution data. These facts suggest that a particular attention should be paid to the rainfall data quality in order to adequately investigate flood risk aiming to achieve flood resilience.

The potential consequences of changes in measuring and recording techniques have been somewhat discussed in the literature with respect to a possible introduction of artificial inhomogeneities in time series. In this paper, we discuss how to detect another artificiality: most of the rainfall time series have a lower recording frequency than that is assumed, furthermore the effective high-frequency limit often depends on the recording year due to algorithm changes. This question is particularly important for operational hydrology, because an error on the effective recording high frequency introduces biases in the corresponding statistics. In this direction, we developed a first version of a SERQUAL procedure to automatically detect the effective time resolution of highly mixed data. Being applied to the 166 rainfall time series in France, the SERQUAL procedure has detected that most of them have an effective hourly resolution, rather than a 5 minutes resolution. Furthermore, series having an overall 5 minute resolution do not have it for all years.

These results raise serious concerns on how to benchmark stochastic rainfall models at a sub-hourly resolution, which are particularly desirable for operational hydrology. Therefore, database quality must be checked before use. Due to the fact that the multiple scales and possible scaling behaviour of hydrological data are particularly important for many applications, including flood resilience research, this paper first investigates the sensitivity of the scaling estimates and methods to the deficit of short duration rainfall data, and consequently propose a few simple criteria for a reliable evaluation of the data quality. Then we showed that our procedure SERQUAL enable us to extract high quality sub-series from longer time series that will be much more reliable to calibrate and/or validate short duration quantiles and hydrological models.