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The influence of rainfall temporal aggregation on the annual maximum depths

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Rainfall data with relatively high time resolution are essential for many hydrologic studies, including the development of rainfall modeling, simulation of infiltration, representation of the mechanisms of runoff generation, description of soil erosion and even the determination of rainfall depth-duration-frequency relationships which requires the knowledge of the annual maximum rainfall depths, Hd, cumulated over different durations, d.
In the last decades the local rainfall measurements are generally obtained by tipping bucket sensors, that allow to record each tipping time corresponding to a well-known rain depth. However, a part of rainfall data to be used in the hydrological practice is available only with coarse temporal aggregation, ta, with undesirable effects, like the underestimate of Hd.
The errors in the evaluation of Hd from data characterized by a coarse temporal aggregation and a procedure to reduce the non-homogeneity of the Hd series are here investigated.
Our results indicate that:
- in the worst conditions, for d=ta, the estimation of a single Hd value can be affected by an underestimation error up to 50%, while the average underestimation error for a series with at least 15-20 Hd values, is less than or equal to 16.7%;
- each very long time series of Hd contains many underestimated values;
- for each category of d values a simple mathematical relation between average underestimation error and the ratio ta/d can be used to correct the mean value of Hd for groups of at least 15-20 elements;
- by applying the proposed procedure the average underestimation error considerably decreases and in some cases becomes negligible;
- the adopted ta has not a clear and significant influence on the Hd dispersion around the average value.