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Climate change impacts on the design of stormwater drainage infrastructures

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In Portugal, as in many other countries of the world, the design of stormwater drainage infrastructure relies on the implicit assumption that the intense precipitation distribution is statistically stationary and based on the intensity-duration-frequency (IDF) curves. However, observed changes in recent past climate and projections for future climate suggest differences in precipitation regime in Portugal, in particular, in what respects to the frequency and intensity of extreme events, thus leading to the need to evaluate the impact of potential climate change on IDF curves.
The objective of this study is to assess the potential consequences of climate change in the design of drainage systems for rainwater and hence the need to review rules and legislation on this design, based on a comparative analysis between Intensity-Duration-Frequency (IDF) curves defined in the Regulatory Decree n º 23/95 of 23rd August, proposed by Matos and Silva (1986), and those obtained with observed data in meteorological stations representing the three rainfall zones recommended for Portugal and with data simulated by the COSMO-CLM regional climate model for recent past (C20) and future (A1B and B1) climate scenarios.
The methodology adopted for the delineation of IDF curves, is based on study of Brandão et al. (2001) and includes: (i) precipitation disaggregation process for sub-daily (method fragments) and sub-hourly (disaggregation coefficients suggested by Brandão et al. 2001) scales; (ii) preliminary statistical exploratory analysis and fitting of the Gumbel distribution function to time series of maximum precipitation intensity for each of the ten durations; (iii) the use of the Gumbel inverse probability distribution to estimate maximum precipitation intensity values for eight return periods; (iv) linearization of IDF curves with logarithms and the estimation of the parameters a and b with robust regression after; and (v) correction of the bias introduced by the COSMO-CLM model dues to its difficulty in reproducing exactly the observed conditions . The methodology developed and ensures robustness, statistical significance and adequate comparative analysis of the results and suggest that the impact of climate change in the design of stormwater drainage organs building will imply, in general, the increase of the dimension of these organs and that this variation is not identical in all three rainfall regions defined for Portugal, or between stations within of these regions.

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