Verification of concentration time formulae accuracy in Southern Brazil

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The time of concentration (TC) of an urban catchment is a fundamental watershed parameter used to compute the peak discharge and/or in the hydrological simulation of sewer systems. In the lack of hydrological data for its estimative, several empirical formulae are used, however, almost none of them have been verified in Brazil leading to large uncertainties in the correct value. In this light, were tested several formulae such as the proposed by Kirpich (and a modifications of this equation proposed by the National Transport Bureau of Brazil (DNIT)), U.S. Corps. Of Engineers, Pasini, Dooge , Johnstone , Ventura and Ven T Chow as they are used in Brazil. The verification was accomplished against measured data in 5 sub-basins situated in the Dilúvio basin, a semi urbanized watershed that contains the most developed area of the city of Porto Alegre. All the rainfall stations were active in the period from late 1970's until early 1980's due to the existence of Projeto Dilúvio but today, however, only two of them are still in operation. Porto Alegre is the capital and largest city in the Brazilian southernmost state of Rio Grande do Sul with a population of approximately 1.6 million inhabitants, the tenth most populous city in the country and the centre of Brazil's fourth largest metropolitan area, with almost 4,5 million inhabitants (IBGE, 2010). The city is situated in a humid subtropical climate with high and regular precipitation throughout the year. Most summer rainfall occurs during thunderstorms and an occasional tropical storm, hurricane or cyclone. The results showed an error of around 70% for half of the formulas, with a tendency to underestimate TC values. Among the tested methods, Johnstone had the best overall result, with an average error of 25%, well far from the second, Dooge, with 43% of average error. The best results were obtained in only one basin, Dilúvio, the largest one, with an area of 25km^2, with an error of just 3% for Modified Kirpich, and 5% for Dooge . The results show the necessity of more studies in order to help in the selection of TC parameter for ungauged basins in Brazil.