Geophysical Research Abstracts
Vol. 18, EGU2016-7685, 2016
EGU General Assembly 2016

Modelling runoff on ceramic tile roofs using the kinematic wave equations

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Rainwater harvesting is a water saving alternative strategy that presents many advantages and can provide solutions to address major water resources problems, such as fresh water scarcity, urban stream degradation and flooding. In recent years, these problems have become global challenges, due to climatic change, population growth and increasing urbanisation. Generally, roofs are the first to come into contact with rainwater; thus, they are the best candidates for rainwater harvesting. In this context, the correct evaluation of roof runoff quantity and quality is essential to effectively design rainwater harvesting systems. Despite this, many studies usually focus on the qualitative aspects in detriment of the quantitative aspects. Laboratory studies using rainfall simulators have been widely used to investigate rainfall-runoff processes. These studies enabled a detailed exploration and systematic replication of a large range of hydrologic conditions, such as rainfall spatial and temporal characteristics, providing for a fast way to obtain precise and consistent data that can be used to calibrate and validate numerical models. This study aims to evaluate the performance of a kinematic wave based numerical model in simulating runoff on sloping roofs, by comparing the numerical results with the ones obtained from laboratory rainfall simulations on a real-scale ceramic tile roof (Lusa tiles). For all studied slopes, simulated discharge hydrographs had a good adjust to observed ones. Coefficient of determination and Nash-Sutcliffe efficiency values were close to 1.0. Particularly, peak discharges, times to peak and peak durations were very well simulated.