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Spatial scale effects on hydrologic modeling of extensive green roofs in New York City

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Effective implementation of green roofs technology as sustainable stormwater management tool requires comprehensive and quantitative information in terms of monitoring and prediction of its hydrologic performance during single rainfall events. Aiming at providing a robust simulation approach to understand the green roof behaviour during different storms, the efficency of one–dimensional hydrologic modeling was investigated, for three green roof systems at different spatial scale and characterized by the same green roof type. HYDRUS 1D model applied to solve the Richards equation with measured water retention curves and fitted hydraulic conductivity at saturation. The effect of the green roof area on the accuracy in predicting the subsurface outflow was investigated. A fairly large experimental dataset was available and let to compare simulated and observed green roofs performances on the basis of a statistical analysis and accounting for different storm size categories.

As a result, the spatial scale of the green roof was found not to significantly affect the model accuracy in predicting the total outflow volume and the peak flow rate, particularly for storms characterized by rainfall depth lower than 25 mm. Peak discharge time and lag time resulted overestimated at all scales, but the discrepancy is lower for medium–sized rain events (ranging from 25 to 75 mm). The Nash–Sutcliffe Efficiency index indicates that the model is as more accurate in reproducing the effluent from the green roofs as greater is the scale of the systems, and as larger is the storm size.