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Quantifying land-cover proportions for urban runoff prediction. The advantage of distributed remote sensing techniques.

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The volume, intensity and contamination of runoff generated by rainfall events in catchments are strongly dependent on land-cover composition. This aspect is extremely important in urbanized catchments, where floods are dangerous for inhabitants and infrastructure; moreover, water contamination is an important issue. Parameterization of distributed models in urban land-use is difficult because impervious objects are mixed with other land-covers like: vegetation, bare soil and water. Many hydrological models do not account for this variability and parameterize urban land-use by focusing only on impervious proportions, assuming one proportion value per land-use class. This parameterization strategy may lead to decreasing physical meaning of other parameters calibrated in a model. This study aims to show how the method of estimation of land-cover proportions impacts discharge prediction of the distributed hydrological model – WetSpa. The study area is an urbanized catchment of the Biala River, situated in the northeastern part of Poland. The simulations were run in a summer period with peak discharge events. Three modeling scenarios of land-cover proportions were tested of which two assumed fully-distributed land-cover proportions in the study area: hard classification of an Ikonos scene and a subpixel classification of a Landsat 5 TM scene. The third scenario used a standard modeling approach in which one impervious proportion is assigned per land-use class. The best Nash-Sutcliffe efficiency (NS) result was obtained for the Landsat TM subpixel classification scenario (NS=0.63). A similar result was obtained for the Ikonos hard-classification scenario (NS=0.62). The standard modeling scenario resulted in the lowest simulation efficiency (NS=0.40). Comparison of the observed and simulated peak discharges showed the best match for the Ikonos hard-classification, while the Landsat TM subpixel had $\sim$18% and the standard modeling approach $\sim$36% underestimation. Based on that, the subpixel scenario is suggested as a cost effective solution in hydrological applications; hard-classification of high resolution imagery should be used in high risk projects like flood prediction. The standard modeling approach is found not proper for urban application. Moreover, the results prove the usefulness of remote sensing techniques and their advantage over standard methods for quantifying parameters for hydrological models.