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Analysis of the impact of urban impervious cover in a small basin: comparison between high and low spatial resolution in the water cycle using the TETIS model

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The mega-city of Bogotá and its metropolitan area includes more than 10 million inhabitants being the higher population density of Colombia. It is located in the center of the country in the department of Cundinamarca and has an area of 1,636.59 km2. Being the country's capital city, it is the core of its economic development, with a GDP of USD 93,990 million in 2014. The vast expansion of this urban center has caused important environmental impacts in its watershed. The impervious cover has affected the quality of its superficial and underground water resources altering the hydrological cycle.

The objective of this study is to analyze the influence of high and low spatial resolutions in the water cycle of catchment with a high proportion of urban areas. In particular, we have compared the water balance and flood regime of a small urban hydrological unit within the Bogotá river basin, which is used as a pilot area for these hydrological analyses. For the generation of parameter maps at a detailed scale, high-resolution spatial images acquired with RPAS technology were used as a source of information. Afterwards, these maps were generalized to a spatial resolution of 100 m. Finally, the results obtained with a spatial resolution of 5 meters are compared with those obtained in the same area with a spatial resolution of 100 meters.

This hydrological unit has been modeled using the distributed hydrological simulation model TETIS. Results obtained have allowed identifying differences due to the generalization of urban area in low spatial resolution. The urban areas analyzed by the model vary up to 100% of the area depending on the spatial resolution and therefore it affects the results of the water balance. These results will allow us to adjust the distributed model conceptualization and to take into account the alterations caused by the impervious cover and incorporate the scale corrections.