

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

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INTRODUCTION

The mega-city of Bogotá and its metropolitan area includes more than 10 millions inhabitants being the higher population density of Colombia. It is located in the center of the country 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.

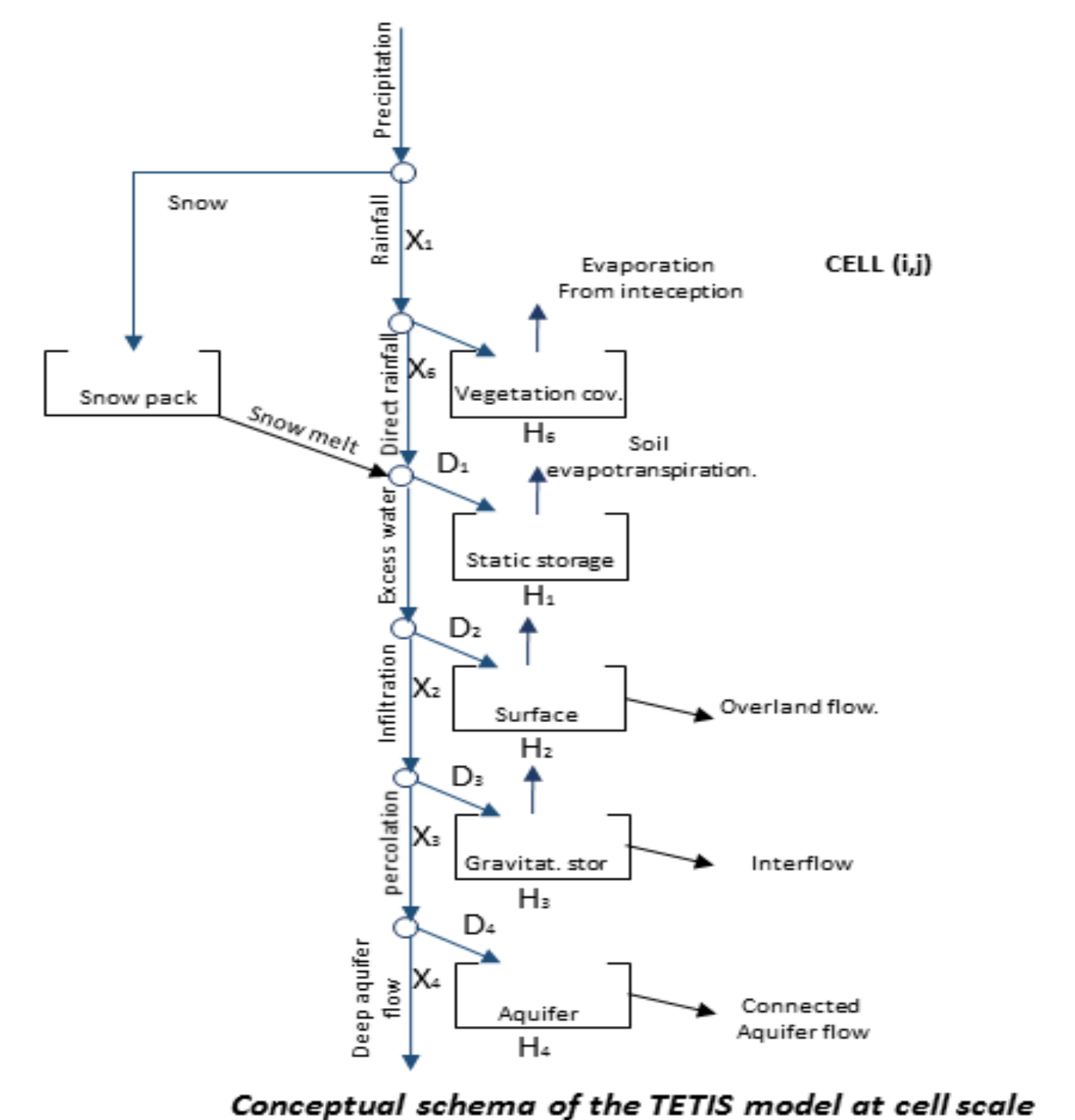


METHODOLOGY

This hydrological unit has been modeled using the distributed hydrological simulation model TETIS.

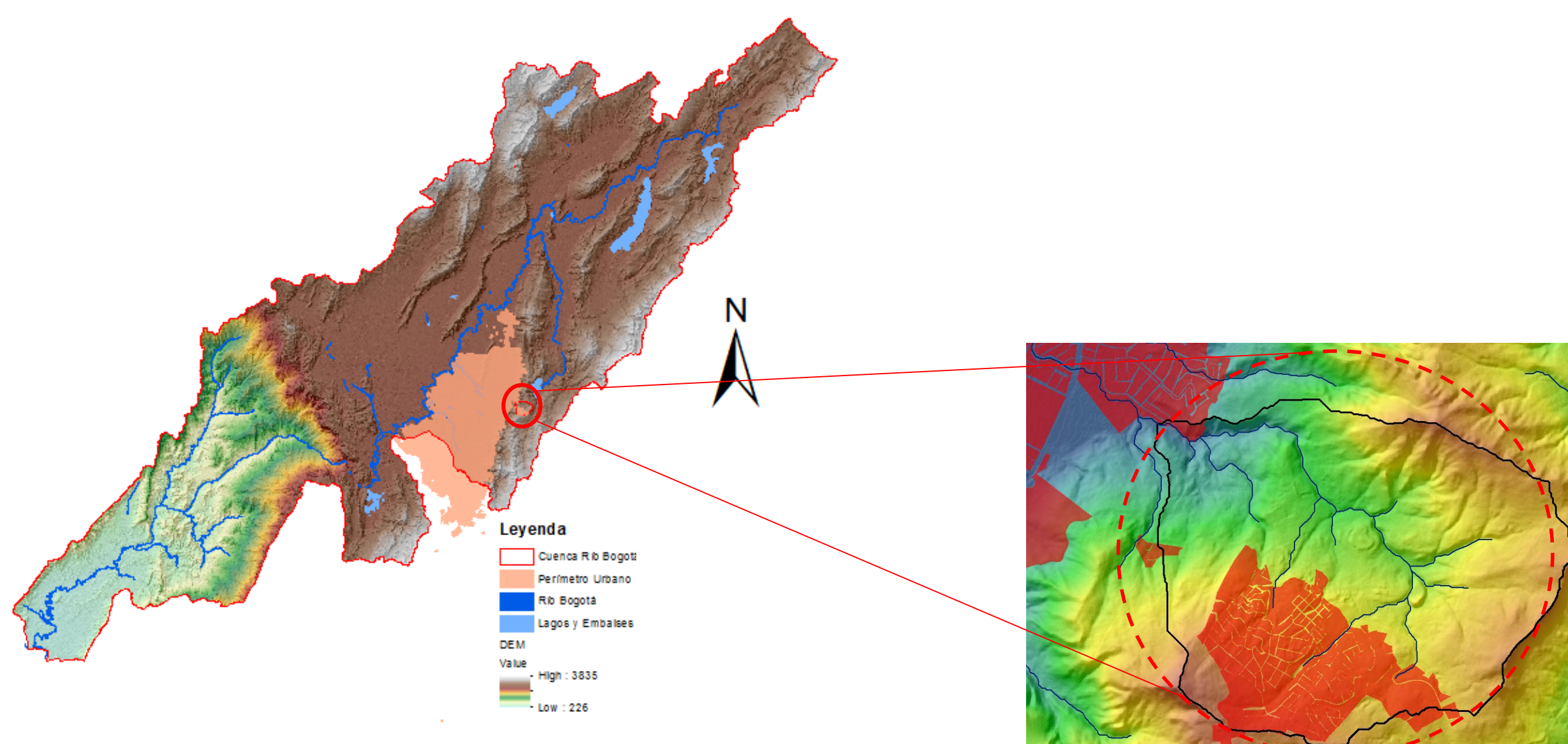
The results obtained with a spatial resolution of 5 meters are compared with those obtained in the same area with a spatial resolution of 100 meters.

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.



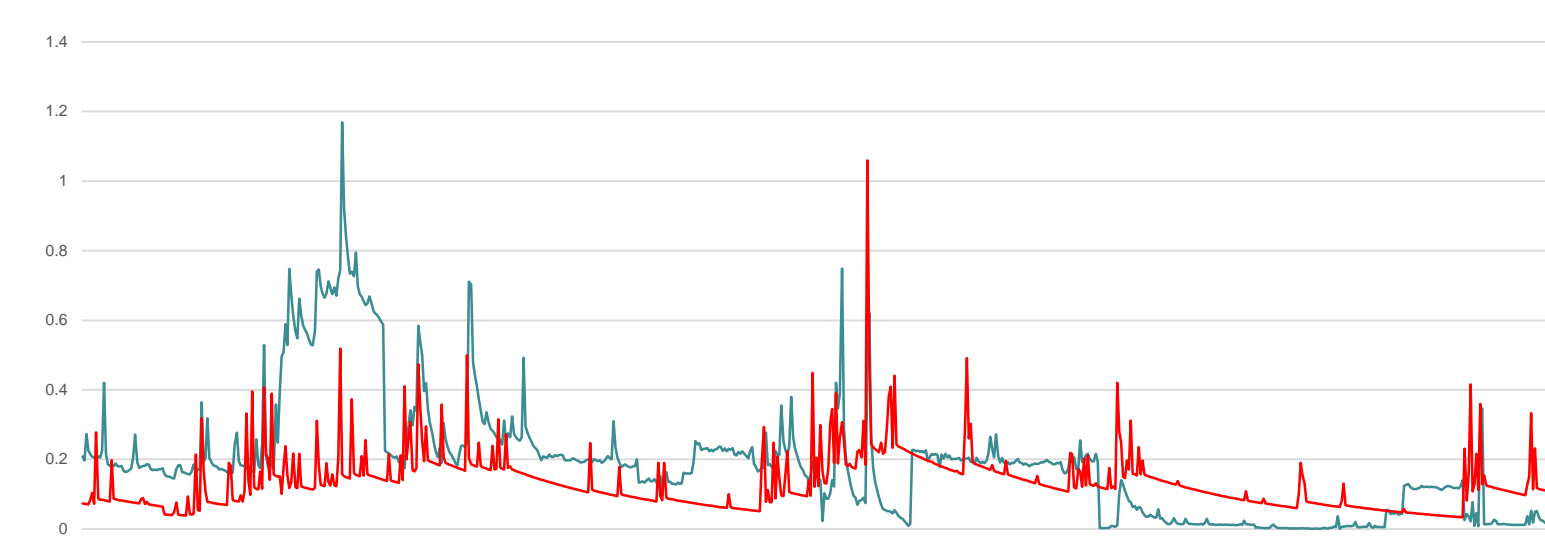
OBJECTIVES

Comparison of the water balance of a small urban hydrological unit within the Bogotá river basin, which is used as a pilot area for hydrological analyses.



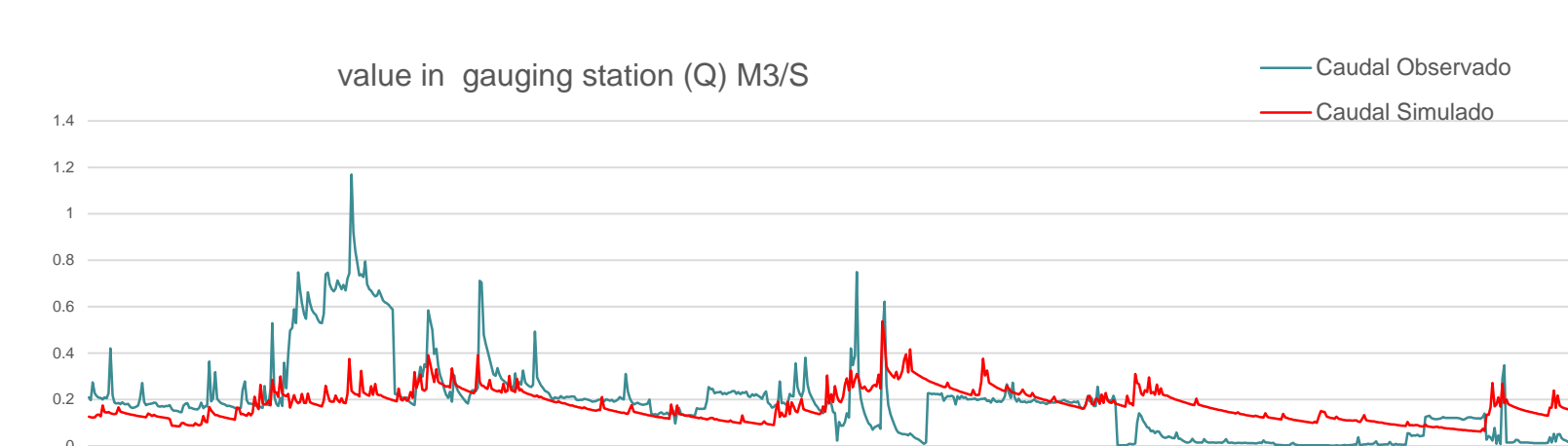
RESULTS

Model 100 meters



Main event properties	
Max Observed Flow (m ³ /s)	1.169
Caudal Max. sim (m ³ /s)	1.06
RMSE	0.176
Volumen Observado (Hm ³)	12.219
Volumen simulado (Hm ³)	8.97
Índice de Nash y Sut. (NSE)	-0.0536
Área acumulada (Km ²)	5.6

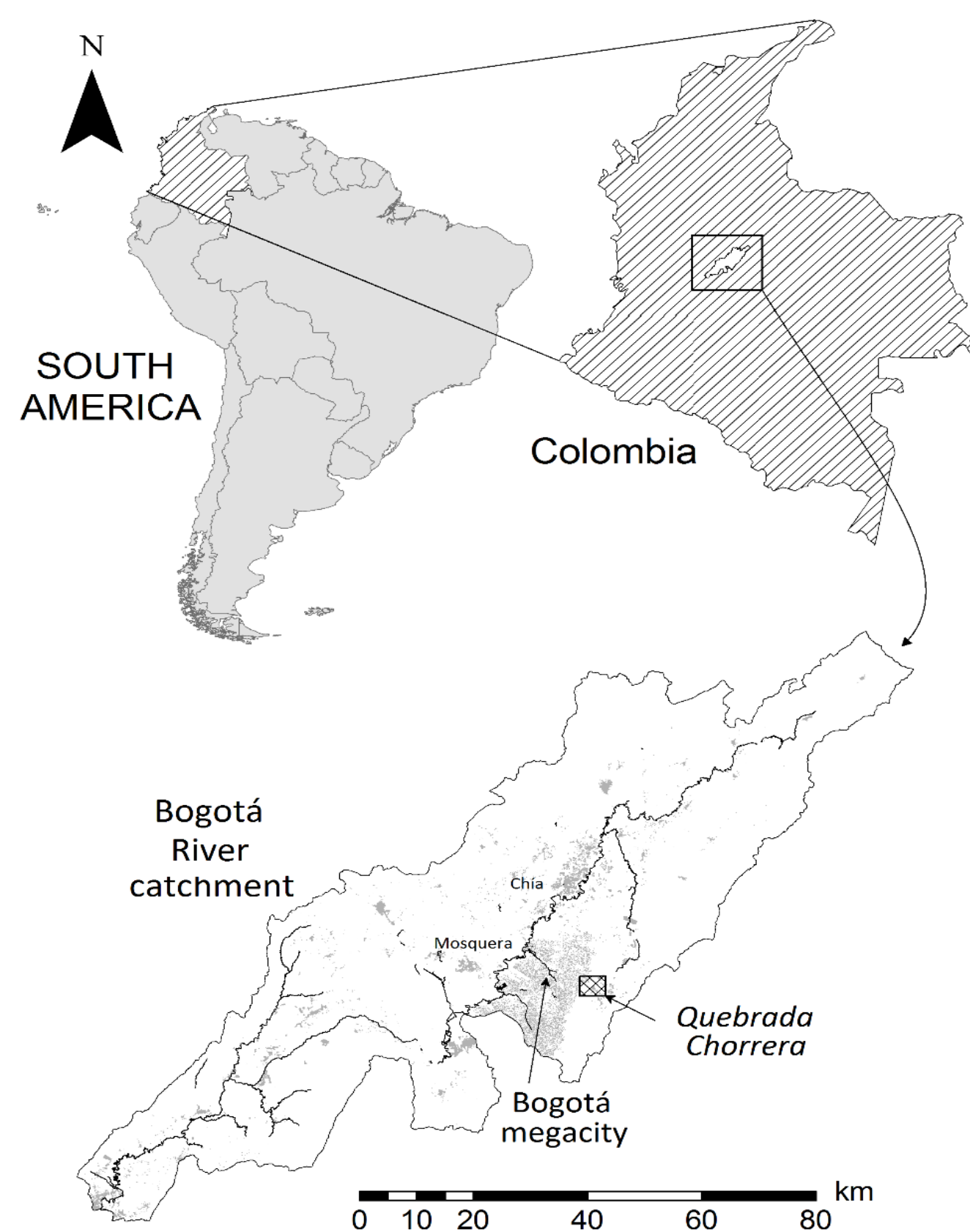
Model 5 meters



Main event properties	
Caudal Max. Obs (m ³ /s)	1.169
Caudal Max. sim (m ³ /s)	0.537
RMSE	0.161
Volumen Observado (Hm ³)	12.219
Volumen simulado (Hm ³)	11.714
Índice de Nash y Sut. (NSE)	0.1343
Área acumulada (Km ²)	5.794

Quebrada Chorrera hydrological unit

Bogotá is the name of the main river that flows from northeast to southwest in the Cundinamarca department of Colombia. It represents the main water source and a natural bound on its west for the megacity with the same name. In the east boundary of the megacity of Bogotá, a small hydrological unit called Quebrada Chorrera represents the study site to be analysed in detail, because its representativeness of the urban dynamics



CONCLUSIONS

Modeling the basin with a 100 meters resolution shows unacceptable results. This may be due to the low spatial resolution of the input data. However, modeling with a 5 m spatial resolution improve results significantly. Results obtained allow to identify inaccuracies in the generalization of urban area using low spatial resolution data.

Total urban area can increase up to 100% when considering a high resolution model. Results obtained from this high resolution model allow to modify the hydrological model TETIS and to adjust the distributed model taking into account the alterations caused by the impervious cover and incorporating the scale corrections.

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