Precise Elevation Modeling for Hydrologic Decision Support System in the Cabuçu de Baixo Urban Basin in Sao Paulo City–Brazil

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Abstract:

The Sao Paulo Metropolitan Region is composed by 35 municipalities, with a population estimated in 17 million people. The post-70’s intense urbanization of the area has caused many hydrologic problems. Flood frequency has increased, as well as peak flows during the rainy season. Some hydraulic improvements have aimed to reduce the damages, however with limited success. The lack of integration decision-making can be considered as one of the most important causes of the increases in urban flooding. However, from a technical point of view, the lack of precise information maybe can be considered the most important factor vitally needed for delivering desired engineering solutions.

Regarding the hydrological investigation, urban basins are more affected by land cover changes than their rural counterparts. The Cabuçu de Baixo watershed is a typical Sao Paulo City area, characterized by recent and unplanned occupation. Dense urbanization can be found intermixed with some parts of preserved nature located in the upstream part of the basin. During the last three decades, its land cover was abruptly changed. Irregular and unplanned settlements were formed over hills and valleys, replacing the vegetation. Later, the number of buildings increased. Implementation of transportation, electrical and hydrological utilities have been required. Sometimes, many of these implementations were done without the use of actualized maps. Due the characteristics of these areas, the use of recent technologies like LIDAR or IFSAR could produce faster results for the geo-database actualization. However, regarding the difficulties for developing countries, the absence of maps, or the amount of obsolete data, has resulted in the adoption of alternative methodologies, aimed at faster and less onerous paths without the needed commitment to a quality solution.

Simulating surface water and flooding based on current geo-technologies is an efficient tool for planning and management for urban environments. In accordance with the principle that “the more actualized the reference database, the more accurate the investigation” this paper illustrates in a real-world example the necessity of precise geoinformation for urban basin investigation. A methodology of terrain modeling for hydrological studies based on breaklines extraction is reported. The coarse detailing was used for the mountainous regions and the finer one for other areas. The meadow areas were prioritized for precise simulation of flooding. Very high resolution orthophoto and contour maps were generated and applied to the Hydrologic Decision Support System. The final analysis shows the viability of the methodology for studies of urban hydrology.

Keywords: Digital terrain model, flooding, surface water, urban basin, simulation.