L-Moments Regional Frequency Analysis Methodology Application in maximum rainfall values over the Bogota River′s basin

Claudia Romero and Duvan Mesa

Universidad Santo Tomás, Bogotá, Colombia (claudia.romero@usantotomas.edu.co)

1°Claudia Patricia Romero Hernández; 2°Duvan Javier Mesa Fernández
Universidad Santo Tomas; Colombia

The application area of this methodology is the Bogota River's basin, which is located in Cundinamarca; a Colombian department with a total surface area of 589.143 hectares. This basin includes 19 sub-basins, and it is the most densely urbanized of the country. Including its metropolitan area, this region boasts a population of 9.000.000 inhabitants; which composes approximately 23% of Colombia's population and possesses around 19% of the country's industries.

This basin has shown a notorious increase of complicated floods frequency in the last few years due to climatic variations. These climatic periods correspond to a weather pattern called Niña Phenomenon (2010-2011), which affected 57.000 citizens in this department and 4,900 people directly in Bogota city, with an estimated economic damage of $277'121,052 USD.

The Regional Frequency Analysis methodology is a statistics procedure that consists in adding information from multiple samples in a single large sample, assuming previously that all of these come from the same probability model, except for a difference between them due to a scale factor.

These samples are defined by a "regionalization" procedure known as the "Avenue Index" or "Flood Index". This procedure groups several kinds of information that comes from a common probability model, such as temperature, rainfall, and water flow. This model must be similar for all of the weather stations located in a homogeneous region.

Maps for each of 4 return periods (5, 10, 50 and 100 years) were developed based on 120 weather stations located on this basin. The information used in this process comes from median monthly rainfall data, based on historical series between 30 and 40 years average. An increase in the annual median rainfall was observed, showing the possibility of even a 100% growth.

"This means that it is probable that during a 100 year period there is one year with cumulative mean rainfall values even the double of the actual mean."

The values will certainly be related to extreme rain events and their rising frequency rather than to the increase of the monthly rainfall.

Bogota's Savannah growing population around Bogotá River′s floodable areas is a real threat and increase the vulnerability to hydrological events, including extreme and mild flooding. The low water evacuation capacity of this region, changes in ground structure and usage, wooded land modifications, water uptake and regulation, and wetland buffering systems disconnection, lead to a larger occurrence and persistency of problems over humans and structural elements.

To conclude, flood problems are still being perceived in a fragmentary way, giving an uneven treatment to each one of this dimensions or so-called risk components. Introduction to flooding evaluation with an integrated work scheme, and the support of forecast and warning tools such as modeling, allows the quantification of processes induced by anthropogenic actions, its effects and the possible modification of the environmental quality, being an essential element in land-use plans.