Contribution to the modeling of the rainfall-runoff relation in the absence of data : case of an urban area 'Tipaza town'

This work is part of the problematics related to the modeling of rainfall-runoff transformation in urban area. In actual fact, as the urban rainfall runoff flooding phenomenon has increased, it has become necessary to define and develop tools that allow predicting such events, or rather their consequences on the urban area. To do so, Tipaza town was selected as the application area of this study. The hydrological modeling selected for the urban rainfall runoff has two components: (i) the rainfall and (ii) its transformation into a runoff through the urban area. This study is developed depending on two major themes, the first leads to the second one. Pluvial vagary is characterized through the modeling of the rainfall intensity-duration-frequency (IDF) curves. The methodology selected to draw up IDF curves is quite developed, in so far as (a) it allows an application using a limited data time set (short series) via an approach based on partial duration series PDS (values above a threshold): exhaustive use of the available data. (b) IDF curves relationship is established using a semi-parametric model, which means that the dynamic parameters (characterizing the region and the aggregation duration) are obtained by an empirical formulation, and the parameters that characterize the intensity value result explicitly from the underlying probability function (overall estimate over all aggregation durations), where usually IDF relationship formulation is totally empirical (Montana, Talbot, etc.). Also, the modeled rainfall has a relatively realistic temporal distribution, in so far as the position (in time) of the shower peak is identified. Rainfall transformation into runoff at the mouth of the watershed has two levels of modeling. The first one is runoff production and the second one the transfer of this runoff through the urban watershed. Production and transfer functions, the reliability of which has been tested in different configurations and deemed to be true, were used in this study due to the unavailability of hydrometrical measurements that allow model calibration. So, those functions do not require any calibration for a use in the same context. Thus, the selected production function derives from the SCS-CN model, it allows taking account of the initial losses and continuing losses over the time, and proportional to rainfall intensity in runoff production. When it is difficult to describe a system through the laws of physics, the alternative is a simplified rainfall-runoff modeling process representation. This conceptual representation is very often a reservoir. Because of that, the transfer of net rainfall hydrographs has been done through the use of a linear reservoir. Although, it does not differentiate between the

two components (on the surface and network: double drainage) from the urban flow, the transfer enables to determine the location and extent of the overlowing. Urban drainage network behavior of Tipasa town is simulated for different requests, which allowed to deem it, as having a design in defect (oversized at mouths, and undersized upstream from the same mouths). Also, it is established that land use modification (urbanization) accelerates hydrologic response of the watersheds and increases the volumes of surface runoff. Similarly, runoff production depends on the previous soil dampness.

Keywords: Rainfall-runoff modeling; pluvial risk; urban runoff; IDF; threshold; production function; transfer function; SCS-CN; linear reservoir; Tipasa; L-moments.