Effect of Rainfall Data on Runoff Analysis

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1.- Introduction

Modeling run off phenomena in basins, from small ones to very complex systems, has been the topic of uncountable researches all around the world. The complexity of weighting all the variables involved in recreate such natural phenomena; lead us in many cases to a “dead road” due to the huge diversity of possible combinations of types of soil and vegetation, moisture conditions, and all the meteorological factors involved just to name some of them. Detailed field measurements on those conditions and proper numerical analysis are needed to clarify the runoff phenomena in a watershed. The runoff phenomena observed in the Tono basin is analyzed by the combination of kinematic wave method and groundwater analysis. In this study the influence of rainfall data measured at three different points was mainly focused.

2.- Basin studied and rainfall data

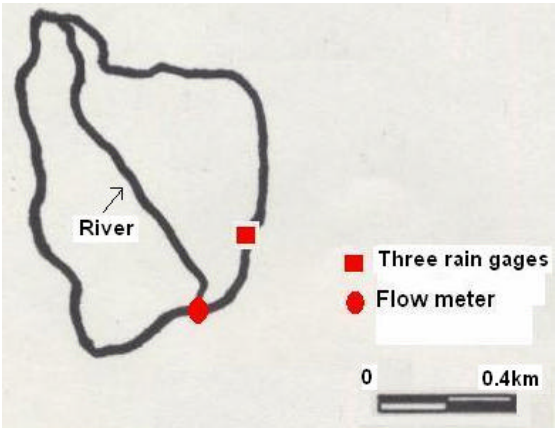

Fig.1 Basin studied

Fig.1 schematically illustrate the shape of the watershed treated. Hydrograph has been measured at the end of this small watershed and 3 rain gauges are installed around of tributaries of the river.

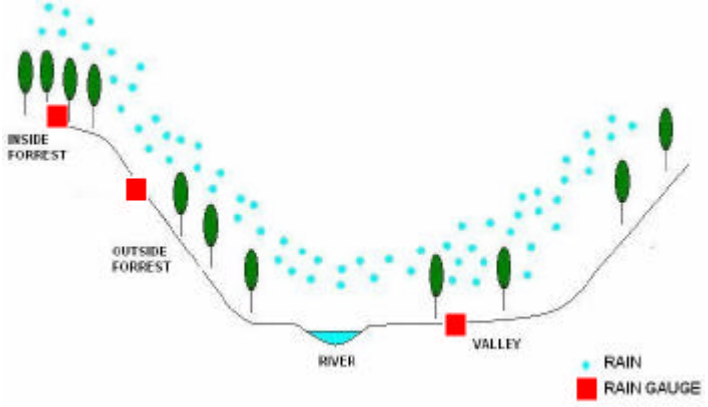

Fig.2 Schematic view of rain gages

Fig2. schematically illustrates the conditions of the places where rain gauges are installed. Meteorological data during Aug.5th and Sept.30th 2000 was used in this study and it is displayed in Fig 3 and Fig.4 :

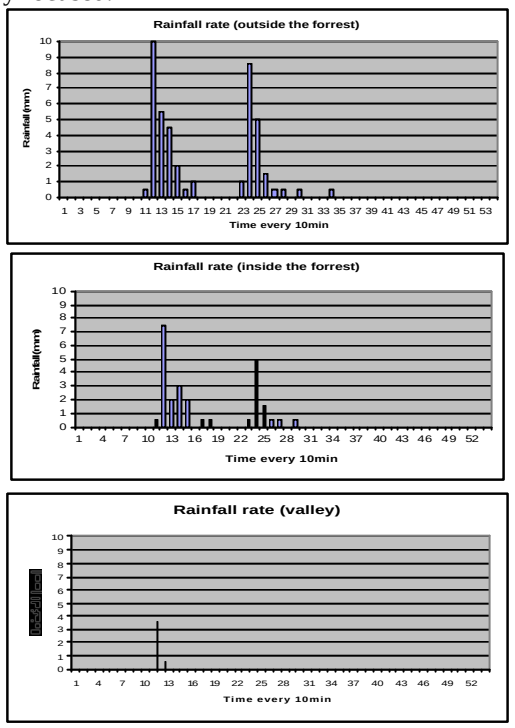

Fig.3 Rainfall data on Aug. 5th.

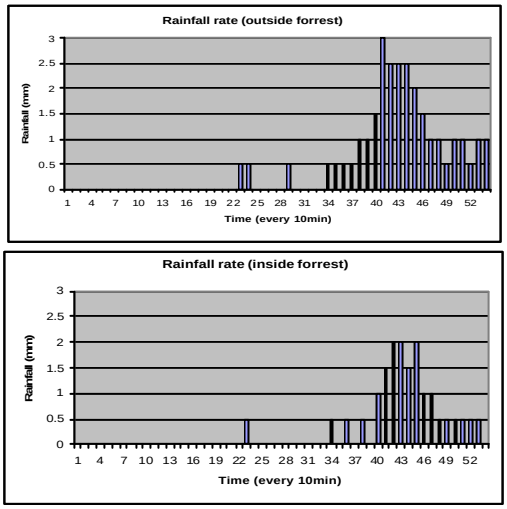

Fig.4 Rainfall data on Sept. 30th.

Keywords : Hydraulic Conductivity(k), Storage Coefficient(s)
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It is clearly observed that the rainfall data are much different according to the place where is located the rain gauges. As presented in Fig.3 rainfall measured at outside forest was higher than inside forest and become very small in the vicinity of the valley. It is very difficult to decide the location of rain gauges. The same feature can also been observed in Fig.4. The objective of this study was focused on to clarify the effect of rainfall on hydrographs.

3.- Analytical Model

Analysis was conducted by the combinated use of kinematic wave and ground water flow analysis.

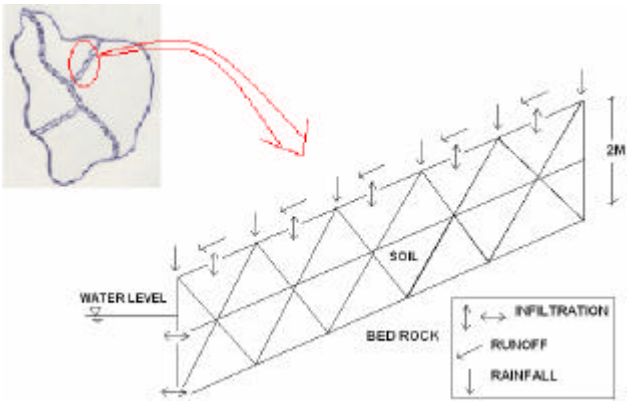


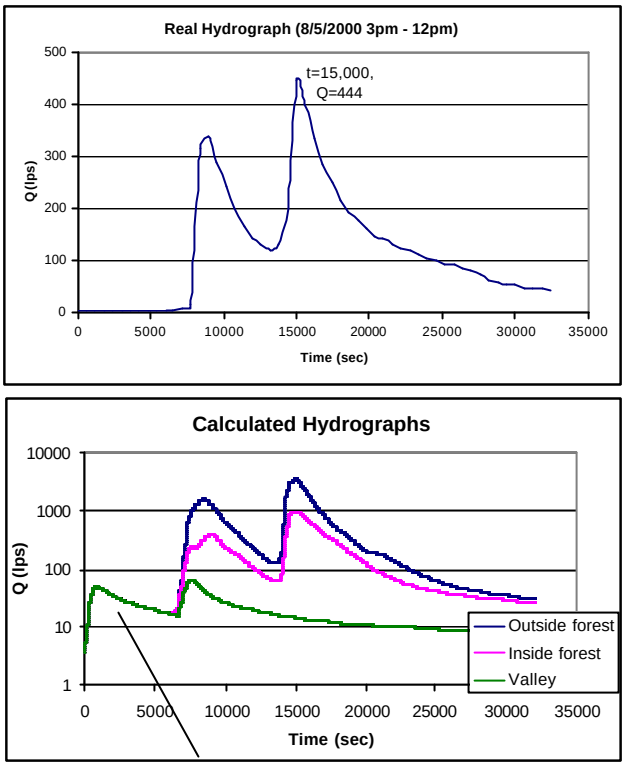
Fig 5. Analytical Model

Fig.5 shows the division of the area into a series of small “channels” used for the analysis of the surface flow (as an example, only 2 channels on the slope are shown) and also details of the mesh division for underground water flow analysis.
Rain is infiltrating into the slope and only part of the rain is flowing as surface runoff. Rain water infiltrated into the slope must be flowing under saturated – unsaturated conditions. In that sense, values of k and s should change according to the saturation conditions. However, those values were the assumed as constants as follow : k=0.00001 m/s and s=0.01/m.

4.- Results and Conclusions

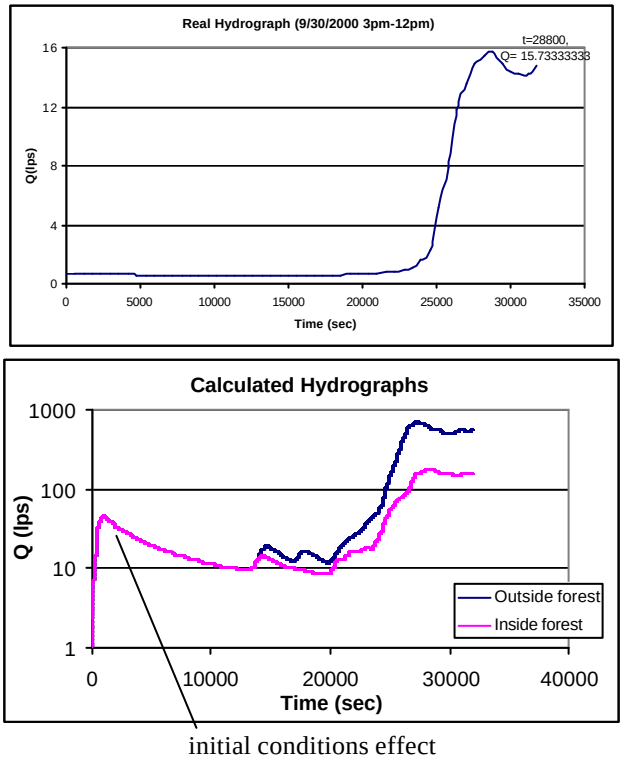
Fig.6 and Fig.7 show the hydrographs measured (real) and calculated. In Fig.7 due to there was no rain measured in the valley, results obtained in this zone are omitted. Calculations were performed from the assumption of “initial saturated conditions in the slope” so, that initial conditions effect could be observed in the beginning.

It is clearly depicted that the results are strongly influenced by the rainfall data obtained at different places. However, the shape and time to the peak are very similar to the real ones. In this study, the effect of rainfall data was considered as the first step to study the physical process of runoff phenomena. The influence of other conditions will be discussed more in details for clarifying runoff process.



initial conditions effect

Fig.6 Real and calculated hydrographs (Aug. 5th.)



initial conditions effect

Fig.7 Real and calculated hydrographs (Sept. 30th)

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