Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

AHW019-01 Room: Exibition hall 7 subroom 2 Time: May 25 15:32-15:45

Classification and prediction of runoff characteristics of mountainous catchments accompanied with soil disturbances

Makoto Tani[1*], Masamitsu Fujimoto[1], Masanori Katsuyama[1], Nagahiro Kojima[2], Ikuhiro Hosoda[3]

[1]Grad. School of Agriculture, Kyoto Univ., [2]: Shiga Forest Research Center, [3]Kansai, For. For. Prod. Res. Inst.

Introduction

To assess effects of human soil disturbances on rainfall-runoff responses was historically important and is a big issue toward the future watershed management, but has been rarely addressed due to a difficult methodology compared to the assessments of the forest logging effects carried out in forest hydrology. A comparison of runoff characteristics among several small study catchments with different vegetation, soil and geological conditions in Japan was made using a runoff model to detect the effect of soil disturbances on runoff characteristics.

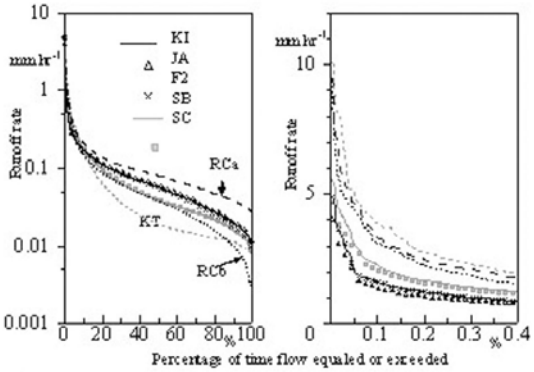

Figure 1. Flow-duration curves produced from the simulated hydrographs for the study catchments.

Introduction

In granite mountains in Shiga Prefecture, we selected four catchments in a bare land (RC), in a poor secondary forest after 30 years passed since the hillside work (JA), in a manmade cypress forest after 70 years passed since the work (KI), and in a mature forest without human disturbances (F2), and in sedimentary-rock mountains, we did two catchments in a manmade cedar-cypress mixed forest in Shiga Prefecture (SB, SC), and in a secondary broad-leaved forest in Okayama Prefecture (KT). Figure 1 shows flow duration curves obtained from the hourly runoff rates calculated by a runoff model using four-year precipitation records for an intercomparison of runoff characteristics among our seven catchments. The right panel is an enlargement of the maximum 0.4% range of runoff rate (the left side portion) in the left panel. The runoff characteristics of KT and RC are much different from others. The characteristics of KT is flashy with the maximum storm flow and very small baseflow. Those of SB and SC are stable compared to those of KT, but those of granite catchments are more stable with little dependencies on the revegetation histories. Two simulation results are shown for RC: RCa is calculated based on the observed smaller evapotranspiration that is the 55% rate of forested catchments, whereas RCb is calculated assuming the same evapotranspiration. This suggest that a stable baseflow for RCa is caused by the low evaporation rate.

Discussion

It is well known that the runoff characteristics are mainly controlled by geology and our results follow it. The bare land catchment in a granite mountain produces high storm peaks because of a lack of surface soil layer, but baseflow is rather stable there because a large temporal change of water storage in weathered bedrock and a small evapotranspiration rate support it. In a

sedimentary-rock catchment, baseflow is generally lower than in a granite one, and a catchment covered with a clayey soil layer with little brown forest soil (KT) especially tends to produce a large stormflow and a small baseflow. These results contribute to predicting what range we should estimate as the effects of soil disturbances on runoff in each catchment geology

Keywords: forest soil, geology, human disturbances, mountainous catchment, runoff model, runoff prediction