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Runoff processes at basin scale in three basins with different geology

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In mountainous catchments, it is known that hydrological value has considerable variation in upstream small basins, but converges in meso and large scale basins (>several hundreds ha) and this converging scale is much influenced by basin geology. Because of bringing out the mechanism which determines such spatial distribution, we need to study runoff processes in various scale basins. However, most of current studies about precipitation-runoff processes are aimed at small scale basins, and few studies are conducted in meso and large scale basins. Even if we investigate in small basins with homogeneous geology, we get a huge variety of runoff processes. So we can't hypothesize that a runoff process which is obtained in one small basin is applied to all other small basins, and we can't have enough information to depict runoff process in the whole basin. Therefore, we need to figure out how the heterogeneity of runoff processes changes with basin scale, and to try describing runoff processes in larger basins than before from investigation of spatial distribution of flow discharge and dissolved matter.
Our purpose is to elucidate the relationship between basin scale and spatial variability of flow discharge and dissolved matter, and to elicit the law about it. Therefore, we investigated the concentration spatial patterns of dissolved silica and conservative ions (Na+,Mg2+,Ca2+) from small scale (<1ha) to meso scale (<2000ha) in three basins with different geology(The Inokawa basin in Tiba Prefecture, The Yodukugawa basin in Kanagawa Prefecture, The Fudoji basin in Shiga Prefecture).The bedrock of Inokawa is sedimentary rocks of Neogene Age, Yodukugawa are diorite and crystalline schist, and Fudoji is weathering granite.
As a result of investigation, flow discharge, and concentration of dissolved matters have considerable variation in small basins, but converge gradually, in the same way to existing studies. In addition, specific discharge is positively correlated with mineral-derived dissolved matters. It indicates that the rise of specific discharge is caused by inflow of groundwater which has high concentration of mineral-derived dissolved matters. Besides, in Inokawa basin, concentrations of a portion of mineral-derived dissolved matters rise with flowing. It indicates that groundwater which infiltrates in small basins flows back via bedrock fracture to the stream.
Based on these results, we proposed the conceptual model which expresses spatial variations of hydrological value in three basins. Main concepts of this model are following three.
1. Stream water is explained the mixture of soil water and groundwater. The variation of flow discharge and concentration of dissolved matter in small basins is caused by the difference between catchment areas of soil water and ground water.
2. As a result of mixing, this difference becomes smaller and smaller and at last becomes negligibly small
3. As the structure of geology, we consider the mixture of deep groundwater passing through bedrock fracture
This conceptual model is able to express the observed pattern of spatial distribution of flow discharge and concentration of dissolved matter well.

Keywords: Runoff process, basin scale, conceptual model, spatial variation, geology, stream water