The Effect of Total Precipitation of Various Periods to Flow Regimes in Mountainous Catchments in Japan: Considering the Geological Characteristics of Catchments

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In order to conduct an appropriate management in each catchment, it is important to understand how the difference in geological conditions affect the relationship between precipitation and flow regimes.

Considering the differences in geological characteristics of catchments, this study aims 1) to clarify the period for calculating the total precipitation that is most influential to several levels of daily flow respectively and 2) to clarify the contribution of the change in the total precipitation of 'the most influential period' to the change in flow.

In this study, 63 mountainous catchments (dam catchments) within the Japanese Archipelago were selected as target areas. First, the 63 catchments were divided into 4 groups according to their geological characteristics. Second, from the observed data of daily flow lasting 26 years (from 1993 to 2018), 6 types of daily flow which represent flow of different scales within a year (1, 10, 25, 50, 75, 95 percentiles of daily flow within a year) were searched. In each geological classification, correlation coefficients between each 6 type of flow and total precipitation of various periods (from 2 days to 365 days) were calculated. Finally, for each geological classification and each type of flow, single regression analyses were conducted, setting the rate of change in flow amount as the objective variable, and the rate of change in total precipitation amount of the appropriate period as the explanatory variable.

As a result, in the analysis of correlation coefficients, significant differences among different geological classifications were seen for lower type of flows but not for higher type of flows. For catchments of volcanic rocks in the Quaternary period, total precipitation of 365 days before the flow occurrence had the highest correlation coefficient with lower type of flows. On the other hand, for catchments of sedimentary rocks in the Mesozoic or Paleozoic era, the most influential period was approximately 45 days, which was the shortest.

Also, increasing trends in flow (i.e. the rate of change in flow > 1.0) during the target period were seen regardless of the geological classification or the type of flow. However, from the simple regression analysis, the significant effect of the change in precipitation to the change in flow was
only seen for annual maximum flow of catchments of sedimentary rocks from the Mesozoic or Paleozoic era. Except this specific geological characteristic and flow type, there is a possibility that other conditions of the catchments (e.g. change in land use) have larger effect to the change in flow compared to the change in precipitation.

In the analyses mentioned above, the effect of snowfall is not considered. Therefore, in the presentation, the difference between snow covered regions and others are compared in addition.