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Flow duration curves focusing on flood runoff in relation to different distributions of soil and geology in mountainous basins in Japan

Kazumasa Fujimura¹, Aki Yanagawa¹, Yoshihiko Iseri², Masahiro Murakami³, Shinjiro Kanae⁴, and Shoji Okada⁵

¹Meisei University, Tokyo, Japan (fujimura@ar.meisei-u.ac.jp)

²University of California, Davis

³Kochi University of Technology

⁴Tokyo Institute of Technology

⁵National Institute of Technology, Kochi College

The behaviors of flood runoff are related to the soil and geological conditions of basin as well as rainfall, basin scale, and topography. However, the effects of surface conditions on flood runoff in natural basins have not been sufficiently investigated until now. Under the situation of an increasing frequency of disasters due to heavy rainfall, it is important to clarify the contribution of basin conditions to flood runoff to enable flood control planning. The aim of this study is to investigate the relationship between flow duration curves mainly for flood runoff and the areal ratios of different types of soil and geology in the basin. We selected eight mountainous basins with areas from 103 to 331 km², located in regions of different topographical, geological, and climatological conditions in Japan. The one percentile flow duration curves out of more than 14 years at hourly time steps are used for evaluation. To clarify the properties of flow duration curves, the discharge into the dams, which means the runoff from basins, is shown as runoff height (Q), and are normalized, the highest value being, by dividing by the maximum runoff height (Q_{max}). The flow duration curves are approximated as straight lines on the log-log graph, and the relationships between the slopes and the areal ratios of the different types of soil and geology are shown as scatter plot graphs. The results indicate that the slope of flow duration curves focusing on flood runoff have correlations and significant differences with the areas of (a) Brown Forest soils, and (b) Neogene rock formation, and with the (c) the Andosols/volcanic rock formation ratio.