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Interrelation between hillslope soil moisture and stream flow in a Paleozoic sedimentary rock watershed

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It is well known that geology is one of influential factors on river regime. In the Paleozoic sedimentary rocks area in Japan, hydrographs are characterized by low base flow and spiky peak flow. To clarify the reasons of such characteristics occur, observation focused on hillslope soil moisture condition was conducted in the gauged Tatsunokuchi-yama Minami-tani watershed (34 ^{o} 42' N, 133 ^{o} 58' E, 50-257 m, 23 ha) underlain by Paleozoic sedimentary rocks. The watershed is covered with primarily *Quercus serrata* dominant mixed forest, and partly *Chamaecyparis obtusa* stands planted in 1970s. Annual precipitation is about 1200 mm with little snowfall.

Ground water levels (GWL) and soil moisture were continuously measured in and around boreholes in a concave slope in the middle reach. Deeper than 0.3 m from ground surface, a thick fractured and weathered bed rock layer extends down to about 10 m at upper slope, and about 16 m at mid-slope. Below the weathered bed rock layer, boring core was relatively unweathered. But conspicuous cracks were obviously seemed to perform as water flow pathway because the surface of crack was dyed. Low coefficients of permeability which ranged from 2^{-8} to 1^{-6} m/s were measured by in situ test in the boreholes.

In the mid-slope, GWL appeared about 15 to 17.5 m in depth from ground surface when surface soil layer was more than field moisture capacity. Although GWL greatly respond to about over 40 mm rainfall events, direct flow rate did not simply increased. In a little antecedent rainfall condition, GWL rising was detected only at the lower slope. Depending on increase of antecedent rainfall, fluctuations of GWL at the mid-slope and the upper slope became obvious, and also direct flow rate went up. The greater amount of rainfall including antecedent rainfall was brought, the more GWL rising belated to stream flow peak observed. The greater intensity of rainfall leads quick rising of stream flow, but it was not effective for GWL rising. According to the stream water quality, rain water component increased when intense rain was brought, subsequently ground water component increased for the duration of rainfall event.

It is realized that water movement is having macroscopic interrelation in the space from upper slope to stream channel. Its complexity would be derived from large soil moisture change by rainfall amount and vegetation activity in the thick weathered bed rock layer in the hillslope as water flow pathways. And it is considered that since the permeability of subsoil is low, stream flow respond by spiky peak against intense rainfall.

Keywords: permeability, soil water pF, ground water, Seto inland sea climate, Tatsunokuchi-yama