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Occurrence of overland flow affected by soil water repellency at forested hillslopes covered by Japanese cypress

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We investigated soil water repellency and hydraulic conductivity for the occurrence of overland flows in hillslopes and examined potential effects of soil surface property on hydrological response in small catchments. This study was conducted in small catchments covered by 40-yrs-old Japanese cypress forest (stand density ranging from 3000 to 4000 stems per ha) in south central Japan. Catchment flow response was monitored in two small headwaters having different coverage of understory vegetation. Catchment A (drainage area: 0.23ha) was dominated by fern-coverage and catchment B (drainage area: 0.43ha, located adjacent to A catchment) had no-under-story vegetation. Two types of six plots (1m in width and 2-m in length) were installed adjacent to the catchments for monitoring the occurrence and volumes of Hortonian overland flow: Three plots were covered by fern bush and litters (fern-plots adjacent to Catchment A), whereas neither under story vegetation nor litter coverage was found for the other 3 plots (bare-plots adjacent to Catchment B). For analyzing soil water repellency (CST test: based on Watson and Letey, 1970) and saturated hydraulic conductivity, soil samples were collected at the various depths of soil matrix (up to 60 cm in depth) adjacent to the hillslope plots. Saturated hydraulic conductivity of all soil samples ranged from 10^{-2} to 10^{-1} cm s^{-1} and did not significantly differ between the two types of plots. Soil water repellency at both plots was exhibited at surface soil layer (0 to 5 cm in depth) that contained much organic materials. Although saturated hydraulic conductivity was high at the surface soil layer, overland flow occurred in both bare-

and fern-plots even during small rainfall events (total precipitation $>$ 10 mm). Therefore, the occurrence of overland flow may be attributed to soil water repellency of surface soil layer rather than the soil crust formation due to rain drop impact. While no noticeable difference in hydrological response delayed to precipitation at the two catchments outlets was found, overland flow measured in both bare- and fern- plots responded to precipitation. Water-repellent substances released from plant litters or micro-organisms, and occurrences of overland flow due to water-repellency had been examined mostly in small grass-covered and pine-forest hillslope plots. However, our findings suggested that (1) overland flow related to soil water repellency occurred even in well vegetated hillslopes; and (2) in spite of coverage of understory vegetation, overland flow and subsurface flow were dominant process at hillslope plot and catchment scale, respectively.