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Study of the aboveground hydrological processes in an unmanaged coniferous forest

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Through field observations we monitored the hydrological processes by measuring gross precipitation (P), throughfall (TF), stemflow (SF), transpiration (Et) and evaporation (Ef) in the Japanese cypress plantation forest floor throughout the 2011 wet season (June-October) in Karasawa Mt., Tochigi Prefecture, Japan. Previous studies have shown the different hydrological components separately. However the interaction of each and every component as a system has not been investigated in one unit. Therefore, in this study, individual components of the hydrological processes were quantified and below ground water storage was estimated by water mass balance equation. Field measurements and hydrograph analysis showed that of the 882.2 mm of cumulative gross precipitation generated by 30 rainfall events during the study period, throughfall, stemflow, and interception loss accounted about 70.6% (622.8 mm), 11.4% (100.7 mm), and 18.0% (158.7 mm), respectively. 82.0% (723.5 mm) of cumulative gross precipitation reached the forest floor, while 16.2% (152.3 mm) was lost through transpiration and 13.1% (123.1 mm) was evaporated from forest floor. According to water mass balance equation, below ground water storage was about 50.7% (447.5 mm), which composed of almost half of cumulative gross precipitation, in other words, 49.3% (434.7 mm) of gross precipitation were consumed in the unmanaged Japanese cypress forest. Daily stand transpiration varied from 0.09 to 2.53 mm day-1 with a mean value of 1.48 mm day-1, and daily evaporation loss from forest floor spread from a minimum value of 0.26 mm day-1 to a maximum value of 3.7 mm day-1 with a mean value of 1.2 mm day-1. Thus, in the unmanaged and dense Japanese cypress plantation forest, the following water loss order can be identified: canopy interception $>$ transpiration $>$ forest floor evaporation. This implies that through forest management and correcting the canopy density, it is possible to improve the ground water capital and water storage capacity of the entire forest watershed.

Keywords: Precipitation, Throughfall, Stemflow, Transpiration, Evaporation, Japanese cypress