Geophysical Research Abstracts
Vol. 12, EGU2010-3856, 2010
EGU General Assembly 2010

Abrupt changes in stemflow with growth in a young stand of Japanese cypress: The cause and ecohydrological interpretation

Shigeki Murakami
(smura@ffpri.affrc.go.jp)

Stemflow (SF) measurements have been conducted for various kinds of tree species all over the world, but few of them focus on the intraspecific changes in SF with age. In this study, SF was measured in a young stand of Japanese cypress (*Chamaecyparis obtusa*, age 9 to 12), one of the major species for plantations in the country, for four consecutive years (Murakami, 2009; Hydrological Research Letters).

The stemflow plot was set at the Hitachi Ohta Experimental Watershed on the Pacific coast of eastern Japan. Canopy cover increased 55% to 94% during the period. Stemflow gauges were set on 9 trees, and stemflow water flowed into a tank that was automatically drained when the water level reached the maximum. The water level in the tank was measured to calculate stemflow per unit ground area. Gross rainfall (R) was measured using tipping bucket raingauges at the openings on the ground level. The stemflow data was analyzed on a rain event basis with the separation time of 6 hours: if rainfall is not observed more than 6 hours after the cessation of rainfall, the storm is defined as a single rain event.

At age 9 the ratio of SF to R (SF/R) was 5.9% on an annual basis, but at age 10 it suddenly dropped down to 2.8% followed by 3.8% at age 11 and 4.3% at age 12. It is surprising that SF/R was the highest at age 9, the youngest, with the canopy cover of only 55%, as opposed to the reasonable increase during age 10 and older. This trend holds true for the analyses both on a quarterly and on a rain event basis. A stem combined with the canopy collects rainwater like a funnel. The efficiency of collecting rainwater by the stem and canopy system is expressed as the funneling ratio (FR; Herwitz, 1986; Earth Surface Processes and Landforms). The value of FR was 81.3 at age 9, and as opposed to the values of SF/R, FR remained constant at older ages: 30.0, 31.4, and 29.0 at ages 10, 11, and 12, respectively.

A photographic analysis revealed that the abrupt drop in SF/R at age 10 was caused by the sudden changes in the structure near the end of branches. Near the tip the branches have linear and upward architecture until age 10 that can collect rainwater effectively to yield high SF/R, but it suddenly turns into downward and convex upward structure at age 10 that reduces catchment area of SF. The canopy is almost closed and establishes the position of upper story vegetation at age 10, which means *C. obtusa* no longer competes with other vegetations for light and water. The constant FR at age 10 and older ages implies that *C. obtusa* is a steady state in terms of SF per unit basal area, i.e. per biomass. It is postulated that large values of SF/R and FR at age 9 and probably younger ages are the strategy for survival of this species to collect enough water in dry periods until the canopy closure.