

Comparison of evapotranspiration obtained through multiple observation methods from a planted forest on complex terrain

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Introduction

Temperate evergreen conifers in eastern Asia are largely distributed in the warm-temperate region and subtropical region, and they grow in rather humid environment under the effect of monsoon, and it is significant to quantify the evapotranspiration (ET) and its characteristics of seasonal variation in such area from the point of view of global and local water cycle. Among the warm-temperate region, southeastern part of Japan is characterized by the highest precipitation rate. Further, planted conifers are the most dominant species in Japan, and about 18% of the land surface of the country is covered with conifers planted in 1950's. Since the trees were planted patchy and have grown usually on a mountainous terrain, it is difficult to estimate ET factor from a single method of observation. Thus, in this study we apply multiple observation methods for a planted coniferous forest in southeastern part of Japan, and try to examine ET estimated from each method.

Materials and Method

Measurement was carried out at Kahoku experimental watershed (KHEW: 33° 08' 13.3" N, 130° 42' 34.3" E) in Kyushu Island, southwestern part of Japan. The main vegetation is Japanese cedar (sugi), planted around the valley to lower hillside, and Japanese cypress (hinoki) planted at upper hillside to the ridge. Runoff was measured at 2 small watersheds (Shimizu et al., 2003; Shimizu, 2007), and net rainfall was measured at an outer open space near the watersheds. Rainfall interception was obtained from 3 plots observation (middle-sugi plot, large-sugi plot and hinoki plot), from the measurements of stem flow and rainfall on the forest floor. Sap flux observation was carried out by applying Granier type sensors at sugi forest stands, to compare the effect of slope position on the plot scale evaporation (Kumagai et al., 2007). The latent heat flux was measured through closed-path method, with a sonic anemo-thermometer and a sampling intake to an IRGA installed at the top of the 50-m meteorological tower, which was built on the middle of the smaller watershed. The data used mainly for the analysis was obtained between 2007 and 2008.

Results

In the year 2007, the annual net rainfall was 1956.5mm, and rainfall interception measured at middle-sugi plot was estimated as 435.3mm. The annual runoff values between the 2 watersheds are remarkably different, and it would be caused the difference of the bedrock inclination direction from the surface landform (Ikawa, 2008). The area-based evaporation values from overstory sugi trees were differed by slope position, but it might be compensated by evaporation from understory which grew more thickly at the upper slope position. The trend of latent heat flux divided by two wind direction was significantly different from each other, which might be related with steep slope and relatively small hinoki trees in the south direction from the tower. In the presentation, we will apply these results to discussion about the annual water budget.

References

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