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# Evapotranspiration and water use efficiency on a coniferous planted forest watershed in south western Japan

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Japanese cedar (*Cryptmeria japonica* D. Don) and Japanese cypress (*Chamaecyparis obtusa* Endl.) are the most popular planted species in Japan. These species cover about 20% of the land surface of the country. On a mountainous topography which is common in Japan, Japanese cedar was usually planted from valleys to lower hillsides with relatively wet and fertile soils, while Japanese cypress was planted on the drier and more nutrient poor ridge areas. Accordingly, evapotranspiration ($ET$) and carbon assimilation may be variable in the two species.

We applied multiple methods to estimate $ET$ from a planted forest watershed located in Kyushu Island, south western part of Japan. The watershed existed on mountainous terrain, and the right bank was mainly covered with well-grown Japanese cedar while the larger part of the left bank was covered with relatively less-grown Japanese cypress. We applied the eddy covariance method, using an observation tower built in the center of the watershed. The eddy covariance data were experimentally divided to two sectors by wind direction, right bank side and left bank side of the watershed, and the lack of data for each wind sector were interpolated by the mutual imputation method. The analysis period in this study is 2007-2008. Within the period, the rainfall interception loss ($I_c$) and sap-flux density were also measured in Japanese cedar plots, and the lower canopy $ET$ was estimated by a model. From the eddy covariance result, $ET$ from the left bank side was estimated as 85% of that from the right bank side in the period. Compared the right bank side $ET$ with the combination of $I_c$, upper- and lower-canopy $ET$, the difference in annual total $ET$ was about 1% when global solar radiation ($S_d$) was greater than 0, which assured the accuracy of the eddy covariance method even over the complex terrain.

As for carbon assimilation, we simultaneously measured $CO_2$ flux and $CO_2$ concentration profile by using the observation tower. Based on the measurements, we can estimate the $CO_2$ exchange between the forest and atmosphere through the similar procedure to $ET$. Thus in this study, we will estimate the carbon budged and calculate the water use efficiency of the whole ecosystem of the watershed and of the both bank sides. From the tentative result obtained at present, the average NEE of the left bank side was 87% to that of the right bank side, in the daytime ($S_d > 0$) in 2007-2008. From the value and the aforementioned ET ratio (0.85), the water use efficiency of the both bank sides were might be almost the same as each other. In the presentation, we will discuss about the detail, considering the respired $CO_2$ in the nighttime and the rainfall interception in the Japanese cypress plot.

Keywords: Planted coniferous forest stand, Growth difference, Water vapor flux, Carbon dioxide flux, Water use efficiency