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# A comparison between wet canopy evaporation estimated by stable isotope ratios of water and canopy interception measured by water balance

Shigeki Murakami (1), Shohei Hattori (2), and Ryu Uemura (3)

(1) Tohkamachi Experimental Station, Forestry and Forest Products Research Institute, Tohkamachi-shi, Japan (smura@affrc.go.jp), (2) School of Materials and Chemical Technology, Tokyo Institute of Technology, Yokohama, Japan, (3) Faculty of Science, Department of Chemistry, Biology, and Marine Science, University of the Ryukyus, Okinawa, Japan

Some papers proved that canopy interception is proportional to rainfall not only on a rain event basis but also on an hourly basis (e.g. Murakami, 2006, J. Hydrol.; Saito et al., 2013, J. Hydrol.). However, theoretically, evaporation does not depend on rainfall amount. These results are enigmatic and we need to reevaluate wet canopy evaporation.

We measured gross rainfall and net rainfall in a plastic Christmas tree stand with a height of 165 cm placed on a 180-cm square tray as described in Murakami and Toba (2013, Hydrol. Res. Lett.). The measurement was conducted outside under natural rainfall. We also estimated wet canopy evaporation using stable isotope ratios of water. During a rain event, we manually sampled gross and net rainwater on an hourly basis. Evaporation was calculated using the difference between the $\delta^{18}$O (or $\delta^{2}$H) values in gross and net rainfall using isotope fractionation factor.

Total gross rainfall in a target rain event in October, 2014, was 28.0 mm and net rainfall (discharge from the tray) was 22.7 mm, i.e. canopy interception was 5.3 mm (18.9% of gross rainfall). The $\delta^{18}$O (or $\delta^{2}$H) value in net rainfall was higher than that in gross rainfall because of fractionation by evaporation on wet canopy surface. Hourly evaporation calculated by the values of $\delta^{18}$O varied from 2% to 24% of gross rainfall, and the weighted average by hourly gross rainfall was 5.2% of gross rainfall. Further, we estimated rainfall interception using a tank model (Yoshida et al., 1993) assuming constant evaporation rate, i.e. 20% of gross rainfall. Total net rainfall calculated by the model was 23.1 mm, i.e. calculated canopy interception was 4.9 mm (17.5% of gross rainfall). Then, keeping the parameters of the model, we simulated net rainfall using hourly surface evaporation obtained by the $\delta^{18}$O values. Calculated net rainfall was 25.6 mm, i.e. wet canopy evaporation was only 2.4 mm (8.6% of gross rainfall).

So far, possible explanation of the discrepancy between the two methods is evaporation of small droplets produced by raindrops splashed onto the canopy (Murakami, 2006). Assuming that the canopy interception loss consists of the wet canopy evaporation and the splash droplet evaporation, amount of the splash droplet evaporation would be equal to the difference between the two methods. The result using $\delta^{2}$H will be shown at the time of presentation.

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