Comparing Three Methods of Sampling Throughfall in a Declining Coniferous Forest at a Low Rainfall Site

Carlyle-Moses, D E
dcarlyle@tru.ca
Thompson Rivers University, 900 McGill Road, Kamloops, BC V2C 5N3, Canada

Kinniburgh, S M
susan-kinniburgh@mytru.ca
Thompson Rivers University, 900 McGill Road, Kamloops, BC V2C 5N3, Canada

Giesbrecht, W J
warren_gman@hotmail.com
Thompson Rivers University, 900 McGill Road, Kamloops, BC V2C 5N3, Canada

McKee, A J
wallace_1000@hotmail.com
Thompson Rivers University, 900 McGill Road, Kamloops, BC V2C 5N3, Canada

Lishman, C E
chad_lishman@hotmail.com
Thompson Rivers University, 900 McGill Road, Kamloops, BC V2C 5N3, Canada

The Mayson Lake Hydrological Processes Study area is located in the southern interior of British Columbia ~ 60 km NNW of the City of Kamloops on the Thompson - Bonaparte Plateau (51.2° N, 120.4° W; 1260 m a.m.s.l.). During the summer of 2008 throughfall was measured in a mature declining mixed lodgepole pine (Pinus contorta var. latifolia Dougl.) - hybrid spruce (Picea glauca (Moench) Voss. x engelmanni Perry x Engelm.) - subalpine fir (Abies lasiocarpa (Hook.) Nutt.) stand, where pines were at the grey - attack stage of a mountain pine beetle (Dendroctonus ponderosae Scolytidae) infestation. Throughfall was estimated on a rainfall event basis using three sampling strategies: 32 stationary wedge gauges, 32 roving wedge gauges that were moved periodically during the study period, and 16 stationary trough gauges. The wedge gauges had a catch area of 36 cm² each, while the trough gauges had a catch area of 2900 cm² each, ~ 80 times larger than the wedge gauges. Throughfall depth (mm) for all three sampling methods followed a power relationship with rainfall depth (mm). No significant difference in the slopes or intercepts of the three power relationships were found (α = 0.05). Thus the throughfall data were pooled to give the following equation relating throughfall depth (mm) to event rainfall depth (mm): TF = 0.348Pg1.33, r² = 0.93, n = 14. An efficiency ratio was derived for this study to compare the sampling accuracy among the three sampling methods used. The efficiency ratio ER between two sampling methods was calculated as n1 / n2, where n1 and n2 are the number of samples required to meet a statistical objective using the method that produces the lowest and highest coefficient of variation (CV) values, respectively. The number of required samples (gauges) for a given method, ni, is found using: t² x CV² / CI², where t is the student t value and CI is the desired confidence interval around the mean expressed as a percentage. Assuming t = 2 and keeping CI constant at 10 %, ni may be equated with 0.04 CV². At the rainfall event scale trough gauges were more efficient at sampling throughfall than wedge gauges with ER values ranging from 1.4 to 3.3. However, at the season-long time scale wedge gauges that were periodically relocated (gauges were moved after approximately 15 mm of rain fell) provided the most accurate throughfall estimates. The ER values derived for season-long throughfall were 1.5 and 1.8 when roving wedge gauges were compared to stationary troughs and stationary wedge gauges, respectively. The results of this study suggest that using a roving wedge gauge method, and thus being able to sum the errors of individual event estimates quadratically, provides a more accurate estimate of season-long throughfall than stationary trough gauges - even with catch areas ~ 80 times greater than wedge gauges. A total of 32 roving wedge gauges were found to provide an estimate of the mean season-long throughfall depth to within 10 % at the 95 % confidence level, while 49 and 58 stationary trough and stationary wedge gauges would have had to been used to provide the same degree of accuracy, respectively.

DE: 1813 Eco-hydrology
DE: 1836 Hydrological cycles and budgets (1218, 1655)
DE: 1895 Instruments and techniques: monitoring
SC: Hydrology [H]
MN: 2009 Joint Assembly