



Motes for forest hydrology – is the time right?

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Low cost, low power wireless sensors (motes) promise to revolutionize environmental data collection, but are they currently refined enough for widespread use by hydrologists? We investigated their viability as a replacement for traditional data collection techniques in a 7 ha forested watershed in South-western British Columbia. The watershed included 3 V-notch weirs and 41 instrument clusters measuring air and soil temperature, humidity, rainfall or throughfall, soil moisture content, and groundwater head. Overland flow occurrence was measured at 16 locations. The foundation of each cluster was a data box containing a MDA300 data acquisition board and a MICA2 processor board from Crossbow Technologies, Inc that allowed for short range wireless data collection. The 41 motes each recorded data every 15 minutes from July, 2006 to April, 2007. In addition to reporting on the reliability of the motes and sensors during the 10 months deployment, the high spatial and temporal resolution data collected by this experiment gave the opportunity to investigate if it is possible to over-sample a watershed. We created subsets of different sample sizes using soil moisture and throughfall data. We selected four hydrological events and three entire months from the complete data set and created ensembles of 100 different realizations each of 5, 10, and 20 randomly selected sampling points. Comparing the root mean squared error (RMSE) between each realization and the value for the full data set enabled us to determine if increasing the sample size produced diminishing returns. There were also significant differences in prediction error for both soil moisture and throughfall at times of differing hydrologic activity. This analysis also provides further support for the theories of changing moisture states of soil moisture and threshold values for throughfall.