Geophysical Research Abstracts
Vol. 14, EGU2012-1492, 2012
EGU General Assembly 2012

Optimum throughfall sampling procedures for detecting differences in canopy interception in a gradient of forest complexity

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Accurate and precise estimates of mean throughfall are required for quantifying and modelling canopy interception. Usually these estimates are subject to considerable uncertainty. This uncertainty not only complicates the detection of interception differences between forests but may also propagate into uncertainty of interception model parameters. As the sampling effort to obtain high-quality throughfall estimates can be substantial it is important to design optimal, cost-efficient sampling procedures. Unfortunately, even after decades of research the link between forest structure and throughfall spatial patterns is not fully understood. The understanding of these patterns, however, is required to optimally design throughfall studies. For instance, the benefit of a large throughfall sampling device whose employment is often more costly compared to a small one depends on the range and strength of spatial autocorrelations. Likewise, the optimum arrangement of samplers within the study area depends on the spatial pattern of throughfall. Due to this influence of throughfall spatial variability on the choice of sampling procedures, guidelines for an optimal sampling of throughfall in different forests are required. In this talk we present our latest research which aims at the detection of throughfall patterns, understanding their controls, and using this knowledge for optimizing sampling procedures to obtain accurate and precise throughfall estimates. A key aspect of the presented research is the application of stochastic simulations based on large empirical datasets. We use these simulations to test the performance of different supports and sampling designs in order to develop optimum sampling procedures for an event-based sampling of throughfall. In contrast to our previous work, which focused on a single forest type, we now extent our investigations to a gradient of forest complexity comprising an uniformly structured plantation forest, a simply structured young secondary forest, and a mature, highly structured old-growth forest. Based on these data we derive the required set of guidelines for throughfall sampling. Moreover, we discuss how uncertainty of throughfall measurements propagates into the estimation and modelling of interception for a range of forest types.