

GENERAL INFORMATION

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ABSTRACT

The canopy budget model simulates the interaction of major ions within forest canopies based on throughfall and precipitation measurements. The model has been used for estimating dry deposition and canopy exchange fluxes in a wide range of forest ecosystems, but different approaches have been reported. We give an overview of model variations with respect to the time step, type of open-field precipitation data, and tracer ion, and discuss the strengths and weaknesses of different assumptions on ion exchange within forest canopies. To examine the effect of model assumptions on the calculated fluxes, nine approaches were applied to data from two deciduous forest plots located in regions with contrasting atmospheric deposition, i.e. a beech (*Fagus sylvatica* L.) plot in Belgium and a mixed sugar maple (*Acer saccharum* Marsh.) plot in Quebec.

For both forest plots, a semi-annual time step in the model gave similar results as an annual time step. Na⁺ was found to be more suitable as a tracer ion in the filtering approach than Cl⁻ or SO₄²⁻. Using bulk instead of wet-only precipitation underestimated the potentially acidifying deposition. To compute canopy uptake of NH₄⁺ and H⁺, ion exchange with K⁺, Ca²⁺, and Mg²⁺ as well as simultaneous cation and anion leaching should be considered. Different equations to allocate NH₄⁺ vs H⁺ uptake had most effect on the estimated fluxes of the cation that was less important at a plot. More research is needed on the relative uptake efficiency of H⁺, NH₄⁺ and NO₃⁻ for varying tree species and environmental conditions.

MATERIALS & METHODS

study area	5n (scientific zone, measuring tower)
time period	March 2003 – March 2004
goal	<ul style="list-style-type: none"> - overview of varying forms of the canopy budget method - study the effect of model variations on the estimated atmospheric deposition and canopy exchange for two contrasting case studies - compare the model results for dry deposition of N and S with and inferential method
set-up	a dominant beech tree in the Aelmoeseneie forest <ul style="list-style-type: none"> - throughfall: 12 collectors (Fig. 5.1 p 71, Staelens_2006_PhD) - stemflow mixed deciduous forest site in Quebec, Canada

data collection	see Staelens_etal_2006_EnvPoll
remarks	Chapter 7 of Staelens_2006_PhD

RESULTS

Sodium was the most appropriate tracer ion for estimating dry deposition and canopy interactions of other base cations, but the reliability of this filtering approach strongly depends on the actual atmospheric particle size distribution. The canopy budget model can be easily applied at half-year data to simulate seasonal patterns. Including weak acid leaching decreased the computed canopy uptake of H^+ and NH_4^+ for the two study systems. For the beech canopy, the calculated dry deposition of NH_x was similar to the N deposition estimated by an inferential technique, when anion leaching was neglected.