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Surface-atmosphere interactions with coupled within-canopy aerodynamic resistance and canopy reflection.

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Abstract
Models that describe the exchange of CO2 and H2O between the surface and atmosphere use bulk-parametrization of the within-canopy aerodynamic resistance and leaf area density (eq. LAI). This bulk parametrization is based on the Monin-Obukhov Similarity (MOS) theory. The MOS theory however breaks down for sparse canopies and it cannot couple profiles in the leaf density to profiles in the within-canopy aerodynamic resistance.
The objective of this research is to create a simple model that is able to couple the within-canopy aerodynamic resistance and canopy reflection for different levels in the canopy. This model should be able to represent the canopy using as fewer parameters as possible, in order to facilitate inversion of remote sensing imagery.
A virtual canopy was simulated using an L-systems approach, Lindenmayer 1968. The L-system approach was chosen because it describes the canopy with fractals. It therefore needs very little inputs to simulate a virtual canopy. A vertical profile of leaf density was calculated for 60 levels from this virtual canopy. The within-canopy aerodynamic resistance was modeled from the vertical leaf density profile using foliage drag coefficient, Massman 1997. A modified version of the SCOPE (Soil Canopy Observations and Photosynthesis) model was used to calculate the H2O and CO2 fluxes using the vertical profiles of leaf density and within-canopy aerodynamic resistance.
The simulated fluxes are compared with field measurements over a vineyard and a forested area. The field measurements in both areas are acquired using the same setup: a basic flux tower in addition with an eddy-covariance setup. We present in this article the methodology and the results, as a proof of concept.

references

Massman, W.J., An Analytical One-Dimensional Model of Momentum Transfer by vegetation of arbitrary structure, Boundary-Layer Meteorology, 1997, 83, 407–421

Lindenmayer, A., Mathematical Models for Cellular Interactions in Development, Journal of Theoretical Biology, 1968, 18, 280-299