

AMS Online Journals Access Control

[Volume 8, Issue 15 \(November 2004\)](#)

Earth Interactions

Article: pp. 1–17 | [Abstract](#) | [PDF \(175K\)](#)

Water Flux in a Cashew Orchard during a Wet-to-Dry Transition Period: Analysis of Sap Flow and Eddy Correlation Measurements

P.G. Oguntunde^a, N.C. van de Giesen^b, P.L.G. Vlek^c, and H. Eggers^d

a. Center for Development Research (ZEF), and Institute of Urban Planning, Land Management and Water Engineering, University of Bonn, Bonn, Germany

b. TU Delft, Delft, Netherlands, and Center for Development Research (ZEF), University of Bonn, Bonn, Germany

c. Center for Development Research (ZEF), University of Bonn, Bonn, Germany

d. Institute of Urban Planning, Land Management and Water Engineering, University of Bonn, Bonn, Germany

ABSTRACT

Information regarding biosphere–atmosphere interactions is important in the study of a hydrological cycle. To this purpose, xylem sap flow (S_F) using the Granier system and evapotranspiration (E_T) using the eddy correlation method were measured during a “wet-to-dry” transition period in a young cashew (*Anacardium occidentale* L.) plantation. Estimates of half-hourly tree transpiration made from stem sap flow measurements and above-canopy eddy correlation measurements of water vapor flux were compared for a period of 22 days of complete records. Cross-correlation analysis was used to estimate the time lags (τ) between the time courses of S_F and E_T , and between S_F and E_T with solar radiation (R_S) and vapor pressure deficit (D). Applying a simple functional technique, values of $\tau = 43$ min (November), $\tau = 46$ min (December), and $\tau = 75$ min (January) with an overall $\tau = 53$ min (using all data) between the time courses of E_T and S_F were estimated. A positive lag indicates that S_F lags behind E_T . However, both E_T and S_F were more dependent on R_S ($r^2 > 0.81$) than on D , whereas S_F was more related to D ($r^2 = 0.60$) compared to E_T ($r^2 = 0.38$). An insignificant ($p > 0.05$) decrease in daily values of both E_T and S_F over the 22 days of concurrent measurements were observed. Daytime average E_T ranged from 2.01 to 3.17 mm day⁻¹ with a mean of 2.7 mm day⁻¹, whereas values of S_F ranged from 0.55 to 0.72 mm day⁻¹ with a mean of 0.65 mm day⁻¹. Tree transpiration accounted for about 25% of the evapotranspiration from the orchard. This result may be of help in correctly predicting the diurnal behavior of transpiration from sap flow measurements.

Manuscript received 4 March 2004, in final form 6 August 2004

DOI: 10.1175/1087-3562(2004)8<1:WFIACO>2.0.CO;2