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Thema
Kommission I: Bodenphysik und Bodenhydrologie

Evapotranspiration und Gasaustausch an der Grenzfläche zwischen Boden und Atmosphäre - Messung und Modellierung

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Titel
Responses of sap velocity in Acacia mellifera trees to soil water availability, vapour pressure deficit and global radiation

Abstract
Acacia mellifera (multi-stem deciduous tree) is one of the dominant woody species responsible for bush encroachment in southern African savannahs. However, very little is known on water use, transpiration or xylem sap flow of A. mellifera. We analyzed the responses of sap velocity in A. mellifera to soil moisture, vapour pressure deficit and global radiation. This knowledge is necessary to improve hydrological modelling and will as such contribute to our understanding of the impacts of bush encroachment in (semi) arid savannahs on the soil water balance. We monitored sap velocities at two sites that differed in tree density in a semi-arid thornbush savannah in central Namibia (mean annual precipitation = 346 mm). Sap velocities were derived using the Heat Ratio Method. Measurements were done in four periods of 3-4 months between November 2014 and September 2016. The measurement periods covered the transitions between the dry and rainy season and vice versa, and the dry season. In two of these periods we did measurements at all stems of three trees per site (a total of 17-19 stems), while in the other two periods sap velocities were measured on one stem per tree for six to eight trees per site. Preliminary results indicate that the day-to-day fluctuations in cumulative daily sap velocity showed a three-phase interaction with soil water tension (minimum soil water tension of four sensors to 1-m depth). Phase I: At soil water tension < ¯ pF 2.5, soil water tension had little influence on sap velocities, and fluctuations in sapflow seemed to be related to VPD and global radiation. Phase II: At soil water tensions between ¯ pF 2.5 and ¯pF 3.2, sap velocities were negatively related to soil water tension. Phase III: At soil water tensions > ¯ pF 3.2 no sap flow could be detected. The study was done in the framework of SASSCAL (Southern African Science Service Centre for Climate Change and Adaptive Land Management) granted by the German Federal Ministry of Education and Research (BMBF).