GENERAL INFORMATION

author(s)	Vermassen D
year	2012
English title	Validation of the SapFlow+ sensor: how accurate is the determination of sap flux density and sapwood moisture content?
original title	Validatie van de SapFlow+ sensor. Hoe nauwkeurig worden sapstroomdichtheid en vochtgehalte van het spinthout door deze methode bepaald?
reference	Msc thesis, Ghent University, Ghent
pages	69
type	dissertation (d2)
ecosystem service	regulating – water cycle
keywords	sap flux density, Sapflow+ sensor
taxa	*Fagus sylvatica*
project	PhD Maurits Vandegehuchte
supervisor	Steppe K
institution	Laboratory of Plant Ecology
document	pdf
data	

MATERIALS & METHODS

study area	
time period	
goal	validation of the SapFlow+ sensor: theoretically and methodologically
set-up	- identifiability analysis - several validation tests on artificial and real stem segments of European beech
data collection	after each experiment: moisture content, volume en density stem segment, position of the needles and heater of the sensor, sapwood surface area
remarks	Thirteen stem segments of beech trees from the Aelmoeseneie forest were used in the validation tests. Two beeches were cut on 7 and 20 September 2011. The trees were c. 15 years old and had a dbh of c. 15 cm. Stem segments of 0.5 – 1.5 m length were sawn in the forest.

RESULTS

This non-empirical heat-pulse based technique is suitable for accurate measurements of sap flux densities across the entire natural range of woody plants and the non-destructive determination of the thermal properties and moisture content of the sapwood.

The heat input q, delivered by the heater to the sapwood, must be exactly known. The determination of the heater resistance seems to be susceptible to variations depending on the way this resistance has been calculated or measured. The proposed solution consists of an preparatory execution of a calibration test in immobilized water, to make sure that the value of q is exactly known and to provide the possibility to introduce a correction factor. Despite the clear improvements of the simulation results by means of this calibration, two alternative models are also proposed, making the determination of the resistance and calibration in immobilized water unnecessary. In the first model, the parameter q is effectively eliminated from the existing model. This q elimination model does not manage to be identifiable for the classic configuration. By changing the positions of the sensor probes around the heater, the model becomes identifiable, for a limited number of configurations, within a certain range of heat-pulse velocities. The second model, in contrast with the q elimination model, does not consist of a real elimination of q, but incorporates the heat input into a new parameter. This makes calculation of the heat input unnecessary, since it's estimated along with the new parameter. By using this model, the relative change in moisture content and the absolute moisture content can also be determined immediately. These theoretical approaches should however still undergo experimental validation tests to assure an accurate operation.