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Sap flow measurement in a street and park of a hot and arid city

S. Cohen (1), L. Shashua-Bar (2), O. Potchter (2), Y. Yaakov (3), P. Bar-Kutiel (2), and J. Tanny (1)

(1) Inst. Soil, Water & Environmental Sciences, ARO, Volcani Center, Israel , (2) Dept. of Geography and Environmental Development, Ben Gurion University of the Negev, Israel , (3) Dept. of Geography, Tel Aviv University, Israel

Urban trees mitigate hot climate by shading, but also through transpirational cooling. Transpiration from urban trees can be a significant part of the urban energy budget, but is difficult to quantify. A direct method for measuring tree transpiration is through the use of sap flow sensors. Several methods have been developed for this, where the most common use heat as a tracer of sap flow. The most popular method among plant environmental ecologists is the thermal dissipation or 'Granier' method, the latter name for its inventor. In this method continuously heated and unheated sensors are inserted into the tree stem and the temperature difference between the two is roughly inversely proportional to sap flux density. Although the method can be accurate, sap flux density can be highly variable in the stem, depending on depth in the stem and azimuth. Inter-tree variation is also large, so a number of sensors per tree and a number of trees need to be monitored for accurate determinations. Finally, it is a good idea to calibrate the sensors for the configuration and species being monitored.
We measured sap flow in a tree covered open mall and a city park in Beer Sheva, Israel – a hot and arid city. Trees that shaded the open mall were of the Delonix regia species while those in the park were Prosopis and Tamarix sp. Individual tree sap flux for large trees exceeded 100 liters on many of the days, equivalent to over 100 W m-2 at mid-day.
This paper will discuss methodological issues as well as some of the results.