# Heat-Pulse Methods for Measuring Soil Physical Properties: Present and Future. (S01-kluitenberg010953-Oral)

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#### Abstract:

The introduction of multi-needle heat-pulse sensors over the past decade has resulted in new methods for measuring volumetric heat capacity, thermal conductivity, thermal diffusivity, and volumetric water content. Opportunities for improving the usefulness of these methods will be discussed. These include, among other things, characterizing the spatial sensitivity of multineedle heat-pulse sensors, the use of inverse modeling to estimate parameters, and improvements in design to reduce sensitivity to needle deflection. A promising new application of multi-needle heat-pulse sensors is the measurement of soil water flux density. Initial work on this topic suggested that thermal methods would be useful only for a relatively narrow range of fluxes. More recent work has revealed that there may be opportunities for widening the range of applicability. These and other opportunities for improving upon this method will be discussed. A third aspect of heat-pulse methods to be addressed is their combined use with other measurement techniques. Current research along this line will be summarized and prospects for future work will be explored. Finally, new applications for heat-pulse methods in research and in the management of soil and water resources will be proposed.

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### **Presentation Information:**

Presentation Date: Monday, November 11, 2002 Presentation Time: 4:00 pm

## Keywords:

Heat-Pulse Methods, Advances in Instrumentation, Soil Physical Property Measurements