



Tropentag, October 11-13, 2006, Bonn

“Prosperity and Poverty in a Globalised World—  
Challenges for Agricultural Research”

## A New Opto-electronic Sensor for Soil Humidity Measurement — Evaluation by Numerical Modelling with Hydrus 2D Software

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### Abstract

Water is becoming a very scarce resource with the increasing population all over the world. Since 75 % of the fresh water is used for agriculture purposes, improving efficiency is essential in irrigation to address global water scarcity. Water can be used more efficiently by using new technology. Precise soil moisture measurement plays a major role in high efficiency water use. There are a lot of sophisticated soil moisture sensors which are directed towards well-resourced farmers. But, the majority of the world's farmers are the resource poor smallholders who have not been able to afford that sophisticated irrigation technologies. This paper is to introduce a new low cost near infra red sensor with a special moisture conductive cladding material. Numerical modelling is a fast and inexpensive approach to evaluating the moisture movement in the soil-sensor system. A prerequisite for the accurate soil moisture flux modelling is precise parameterisation of soil and cladding material hydraulic functions. Bimodal Van Genuchten parameterisation of Durner model was used to get hydraulic parameters of the special cladding material. Available hydraulic parameters of the soil were used for the model. There is a possibility to change the environmental and soil characteristics according to weather or climate of the place where sensors are supposed to be installed. Simulated results show a very good relationship with hydraulic characteristics of the cladding material and the soil during a definite range of matrix potential. Experimental observations show good correspondence to the simulation results in modelling. The suitability of the Hydrus 2D software for evaluation of soil-sensor relationship will be discussed.

**Keywords:** Modelling, near infra red, opto-electronic sensor, soil moisture