

7th Groundwater Symposium of the  
International Association for Hydro-Environment Engineering and Research (IAHR)

## Preliminary field tests to determine the soil water content using resistivity measurements

C. Miracapillo<sup>a\*</sup> and H. Morel-Seytoux<sup>b</sup>

<sup>a</sup> University of Applied Sciences of Northwestern Switzerland, 4132 Muttenz, Switzerland

<sup>b</sup> Hydroprose International Consultant, 328 Beech Avenue, Santa Rosa, CA 95409, USA

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### Abstract

Preliminary field tests were carried out in the protected area of Langen Erlen in Basel in order to find a correlation between variations of soil resistivity and variations of the soil water content. The experimental set up is described and the accuracy of the data is evaluated. Data are interpreted using a conceptual physical model in order to determine the infiltration patterns. An inverse relationship between the variations of soil resistivity and the variations of soil water content is used.

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Peer-review under responsibility of the Scientific Committee of the IAHR Groundwater Symposium 2014

**Keywords:** unsaturated zone; water content; resistivity values

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### 1. Introduction

In soil sciences, hydrology and agricultural sciences, water content plays an important role regarding groundwater recharge, agriculture, soil chemistry and ecology. The interest in modeling soil water dynamics in the unsaturated zone and in soil moisture variations has been increased in the last 30 years [1] [2] [3] [4] [5]. A wide range of techniques for field estimation of the water content have been improved and their accuracy tested [6].

\* Corresponding author. Tel.: +41 61 361 2470

E-mail address: [cinzia.miracapillo@fhnw.ch](mailto:cinzia.miracapillo@fhnw.ch)

The purpose of this study is to provide the order of magnitude of soil resistivity in an area of Basel and their variations under permanent and transient conditions.

This study is part of a project, which focuses on soil moisture measurements using the Electrical Impedance Spectrometry Method. The investigations made on the real part of the impedance are summarized in this article, while the investigations on the imaginary part are the content of a future article. The modeling approach is based on soil water balance [7], on a rectangular shaped water front and on an inverse relationship between the variations of soil resistivity and the variations of soil water content.

## 2. Test description a data interpretation

Test 1 and test 2 were both carried out under constant conditions (no water supply at the soil surface) respectively at experimental site1 and at experimental site 2. Both experimental sites are located in the groundwater recharge area of the „Lange Erlen“ in Riehen, close to Basel (Fig.1). Experimental site 1 is on a cultivated field, while experimental site 2 is on a artificial groundwater recharge basin „Verbindungsweg“. Test 3 was carried out at experimental site 2.

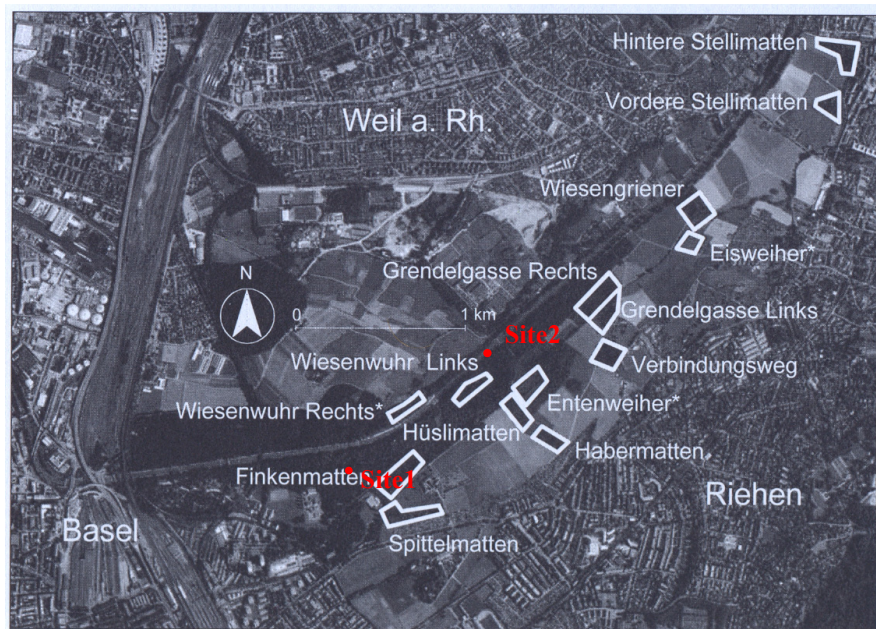


Fig. 1. The „Lange Erlen“ with its artificial recharge basins and the location of the two experimental sites

The following devices were used to measure the electrical resistivity of the soil:

- Data Logger with Panel (8 boards, each with 16 channels, giving a total of 128 channels)
- Personal computer with Z-Meter und software
- Battery (12 Volt, 40 Ampere)
- Converter (12-220 Volts)
- Three pairs of probes 1.5m, 3.0m, 4.5m long with point.

The probes are composed of Electrodes in fine steel 1.4404 (produced by C.C.T. inox S.p.A. in Italy) and plastic pieces in Polyamid PA Ertalon 6 SA Natural (produced by Quadrant in Belgium).

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