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Authors

Concialdi, Paola
Di Prima, Simone
Bhanderi, Harsh M
[et al.](#)

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An open-source instrumentation package for intensive soil hydraulic characterization

Paola Concialdi ¹, Simone Di Prima ^{2,3,*}, Harsh M. Bhanderi ⁴, Ryan D. Stewart ⁵, Majdi R. Abou Najm ⁶, Murari Lal Gaur ⁴, Rafael Angulo-Jaramillo ² and Laurent Lassabatere ²

¹ University of Palermo, Department of Agricultural, Food and Forest Sciences, Palermo, Italy.

² Université de Lyon; UMR5023 Ecologie des Hydrosystèmes Naturels et Anthropisés, CNRS, ENTPE, Université Lyon 1, Vaulx-en-Velin, France.

³ University of Sassari, Department of Agricultural Sciences, Sassari, Italy.

⁴ College of Agricultural Engineering, Anand Agricultural University, Godhra, Gujarat, India.

⁵ School of Plant and Environmental Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA, United States.

⁶ Department of Land, Air and Water Resources, University of California, Davis, CA 95616, United States.

* Corresponding Author. E-mail: sdiprima@uniss.it

Abstract

We present a new open-source and modular instrumentation package composed of up to ten automatic infiltrometers connected to data acquisition systems for automatic recording of multiple infiltration experiments. The infiltrometers are equipped with differential transducers to monitor water level changes in a Mariotte reservoir, and, in turn, to quantify water infiltration rates. The data acquisition systems consist of low-cost components and operate on the open-source microcontroller platform Arduino. The devices were tested both in the laboratory and on different urban and agricultural soils in France and India. More specifically, we tested three procedures to treat the transducers readings, including a filtering algorithm that substantially improved the ability to determine cumulative infiltration from raw data. We combined these three procedures with four methods for estimating the soil parameters from infiltrometer data, showing pros and cons of each scenario. We also demonstrated advantages in using the automatic infiltrometers when infiltration measurements were hindered by: i) linearity in cumulative infiltration curves owing to gravity-driven flow, ii) an imprecise description of the transient state of infiltration, and iii) the occurrence of soil water repellency. The use of the automatic infiltrometers allows the user to obtain more accurate estimates of soil hydraulic parameters, while also reducing the amount of effort needed to run multiple experiments.

Keywords: automatic infiltrometer; infiltration rate measurements; soil hydraulic properties; Arduino.

DOWNLOAD THE FULL MANUSCRIPT HERE:

<https://bestsoilhydro.files.wordpress.com/2019/12/concialdi-et-al-2019.pdf>