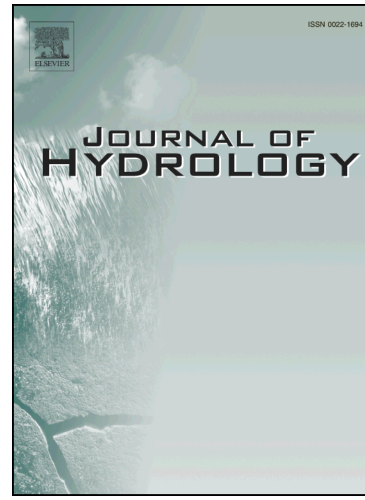
Accepted Manuscript



Research papers

Automated general temperature correction method for dielectric soil moisture sensors

R.G.C. Jeewantinie Kapilaratne, Minjiao Lu

PII: S0022-1694(17)30343-8
DOI: http://dx.doi.org/10.1016/j.jhydrol.2017.05.050
Reference: HYDROL 22041

To appear in: *Journal of Hydrology*

Received Date: 30 December 2016
Revised Date: 10 May 2017
Accepted Date: 25 May 2017

Please cite this article as: Jeewantinie Kapilaratne, R.G.C., Lu, M., Automated general temperature correction method for dielectric soil moisture sensors, *Journal of Hydrology* (2017), doi: http://dx.doi.org/10.1016/j.jhydrol.2017.05.050

Automated general temperature correction method for dielectric soil moisture sensors

R.G.C. Jeewantinie Kapilaratne*[1], Minjiao Lu[2]

[1,2]Dept. of Civil and Environmental Engineering, Nagaoka University of Technology, Japan
[2]Adjunct Professor, Chongqing Jiaotong University, China
[*1]k.jeewantinie@gmail.com; [2]lu@nagaokaut.ac.jp

Abstract

An effective temperature correction method for dielectric sensors is important to ensure the accuracy of soil water content (SWC) measurements of local to regional-scale soil moisture monitoring networks. These networks are extensively using highly temperature sensitive dielectric sensors due to their low cost, ease of use and less power consumption. Yet there is no general temperature correction method for dielectric sensors, instead sensor or site dependent correction algorithms are employed. Such methods become ineffective at soil moisture monitoring networks with different sensor setups and those that cover diverse climatic conditions and soil types. This study attempted to develop a general temperature correction method for dielectric sensors which can be commonly used regardless of the differences in sensor type, climatic conditions and soil type without rainfall data.
In this work an automated general temperature correction method was developed by adopting previously developed temperature correction algorithms using time domain reflectometry (TDR) measurements to ThetaProbe ML2X, Stevens Hydra probe II and Decagon Devices EC-TM sensor measurements. The rainy day effects removal procedure from SWC data was automated by incorporating a statistical inference technique with temperature correction algorithms. The temperature correction method was evaluated using 34 stations from the International Soil Moisture Monitoring Network and another nine stations from a local soil moisture monitoring network in Mongolia. Soil moisture monitoring networks used in this study cover four major climates and six major soil types. Results indicated that the automated temperature correction algorithms developed in this study can eliminate temperature effects from dielectric sensor measurements successfully even without on-site rainfall data. Furthermore, it has been found that actual daily average of SWC has been changed due to temperature effects of dielectric sensors with a significant error factor comparable to ±1% manufacturer's accuracy.

Keywords: Temperature effect removal, dielectric sensors, soil water content, automation, statistical inference