Christiaan Dirksen:

Soil Physics Measurements

Language: English

(ScienceDirect)
ISBN 978-3-510-65386-7, paperback, price: 35.00 €
in stock and ready to ship

Buy article
Order form

BibTeX file

Keywords
soil • water • tensiometry • hydraulic • measurement
Synopsis

Soil Physics deals with the analysis and quantification of the physical properties and processes in the upper layer of the earth's crust, with major emphasis and activity on transport and accumulation of water and solutes in the (water) unsaturated zone. There is a relative abundance of textbooks dealing with the theory and application of Soil Physics, but there are very few books that give detailed descriptions of soil physics measurements and step by step instructions for exercises that are suitable for teaching. This book is intended to help fill this gap for measurements related to water transport in unsaturated soil.

It is impossible to cover all the soil water measurements that are presently in use. This volume gives a representative cross section of the available types of methods. As such, it reflects the present status of the practical “Soil Physics Measurements” (SPM) that was initiated at Wageningen University about fifteen years ago. This advanced practical is required for undergraduates in the Soil, Water and Atmosphere study program, but is also taken regularly by undergraduates in related disciplines and graduate students from abroad. Through the years, new measuring methods and techniques have been incorporated. A prime example is soil water content measurements. Whereas in the past gamma ray attenuation and neutron thermalisation have been used, presently water contents are measured, beside the standard gravimetrical method, mainly by time domain reflectometry. The contents of the SPM practical is covered in chapters on soil water content, tensiometry, steady hydraulic conductivity measurements, instantaneous profile method, and sorptivity and diffusivity measurements. The final chapter presents a framework for evaluating direct and indirect methods for determining soil hydraulic conductivity functions.

More elementary experimental operations such as retrieving “undisturbed” core samples, gravimetric determination of soil water content, volume fractions, bulk density, and soil water retention characteristic, as well as measurements of hydraulic conductivity, infiltration, capillary rise, and sorptivity under saturated conditions are taught in an introductory practical. To make this book complete in itself, a review of the basic concepts of Soil Physics and detailed descriptions of these elementary experimental operations are presented in the second chapter. An introductory chapter briefly describes the hydrology and hydraulic properties of the unsaturated zone and summarizes the contents of each of the chapters. It also offers organizational details of the SPM practical for teachers who may want to set up a similar practical.

The general pattern of the chapters consists of theory, review of available methods, selection of one or more methods, practical aspects, evaluation, and step by step instructions for exercises. They are written from the experimentalist’s point of view. Only the easily understood head equivalents of soil water potentials are used and the mathematics is kept to a minimum. Students and professionals in soil science, hydrology, and other earth sciences with little knowledge of calculus should be able to understand the subject matter and carry out the exercises. Students participating in the practical are expected to have mastered the subject matter treated in the book “Elements of Soil Physics” (Koorevaar et al., 1983), but only parts of the third and fifth chapter of this book are really needed.

Table of Contents

1 Introduction 1
1.1 Unsaturated zone 1
1.1.1 Hydrology 1
1.1.2 Soil hydraulic properties 2
1.2 Chapter contents 3
1.3 Soil physics measurements practical 5
1.3.1 Time schedule 5
1.3.2 Report 9

2 Basic concepts of soil physics 10
2.1 Composition of unsaturated soil 10
2.2 Soil water potentials 11
2.3 Soil water retention characteristic 12
2.4 Soil water transport 14
2.4.1 Hydraulic conductivity 14
2.4.2 Continuity equation 14
2.4.3 Hydraulic diffusivity 15
2.4.4 Infiltration, capillary rise and absorption 15
2.4.5 Sorptivity 16
Exercises 18
A. Core soil samples 18
Positioning 18
Retrieval 19
Trimming 20
B. Soil water retention characteristic 21
Hanging water column 21
Pressure membrane apparatus 22

3 Soil water content 24
3.1 Time domain reflectrometry 25
3.1.1 Permittivity 25
3.1.1.1 Frequency dependence 26
3.1.2 Water content 26
Measurement of Soil Physical Properties. 63. Practical Manual on Measurement of Soil Physical Properties. Kalikinkar Bandyopadhyay, Pramila Aggarwal. Soil Physics deals with the application of principles of physics in Soil Science research. It is imperative to have a thorough knowledge on the protocols for accurate measurement of different physical properties of soil to devise technologies to optimize the soil physical environment for sustainable agricultural production. **Soil physics** • **Soil texture** • **Soil surface area** • **Soil structure** • **Volume and mass relationships** • **Water content measurements** • **Units.** Soil physics: the study of the state and transport of all form of matter and energy in soils. J. Why study soil physics ??? Root zone. Vadose zone.