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Soil quality — Screening method for soil temperature — Measurement by infrared (IR) thermometer

Qualité du sol — Méthode de criblage pour la température du sol — Mesure par thermomètre infrarouge (IR)

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 190, *Soil quality*, Subcommittee SC 3, *Chemical and physical characterization*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

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Introduction

Soil temperature gives useful information in the engineering and industrial fields, especially geology, geotechnics, biology and agriculture. In recent years, climate change issues have been discussed globally, including greenhouse gas emissions from soil. Microbial decomposition of organic matter contributes to greenhouse gas emissions from soils, with the activity of the microbes and hence the rate or flux of these emissions dependent on soil temperature. Hence the temperature of the soil can be an indirect indicator of its risk of greenhouse gas emissions. Soil temperature directly affects the growth of plants. Optimum temperatures or temperature ranges exist for plant germination, growth and ultimately yield.

The guidance document for measurement of soil temperature (ISO 4974) describes two approaches, depending on the purpose of the investigation and the accuracy required. Conventional measurement is applied where greater accuracy is needed, whereas quick measurements can be made (e.g. using an infrared (IR) thermometer) where accuracy is not as critical, thus allowing to improve measurement efficiency (e.g. measurement time per spot) in exchange for accuracy.

This document describes the principle of quick measurement for soil temperature applying infrared (IR) detection, which is briefly introduced (without the measurement procedure descriptions) in ISO 4974 as one of the soil temperature measurement methods. ISO 4974 contains general discussions about temperature and its measurement principles, including what soil temperature is, why it is measured, by what kinds of principles it can be measured and how measurement methods should be appropriately selected depending on given soil temperature measurement purposes. This document describes the details of a specific soil temperature measurement procedure using an IR thermometer and explains the measurement principle. This method is positioned as one of the screening methods which have been developed under the concept designated in ISO 12404, which is a general guidance document of screening methods.

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Soil quality — Screening method for soil temperature — Measurement by infrared (IR) thermometer

1 Scope

This document specifies a method for quick measurement of soil temperature using an infrared (IR) thermometer.

The method is applicable to a variety of technical fields, including geology, geotechnics, biology and agricultural sciences, as well as climate change studies and metrological investigation.

NOTE The method designated in this document is recognized as a quick measurement in ISO 4974 and meets the definition of screening method as designated in ISO 12404:2021, 3.2.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
soil temperature
temperature measured at a targeted spot in the soil or at the soil surface

Note 1 to entry: The temperature at a spot in the ground shallower than 300 mm is affected by the atmospheric temperature. When measuring temperatures at such depths, one should be aware of this effect.

4 Principle and application

4.1 Fundamentals

Temperature cannot be measured directly. It can only be estimated by its influence on some properties of matter that responds to variation in the intensity of heat in an object's body. Liquid forms of matter such as mercury have been used historically, but ethanol and kerosene are more commonly used today. Changes in the volumes of these liquids with temperature are used as practical means to measure temperature. Alcohol thermometers contain these organic liquids in a glass tube marked with a calibrated scale, which relates the change in the volume of the solvent to changes in temperature.

When estimating the temperature of a target object using an alcohol thermometer, the liquid that responds to the object is brought into close contact with the object. The measurement is made after thermal equilibriums have been reached between the target object and alcohol responding to the object's heat, as well as between alcohol and its volume responding to the heat of alcohol itself. However, it takes time for both object and alcohol and for both alcohol and its volume to reach the respective equilibriums.

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