International Standard

ISO 20951

Soil quality — Guidance on methods for measuring greenhouse gases (CO_2, N_2O, CH_4) and ammonia (NH_3) fluxes between soils and the atmosphere

Qualité du sol — Recommandations sur les méthodes de mesure des gaz à effet de serre (CO_2, N_2O, CH_4) et des flux d'ammoniac (NH_3) entre les sols et l'atmosphère

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 190, *Soil quality*.

This second edition cancels and replaces the first edition (ISO 20951:2019), of which it constitutes a minor revision. The changes are as follows:

— editorial changes in Table 1 and Table 2;

— adjustment of formatting throughout the text;

— the Bibliography and references in the text have been updated.

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

Greenhouse gas (GHG) emissions from soils are a major environmental concern. Global and national emission inventories have identified soils, in particular agricultural soils, as being a major contributor to these emissions, in particular nitrous oxide (N_2O), methane (CH_4) and carbon dioxide (CO_2) related to loss of soil organic matter. Agricultural soils are also major emitters of ammonia (NH_3), which is a precursor of N_2O. Changes in soil management should take account of these emissions as part of efforts to mitigate climate change.

GHGs and ammonia fluxes from soil are complex to measure. They are variable and heterogeneous as they are governed by weather and meteorological conditions (e.g. temperature and moisture regimes), soil characteristics (e.g. soil parental material, pH, clay content, cation exchange capacity) and, for managed soils, by the agricultural or forestry practices (e.g. crop and wood residues management, soil tillage or no-tillage, inputs of soil conditioner and fertilizers, irrigation). These factors generally interact and their effects on GHG emissions are still poorly quantified. This results in large uncertainties for the inventories of national and global agricultural emissions. For example, Freibauer, 2008[1] has estimated an uncertainty at 80 % for European (EU27) agricultural N_2O emissions. With the reinforcement of international and regional climate policies, comparable and reliable information is needed to report on GHG emissions but also to adopt and verify mitigation options.

No standard covers the measurement of GHGs and ammonia emissions from soils. However, several measurement methods have been developed. This document provides guidance on the main methods available to quantify the exchanges of greenhouse gases (CO_2, N_2O, CH_4) and ammonia (NH_3) between soils and the atmosphere. It is intended to help users to select the measurement method or methods most suited to their purposes by setting out information on the application domain and the main advantages and limitations of each method.

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Soil quality — Guidance on methods for measuring greenhouse gases (CO_2, N_2O, CH_4) and ammonia (NH_3) fluxes between soils and the atmosphere

1 Scope

This document gives an overview and provides guidance on the main methods available to quantify the exchanges of greenhouse gases (CO_2, N_2O, CH_4) and ammonia (NH_3) between soils and the atmosphere.

It is intended to help users to select the measurement method or methods most suited to their purposes by setting out information on the application domain and the main advantages and limitations of each methods.

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
intrusive method
measuring method that can influence the emitting processes

3.2
mass balance method
method based on a mass balance consisting of measuring the flux of compounds entering and leaving a volume of air above the soil surface being studied

3.3
micrometeorological method
method using analyses of the atmospheric concentration of the gas and meteorological measurements such as wind speed, wet and dry-bulb air temperatures, net radiation, and heat fluxes

Note 1 to entry: These techniques are used for determining field-scale fluxes, and include eddy covariance, energy balance, aerodynamic and mass balance method. They do not disturb the environmental conditions.

3.4
oasis effect
effect arising from the local environment of the field being studied and affecting emissions from a particular field depending on whether it is in an environment with a high level of emissions or a low level of emissions

Note 1 to entry: The oasis effect will only affect compounds whose fluxes result from a thermodynamical equilibrium between the surface and the atmosphere (NH_3).

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