

Tagungsnummer

V339

Thema

Kommission I: Bodenphysik und Bodenhydrologie

Freie Themen

Autoren

K. Dorau¹, J. Luster², T. Mansfeldt¹

¹Universität zu Köln, Geographisches Institut, Köln; ²Swiss Federal Institute for Forest, Snow and Landscape Research WSL, Zürich

Titel

Soil aeration - The relationship between redox potential and air-filled pores

Abstract

Soil water contents are variable with impact on oxygen diffusion rates and redox potentials (E_H). When water saturated soils become aerated, a switch from reducing to oxidizing conditions occurs. However, only limited information are available at which air-filled pore volume ($[\epsilon]$) this dramatic shift happens. Therefore, undisturbed soil cores were taken by steel cylinders from the topsoils of a Fluvisol and a Gleysol that differed in soil structure and clay content. After submergence in the laboratory, the samples were sealed by a glass dome to exclude oxygen and to achieve strongly reducing conditions ($E_H < -100$ mV). We aerated the sample on demand by removal of glass plugs in the dome and consecutively measured E_H by platinum-(Pt) tipped electrodes and $[\epsilon]$ by pressure head readings on hourly basis. We propose to use the terms: i) $[\epsilon]_{Pt\ reaction}$, to indicate the air-filled pore volume at which a response of the Pt-tipped electrode due to contact with oxygen occurs (i.e., E_H increase > 5 mV h^{-1}), and ii) $[\epsilon]_{Pt\ aeration}$, to indicate when oxidizing soil conditions are present (i.e., $E_H > 300$ mV at pH 7). These characteristic $[\epsilon]_{Pt\ reaction}$ values were at 0.036 ± 0.013 cm³ cm⁻³ for the Fluvisol and at 0.048 ± 0.017 cm³ cm⁻³ for the Gleysol whereas $[\epsilon]_{Pt\ aeration}$ values were at 0.047 ± 0.005 and at 0.085 ± 0.002 cm³ cm⁻³, respectively. This study provided important information to determine the aeration status of a soil when, e.g., $[\epsilon]$ is known but E_H measurements are absent.