Introduction

The dynamics of water repellency (WR) in soils are still not well understood. In order to get deeper insight into these dynamics, a strategy has to be developed that allows an easy and fast detection of WR distributions at several times without disturbing the soil structure. One strategy would be to apply the water drop penetration time test (WDPT) at a certain soil surface at different times.

A new alternative strategy might be the use of infrared (IR) thermography, which detects net long wave radiation from surfaces in highly spatial resolution and thus gives a direct information about the surface temperature distribution.

In this contribution we address the question how to relate the temperature distribution to the WR distribution. The general idea behind the assumption of this relation is rooted in the following two points: (i) WR is usually closely related to actual water dynamics (Täumer, 2006) and (ii) the soil temperature regime is closely related to water dynamics. There are two possible ways how to use these relationships: a) by using the high heat capacity of water as compared to bare soils and b) using the loss of vaporization energy at evaporative surfaces (Peters et al., 2009).

In this contribution we test the latter approach, i.e. we use the fact that vaporization of water is energy consuming and thus cools down the surface. The individual photographs and IR images correspond to the times drawn on top of the IR images.

Experimental Setup

Four different soil materials (soils A,B,C,D) with different degrees of water repellency were air dried and packed into a polystyrene box (20 x 20 x 6 cm). After packing, water was allowed to rise into the soil from the bottom. Surface temperature was detected in 30 s interval with an IR camera. The mean surface temperatures of soil A and B, which were not or only weakly water repellent, dropped soon after beginning of the experiment. Soil C kept warm for ≈1 hour, whereas the mean surface temperature of soil D dropped considerably later and without reaching its minimum in the experiment.

Results

Figure 4 displays the temperature distribution at 11 different times. The predefined water repellency pattern can be exactly detected by infrared thermography.

Conclusions

- Water repellency distribution can be examined using IR thermography.
- The pattern as detected by IR thermography exactly matched the pattern of water repellency distribution determined by WDPT.
- The pattern of water repellency distribution was not detectable by mere visual inspection.

References
