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Effect of Thickness of a Water Repellent Soil Layer on Soil Evaporation Rate

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A water repellent soil layer overlying wettable soil is known to affect soil evaporation. This effect can be beneficial for water conservation in areas where water is scarce. Little is known, however, about the effect of the thickness of the water repellent layer. The thickness of this layer can vary widely, and particularly after wildfire, with the soil temperature reached and the duration of the fire. This study was conducted to investigate the effect of thickness of a top layer of water repellent soil on soil evaporation rate. In order to isolate the thickness from other possible factors, fully wettable standard sand (300∼600 microns) was used. Extreme water repellency (WDPT > 24 hours) was generated by 'baking' the sand mixed with oven-dried pine needles (fresh needles of Pinus densiflora) at the mass ratio of 1:13 (needle:soil) at 185°C for 18 hours. The thicknesses of water repellent layers were 1, 2, 3 and 7 cm on top of wettable soil. Fully wettable soil columns were prepared as a control. Soil columns (8 cm diameter, 10 cm height) were covered with nylon mesh. Tap water (50 ml, saturating 3 cm of a soil column) was injected with hypoderm syringes from three different directions at the bottom level. The injection holes were sealed with hot-melt adhesive immediately after injection. The rate of soil evaporation through the soil surface was measured by weight change under isothermal condition of 40°C. Five replications were made for each. A trend of negative correlation between the thickness of water repellent top layer and soil evaporation rate is discussed in this contribution.