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Dynamics of the Capillary Fringe with a Fluctuating Water Table

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The capillary fringe (CF) is the interface region between the groundwater and the vadose zone. Due to the irregular forcing by rain and groundwater level changes, it is highly dynamic.

The response of the CF to water table fluctuations with different periodes and amplitudes was studied experimentally with a sand soil in a Hele-Shaw-cell using the light transmission method. It was found that the height of the CF is different after imbition and drainage, which is explained by the hysteretic nature of the soil water characteristic. The first imbition process into a dry sand is different than subsequent ones, which is caused by the wettability of the sand grains. For drainage processes, there are two regimes depending on the amplitude of the forcing A_{f}. If A_{f} is smaller than a critical amplitude A_{crit}, the position of the CF increases with amplitude compared to the reference state, above A_{crit} it decreases. The entrapment of air was also examined.