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Relative humidity controls water distribution in clayey materials

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First author, Ph.D. student Xiang Lin, working in the field to collect samples of clay-rich sediments. Photo by (Max) Qinhong Hu.

In the unsaturated (vadose) zone, soil water—with adsorbed water one of the important components—plays an important role in fluid flow and chemical movement. Furthermore, tight (low-permeability) clayey soils and sediments are implicated in soil and water management, whether it is about agricultural activities or release and remediation of contaminants. In addition to capillary water, the adsorbed water consists of water film and interlayer water, and its content is related to relative humidity (RH).

New research in *Vadose Zone Journal* theoretically and experimentally investigates the variation in adsorbed water content in six clayey materials (sediments and clay minerals) as the RH changes. The water contents of three water types (capillary water, water film, and interlayer water) in unsaturated conditions were quantitatively divided by theoretical calculation and then then experimentally measured to quantify their amounts and define their interrelationships.

At low water vapor pressure (about RH<60%), adsorbed water (water film and interlayer water) accounts for most of the total water content. On the other hand, capillary water gradually dominates the water content at higher RH values. This provides evidence that soil water possesses different physical properties at different water contents, especially for high interlayer water that does not actively participate in flow and transport, causing the illusion that the available water is abundant at high water contents.

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Lin, X., Hu, Q., Chen, Z., Wang, Q., Zhang, T., & Sun, M. (2020). Changes in water vapor adsorption and water film thickness in clayey materials as a function of relative

humidity. *Vadose Zone Journal*,*19*, e20063. https://doi.org/10.1002/vzj2.20063

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