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# Water content in unsaturated soil pores at high suction

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A thermodynamic treatment of the capillary solutions enabled Mercury and Tardy (1997 and later) to conclude that the magnitude of water-rock interactions in the unsaturated zone can differ significantly from that known in the saturated zone. According to the Laplace and Kelvin's laws, the lower the RH (Relative Humidity) in the ambient air, the thinner the pores wherein capillary solutions can be held, the greater the suction in the solution and eventually, the greater the difference in the thermodynamic capillary behavior compared to that of free water. In order to consider the potential influence of capillary water in a natural medium in terms of mass balance and transfer mechanisms between phases at the scale of the vadose zone-saturated zone systems, the amount of water held at high suction (low RH) in the adequately thin pores must be assessed. In this study, the soil water retention curves (SWRC) are used to determine the soil water volumes in this specific range of suctions, by using the Rossi and Nimmo (1994) SWRC model. The concerned capillary-marked water are stated to be found in the range limited by the "critical matric potential $\Psi_{c(spi)}$", beyond which the capillary water cannot exist and the "minimum matric potential $\Psi_{min}$", beyond which the capillary water is in general chemically different from free water. The volumes attributed to capillary water in the suction range between these two potential limits calculated using Rossi and Nimmo's (1994) data of two silty loams reach several tens of liters per cubic meter of soil (i.e., 34 l/m$^3$ in the Salkum silty loam). In terms of mass balance, the quantity of capillary-marked water appears, therefore, significant in certain contexts. Integrating capillarity water volumes and their geochemical particularities in classical geochemical speciation models like PHREEQC (Parkhurst and Appelo, 1999) is an interesting way to estimate the long-term influence of capillary effects along the unsaturated-saturated continuum.

References

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