

Interactive comment on “Big and small: menisci in soil pores affect water pressures, dynamics of groundwater levels, and catchment-scale average matric potentials” by G. H. de Rooij

Anonymous Referee #3

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General comments: The manuscript (ms) focuses on the role of menisci in soil pores on larger-scale hydraulic behavior. Although the paper is written in good English, it is too lengthy and goes often too much into detail, which reduces its readability. The appendix is rather long and reads as a specific comment to the paper of Zehe et al. (2006) and might be treated so.

Although the author states that "Tracking pore-scale processes beyond the Darcy scale is not feasible. (P6492L6-7)", he continuously stresses the important role of menisci on larger scale hydraulic processes. Furthermore, I do not very much like the general idea

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that processes on a small scale are still dominant at a much larger scale. This means that one always needs pore-scale information, like the 'liquid-occupied horizontal area A_lg' which is generally difficult to obtain even at the small (pore) scale, but which is virtually impossible to get at the catchment or even larger scales. By properly averaging the energy status of the soil water at the pore scale, information on curvatures of the menisci are not needed to determine the energy status of the soil water even at the Darcian scale, not to mention at the catchment scale.

This procedure was also described in the ms. The curvature of the menisci between the liquid and the gas phase is a pore-scale feature, whose effect is expressed in the matric potential at the next larger (Darcian) scale after averaging. The relevant spatial scale in this ms is the catchment to regional scale where most issues of societal interest arise. A local volume-averaging approach is discussed in 2.3 for an upscaled pressure potential at the catchment scale. Section 2.3 is also the only section without referring to menisci in soil pores or curvatures, which is correct, because at this scale the energy status of the soil water is given by the properly upscaled matric potential. However, this aspect is not new, but has also been addressed by the same other in a previous paper (de Rooij, 2009).

The practical relevance of the ms is limited. Large parts of the analysis in 2.2 restricts to hydrostatic equilibrium with no flow of water, or is extended to situation with slow flow. Although slow flow is not quantified, I guess it refers to situations where the hydraulic gradient deviates not too much from zero. At the management scale, rainfall and evapotranspiration are dominant, resulting in significant flow velocities and in large differences in hydraulic gradients over time. For these dynamic conditions, the proposed analysis is, at best, of limited use, as the author also states himself. Therefore, to my view, this paper is more of academic relevance without much practical applications and lacks sufficient novelty of new insights.