

Interactive comment on “Significance of tree roots for preferential infiltration in stagnic soils” by B. Lange et al.

B. Lange et al.

Received and published: 25 May 2009

Thank you for your comments. However, they were quite unspecific, and even contradicting in parts, thus difficult to properly respond.

Comment of Referee #2: For example, the root density of fine roots measured was between 0.017 and 1.85, which is extremely low in the context of measured rld, but this is not acknowledged.

Our response: What are the referee's units of rld? This may perhaps already shed light on the discussion. If we consider all root diameters, as Referee #1 has suggested, than our root length densities (rld) varied between 0.023 and 2.216 cm cm⁻³, and are comparable to those of Genenger et al. (2003), who found fine root densities of

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approximately 0.6, 1.0 and 1.0 cm cm⁻³ in in-growth cores after 1, 1.5 and 2 years in the top soils of a spruce-dominated forest stand in Switzerland. Alaoui and Helbling (2006) stated that macropore volumes in top soils represented only 2.00 and 0.23 % of the total soil volume but transported approximately 100 and 74 % of the total water flow. The root volumes of the investigated horizons in our study accounted for 0.05 to 6.5 % (median 0.78 %) of the total soil volume. If we assume that water flows along roots and root channels, as Jørgensen et al. 2002 reported, than the root volumes we found were at the same order of magnitude as the macroporosity of Alaoui and Helbling (2006). We will clarify the context of rld in the discussion.

Comment of Referee #2: Also, the correlation between bulk density and the rivulet parameters is greater than the correlation between root parameters and rivulet parameters.

Our response: We properly laid out the theoretical base of the rivulet approach and clearly showed that film thickness F and contact length L are the two pertinent parameters of flow. Contact length L times unit depth of the water film represents the vertical area per unit volume of soil onto which momentum dissipates. (The approach faintly alludes to the height and the hydraulic radius in open channel flow). With this in mind, we do not to have care about the material that surrounds the flow channels. In particular, bulk density is rather meaningless with respect to our hydraulic characterization of the preferential flow paths. Therefore, only the relations between root densities and either L or F are relevant to the focus of the manuscript. Moreover, careful examination of Table 3 shows that the coefficients of correlation between root parameters and the contact length L significantly exceed those between bulk density and L . Taking account all roots, the coefficient of correlation between root length density and L still is $r = 0.892$ while $r = -0.738$ between bulk density and L . The correlations between root length density and F and bulk density and F , respectively were similar i.e., $r = -0.743$ and $r = 0.738$, when all roots are considered.

Comment of Referee #2: This provides an opportunity for an interesting discussion -

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how would the rivulet parameters be expected to change with increasing bulk density - given the plethora of information available on this subject, and how would you expect rivulet parameters to change with increasing root length or morphology, but this is not addressed.

Our response: Section 5 Applications extensively assesses the rivulet parameters in view of increasing rld. We clearly showed with Figs. 8 and 9 how increased rld resulted in a decreased film thickness but an increased contact length. Again, the inclusion of bulk density in our discussion would be completely irrelevant. Moreover, Angers and Caron (1998), for example, stated that growing roots exert radial pressure on the soil, thus adding to the local variation of bulk density and supporting our notion of the bulk density's futility in the context of our discussion.

Comment of Referee #2: There is no novelty in the application, it is very similar to that in the paper by Germann et al. (2007) where the rivulet theory is developed.

Our response: We agree that both papers are based on the same theory, however, Germann et al (2007) did not relate their results with the root length density. Hence the novelty of our manuscript.

Literature

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HESSD

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