



Supplement of

Controls of macropore network characteristics on preferential solute transport

M. Larsbo et al.

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1 **Supplementary material**

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3 Table S1. Column lengths and average irrigation rates at the nominal irrigation rates used in the breakthrough experiments. Standard deviations are given in
 4 parenthesis.

Column	Length (mm)	Average irrigation rate (mm h^{-1}) at a nominal irrigation rate of				
		2 mm h^{-1}	4 mm h^{-1}	6 mm h^{-1}	8 mm h^{-1}	12 mm h^{-1}
Säby 1 (loam) a	169	1.9 (0.06)	4.1 (0.13)	6.0 (0.04)	7.7 (0.18)	10.6 (NA)
Säby 1 (loam) b	168	1.9 (0.06)	3.5 (0.33)	5.9 (0.87)	7.7 (NA)	13.9 (NA)
Säby 1 (loam) c	183	2.0 (0.07)	4.1 (0.18)	5.9 (0.16)	7.9 (0.13)	14.2 (NA)
Säby 1 (loam) d	173	1.8 (0.11)	3.4 (0.58)	5.9 (0.18)	7.8 (0.49)	13.1 (NA)
Säby 1 (loam) e	175	2.1 (0.06)	3.9 (0.06)	5.9 (0.32)	Ponding	Ponding
Säby 2 (clay) a	167	2.1 (0.05)	4.2 (0.07)	6.2 (0.21)	8.5 (0.08)	11.1 (NA)
Säby 2 (clay) b	169	1.9 (0.34)	Ponding	Ponding	Ponding	Ponding
Säby 2 (clay) c	174	2.1 (0.28)	4.0 (0.17)	Ponding	Ponding	Ponding
Säby 2 (clay) d	169	2.0 (0.10)	3.8 (0.00)	6.4 (0.38)	7.3 (NA)	10.6 (NA)
Säby 2 (clay) e	NA	NA	NA	NA	NA	NA
Ultuna a	170	2.0 (0.08)	4.3 (0.25)	5.9 (0.06)	7.7 (0.61)	10.9 (NA)
Ultuna b	161	1.9 (0.05)	4.1 (0.15)	Ponding	Ponding	Ponding
Ultuna c	170	2.0 (0.06)	3.5 (0.53)	Ponding	Ponding	Ponding
Ultuna d	169	2.0 (0.06)	3.9 (0.09)	6.2 (0.46)	8.2 (0.49)	13.1 (NA)
Ultuna e	NA	Ponding	Ponding	Ponding	Ponding	Ponding
Krusenberg a	150	2.0 (0.05)	4.1 (0.08)	6.1 (0.08)	7.8 (0.77)	12.8 (NA)
Krusenberg b	166	2.0 (0.02)	4.0 (0.10)	6.0 (0.08)	7.2 (NA)	14.5 (NA)
Krusenberg c	162	2.0 (0.03)	3.9 (0.13)	6.3 (0.42)	8.0 (NA)	13.6 (NA)
Krusenberg d	168	2.0 (0.09)	4.0 (0.09)	5.7 (0.09)	7.6 (NA)	13.2 (NA)
Krusenberg e	159	1.9 (0.06)	3.7 (0.21)	5.9 (0.32)	7.8 (0.08)	12.2 (NA)
Average	168	2.0 (0.09)	3.9 (0.18)	6.0 (0.26)	7.8 (0.35)	12.6 (NA)

1 Table S2. Macropore system characteristics.

Column	Macroporosity -	Specific macropore surface area $\text{mm}^2 \text{ mm}^{-3}$	Hydraulic radius mm	Mean pore thickness mm	Mean aggregate thickness mm	Fractal dimension -	Global connectivity -
Säby 1 (loam) a	0.071	0.061	1.2	1.8	55	2.50	1
Säby 1 (loam) b	0.051	0.039	1.3	1.3	65	2.47	1
Säby 1 (loam) c	0.076	0.064	1.2	1.5	51	2.54	1
Säby 1 (loam) d	0.052	0.040	1.3	1.6	65	2.44	1
Säby 1 (loam) e	0.050	0.037	1.4	1.3	60	2.49	1
Säby 2 (clay) a	0.122	0.079	1.5	3.6	51	2.54	1
Säby 2 (clay) b	0.042	0.032	1.3	1.3	58	2.43	0
Säby 2 (clay) c	0.033	0.019	1.8	2.0	79	2.34	1
Säby 2 (clay) d	0.052	0.037	1.4	1.6	64	2.42	1
Säby 2 (clay) e							
Ultuna a	0.065	0.052	1.2	2.1	71	2.43	1
Ultuna b	0.049	0.039	1.2	1.4	79	2.38	1
Ultuna c	0.037	0.027	1.4	1.3	74	2.36	0
Ultuna d	0.078	0.069	1.1	1.8	47	2.52	1
Ultuna e							
Krusenberg a	0.075	0.056	1.3	2.0	56	2.49	1
Krusenberg b	0.073	0.060	1.2	1.6	49	2.51	1
Krusenberg c	0.072	0.060	1.2	1.7	48	2.51	1
Krusenberg d	0.092	0.075	1.2	1.9	47	2.54	1
Krusenberg e	0.086	0.064	1.3	2.5	56	2.49	1

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1 Table S3. Characteristics of the largest cluster connecting the soil surface to the bottom of the sample. The data are for the largest non-connected cluster for
 2 cases when such a cluster did not exist (i.e. when Global connectivity = 0 in table S3).

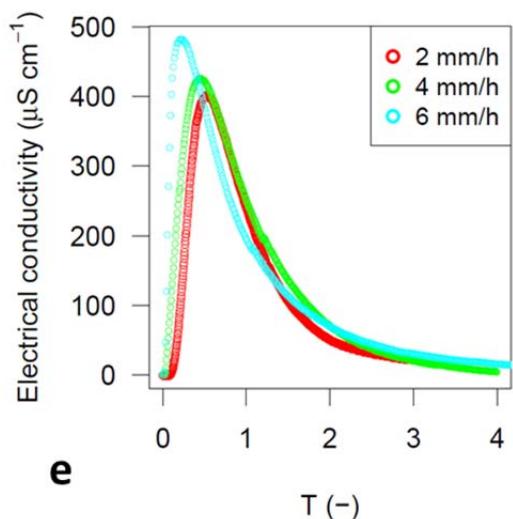
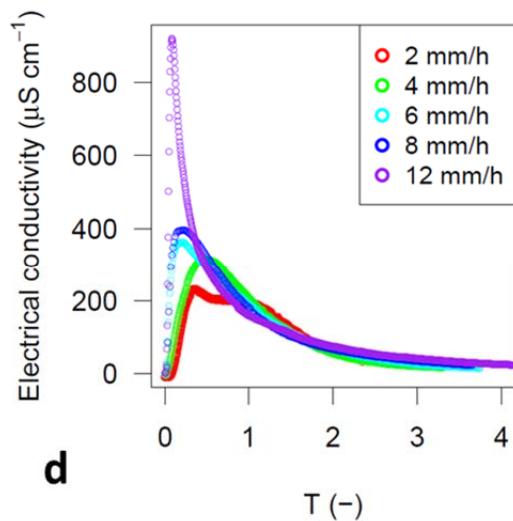
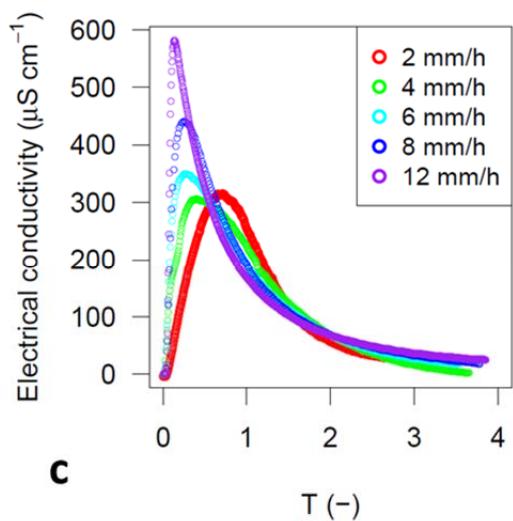
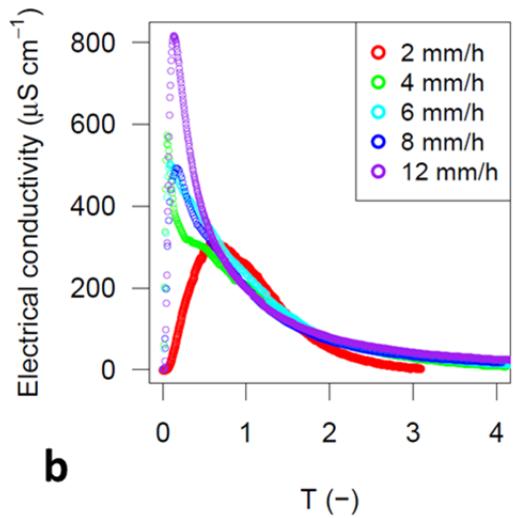
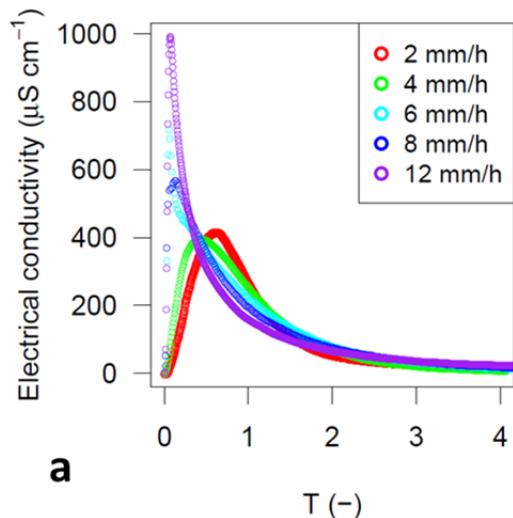
Column	Fraction of macropore volume	Mean pore thickness	Euler number	Critical pore diameter	Tortuosity
	-	mm	-	mm	-
Säby 1 (loam) a	0.91	2.2	-24000	0.77	2.7
Säby 1 (loam) b	0.87	1.7	-21700	0.48	1.8
Säby 1 (loam) c	0.91	1.8	-27200	0.73	1.3
Säby 1 (loam) d	0.81	2.1	-21300	0.24	1.5
Säby 1 (loam) e	0.83	1.7	-21300	0.59	2.2
Säby 2 (clay) a	0.92	4.5	-16400	1.7	1.2
Säby 2 (clay) b	0.79	1.7	-18900	NA	NA
Säby 2 (clay) c	0.79	3.1	-14900	0.24	1.4
Säby 2 (clay) d	0.78	2.2	-19600	0.24	1.2
Säby 2 (clay) e					
Ultuna a	0.93	2.7	-26300	0.87	1.5
Ultuna b	0.89	1.8	-26900	0.77	2.0
Ultuna c	0.83	1.6	-26100	NA	NA
Ultuna d	0.91	2.2	-30800	1.08	1.7
Ultuna e					
Krusenberg a	0.85	2.5	-23900	0.54	2.7
Krusenberg b	0.87	2.0	-29600	0.24	1.1
Krusenberg c	0.89	2.1	-28800	0.24	1.1
Krusenberg d	0.91	2.4	-31100	0.77	2.2
Krusenberg e	0.72	3.5	-24400	0.73	1.6

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1 Table S4. Measures of preferential transport for the irrigation rates used in the breakthrough experiments.

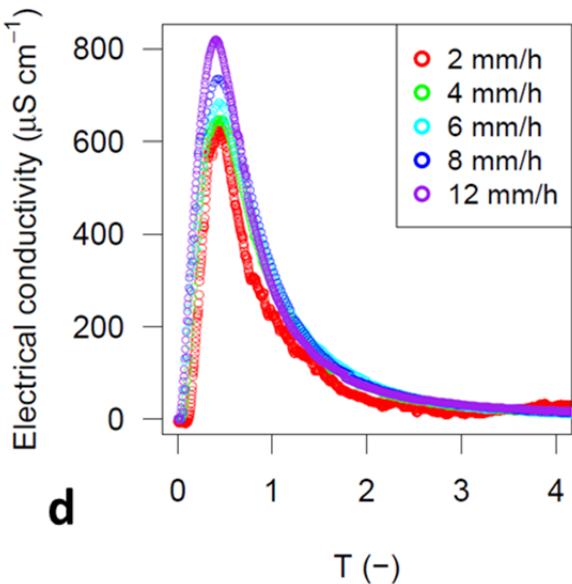
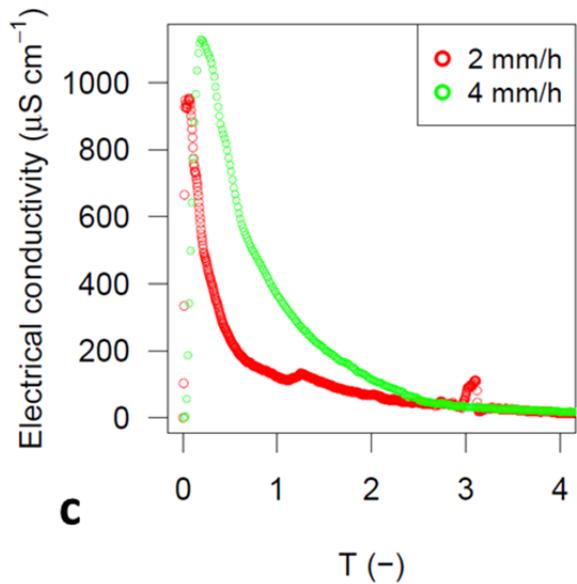
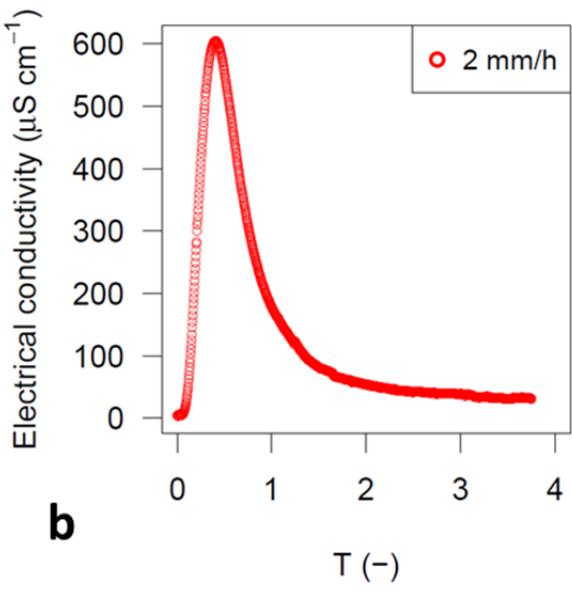
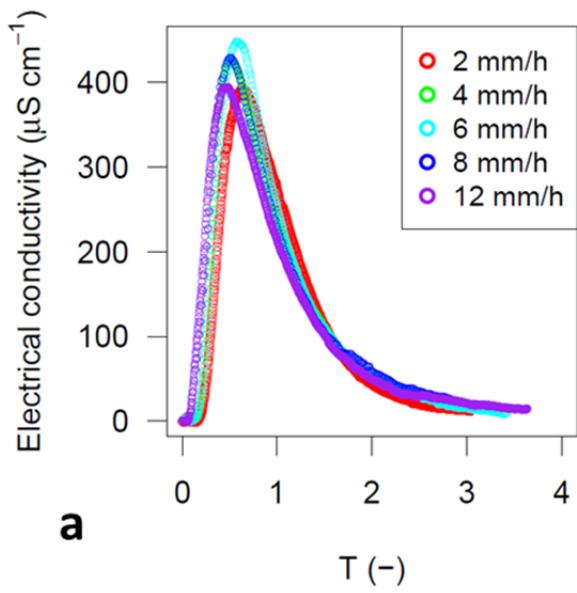
Column	5 % arrival time (-) at a nominal irrigation rate of					Apparent dispersivity (cm) at a nominal irrigation rate of				
	2 mm h ⁻¹	4 mm h ⁻¹	6 mm h ⁻¹	8 mm h ⁻¹	12 mm h ⁻¹	2 mm h ⁻¹	4 mm h ⁻¹	6 mm h ⁻¹	8 mm h ⁻¹	12 mm h ⁻¹
Säby 1 (loam) a	0.25	0.19	0.07	0.07	0.06	7.8	9.1	14.4	15.5	20.1
Säby 1 (loam) b	0.29	0.07	0.08	0.10	0.10	5.1	12.0	13.0	13.1	15.8
Säby 1 (loam) c	0.28	0.16	0.14	0.14	0.11	5.6	9.5	11.0	12.7	14.9
Säby 1 (loam) d	0.26	0.21	0.11	0.11	0.07	5.2	7.9	11.4	12.4	17.1
Säby 1 (loam) e	0.31	0.21	0.11	Ponding	Ponding	7.0	9.0	14.0	Ponding	Ponding
Säby 2 (clay) a	0.38	0.33	0.34	0.27	0.26	4.8	6.6	6.3	7.7	8.4
Säby 2 (clay) b	0.24	Ponding	Ponding	Ponding	Ponding	11.8	Ponding	Ponding	Ponding	Ponding
Säby 2 (clay) c	0.04	0.12	Ponding	Ponding	Ponding	20.5	20.1	Ponding	Ponding	Ponding
Säby 2 (clay) d	0.26	0.21	0.18	0.19	0.18	12.6	12.6	13.3	14.5	16.5
Säby 2 (clay) e	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used	Not used
Ultuna a	0.35	0.36	0.32	0.23	0.20	7.4	8.6	9.8	13.0	14.4
Ultuna b	0.26	0.29	Ponding	Ponding	Ponding	13.6	13.3	Ponding	Ponding	Ponding
Ultuna c	0.07	0.12	Ponding	Ponding	Ponding	26.4	25.5	Ponding	Ponding	Ponding
Ultuna d	0.34	0.32	0.36	0.33	0.34	6.5	7.2	6.7	7.8	7.6
Ultuna e	Ponding	Ponding	Ponding	Ponding	Ponding	Ponding	Ponding	Ponding	Ponding	Ponding
Krusenberg a	0.50	0.35	0.33	0.27	0.22	2.6	4.5	5.4	7.6	7.5
Krusenberg b	0.52	0.42	0.41	0.37	0.30	2.5	3.6	4.6	5.8	5.9
Krusenberg c	0.52	0.42	0.39	0.38	0.36	2.4	3.6	4.3	4.9	5.1
Krusenberg d	0.47	0.39	0.33	0.28	0.25	3.1	4.5	6.0	6.7	7.2
Krusenberg e	0.45	0.42	0.35	0.26	0.11	4.0	4.9	6.5	8.0	10.9



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3 Figure S1. Tracer breakthrough curves for the Säby 1 (loam) soil at the different steady-state flow
4 rates. $T=t/\mu_1$ (-), where t is time (h) and μ_1 (h), is dimensionless time.



3 Figure S2. Tracer breakthrough curves for the Säby 2 (clay) soil at the different steady-state flow
4 rates. $T=t/\mu_1$ (-), where t is time (h) and μ_1 (h), is dimensionless time.

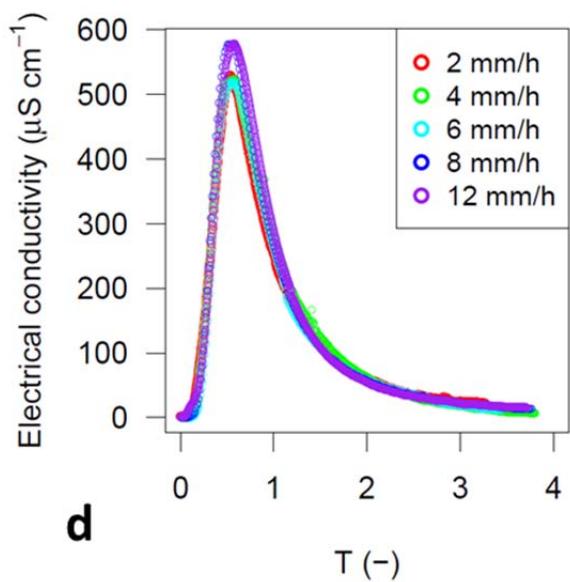
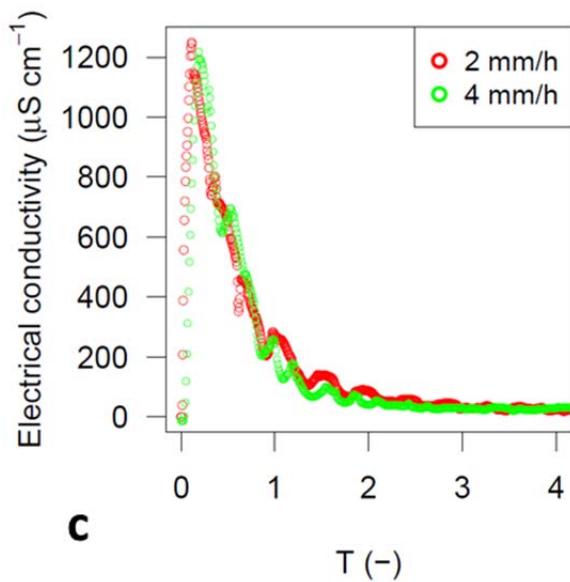
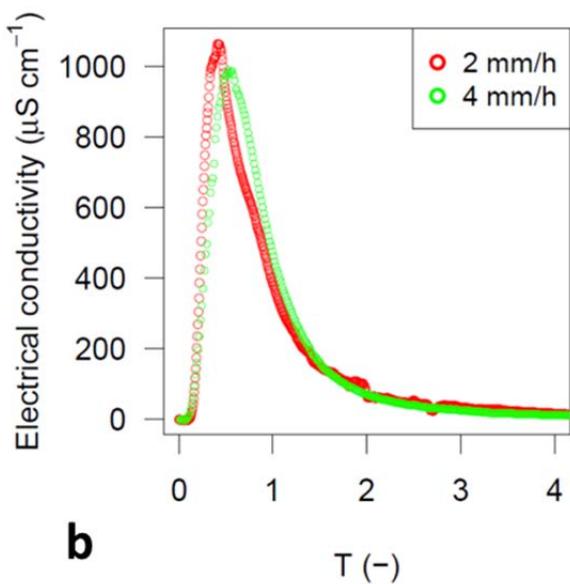
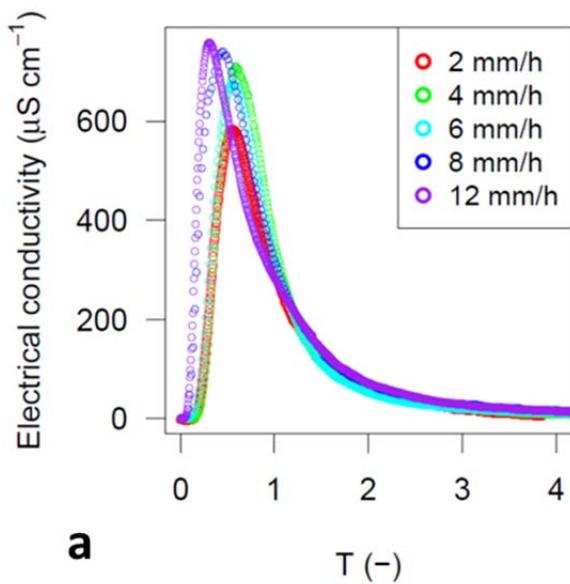
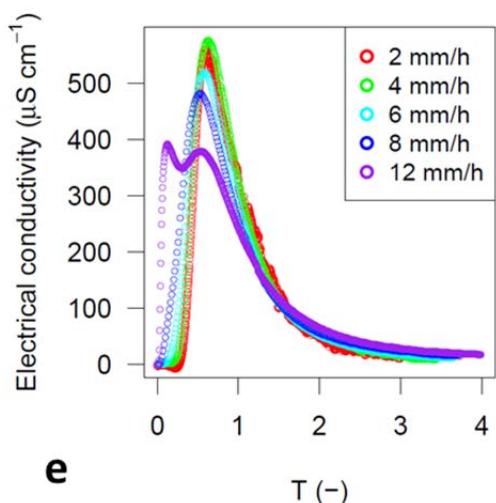
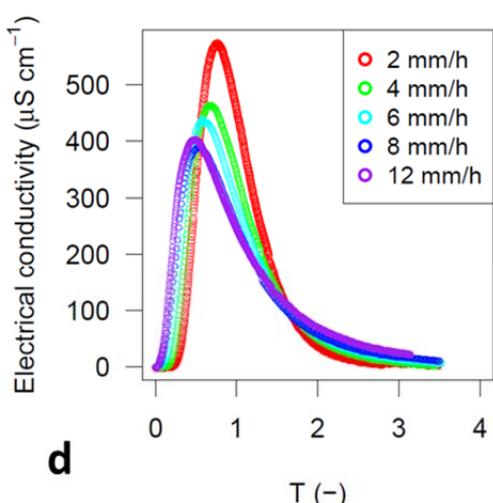
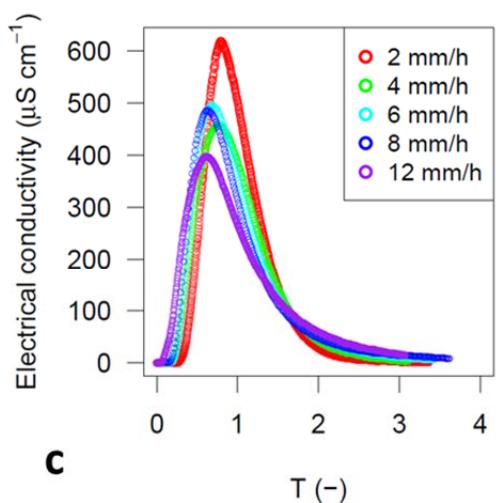
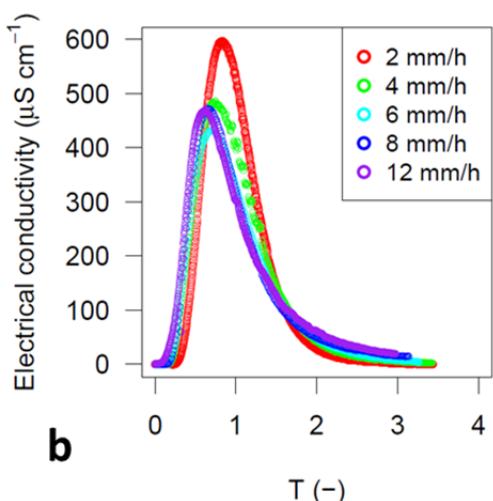
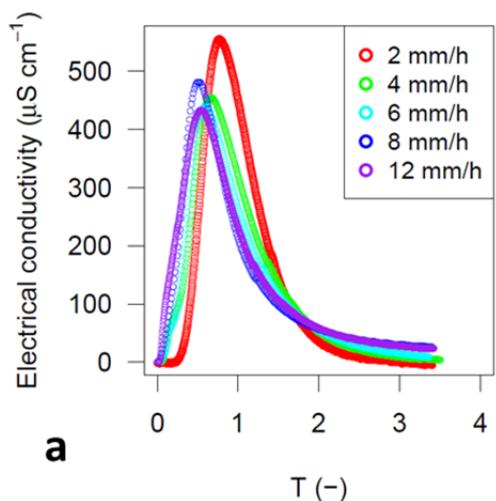


Figure S3. Tracer breakthrough curves for the Ultuna (clay) soil at the different steady-state flow rates. $T=t/\mu_1$ (-), where t is time (h) and μ_1 (h), is dimensionless time.



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3 Figure S4. Tracer breakthrough curves for the Krusenborg (clay loam) soil at the different steady-
4 state flow rates. $T=t/\mu_1$ (-), where t is time (h) and μ_1 (h), is dimensionless time.