Biopore Workshop , 17.10. – 19.10. 2011

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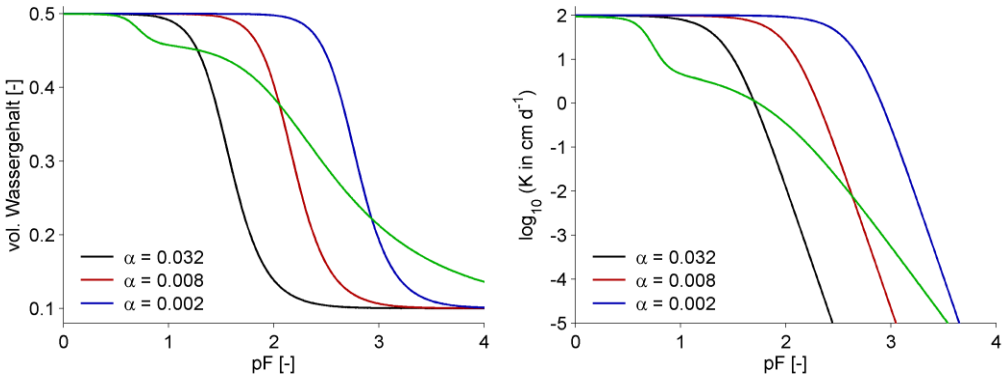
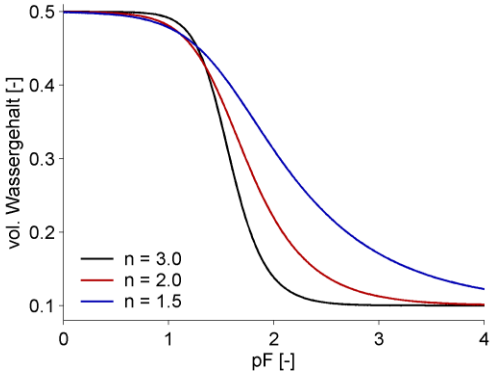
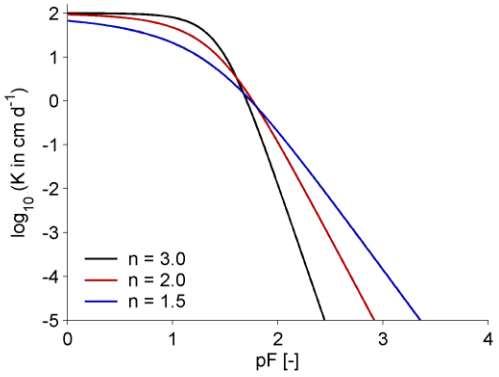
Fachgebiet Standortkunde und Bodenschutz
Institut für Ökologie
Technische Universität Berlin

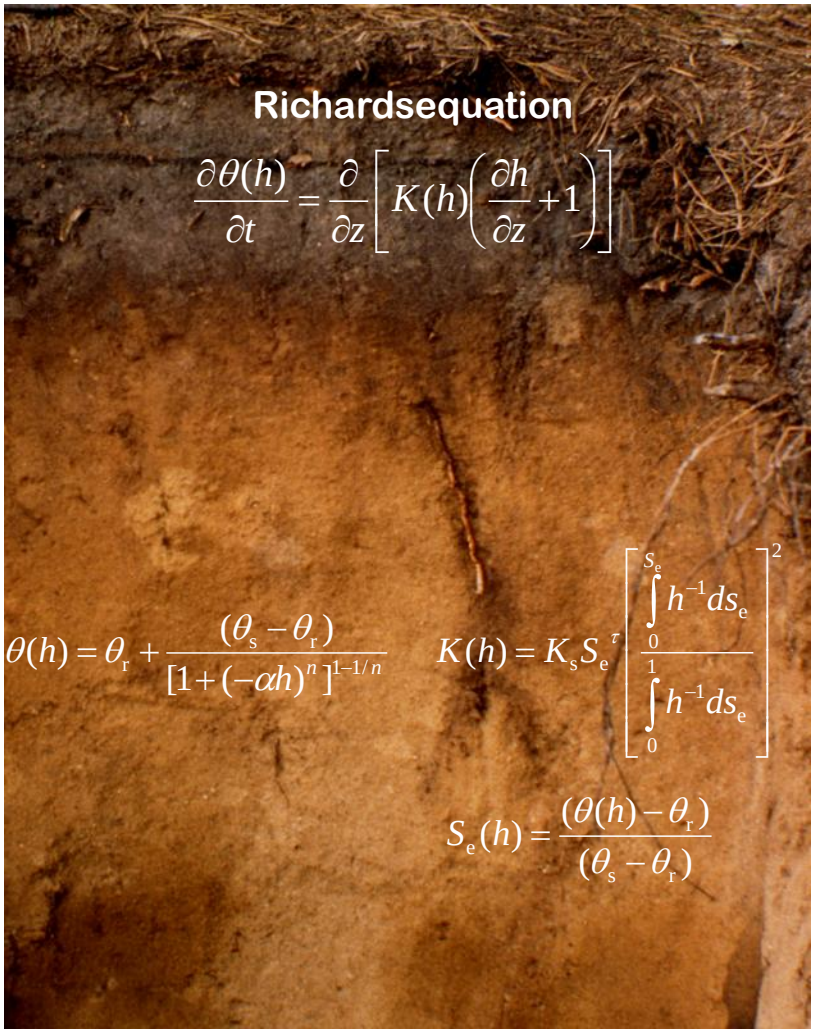
soil hydraulic properties

$\theta(h)$ $K(h)$





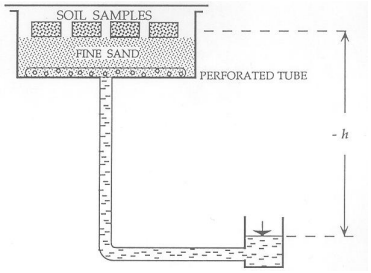


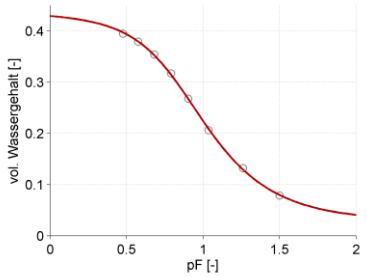


PhD thesis

hydrostatic experiments

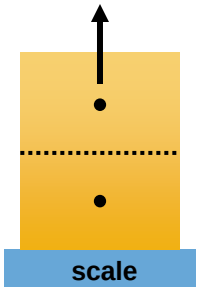
(2006)

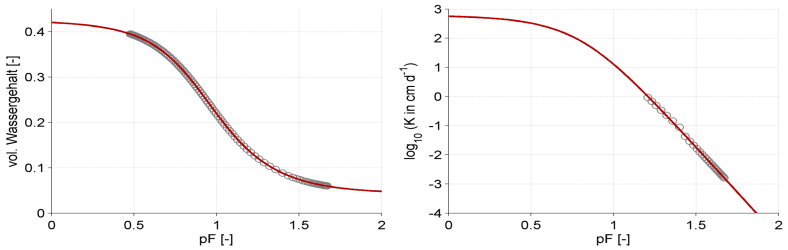




evaporation method

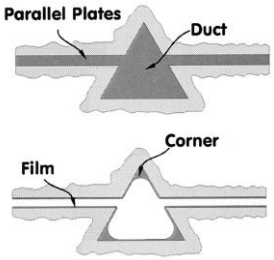
(2008a)

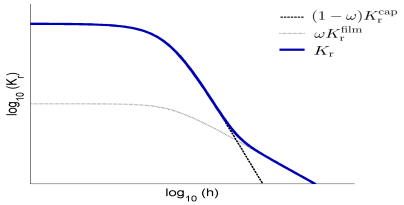




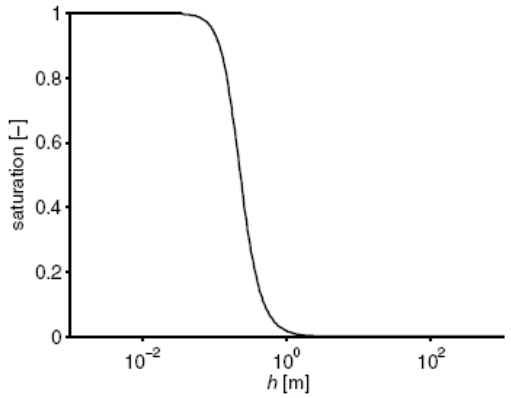
conductivity model

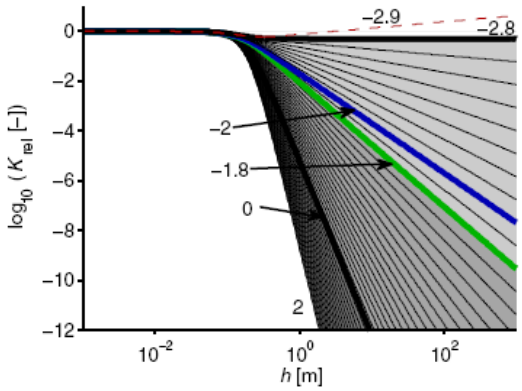
(2008b)

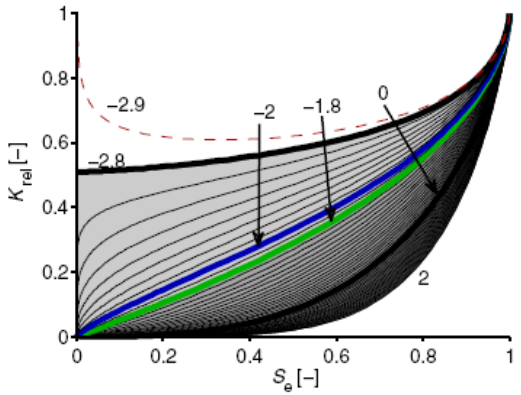


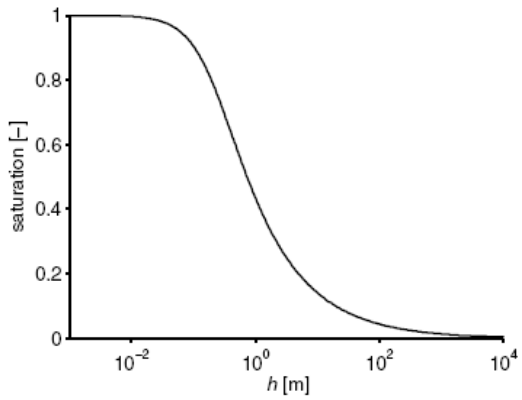


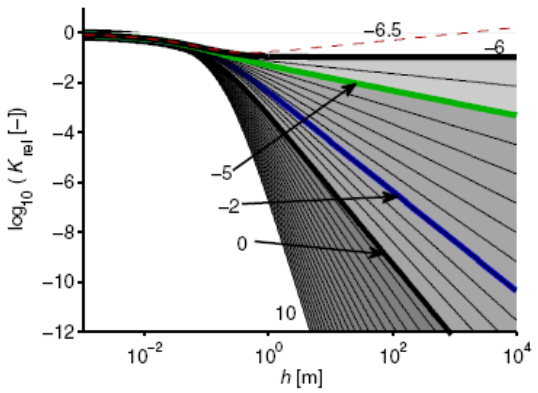
parameter boundaries

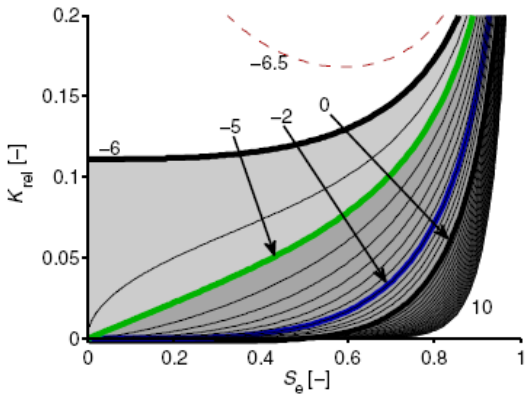






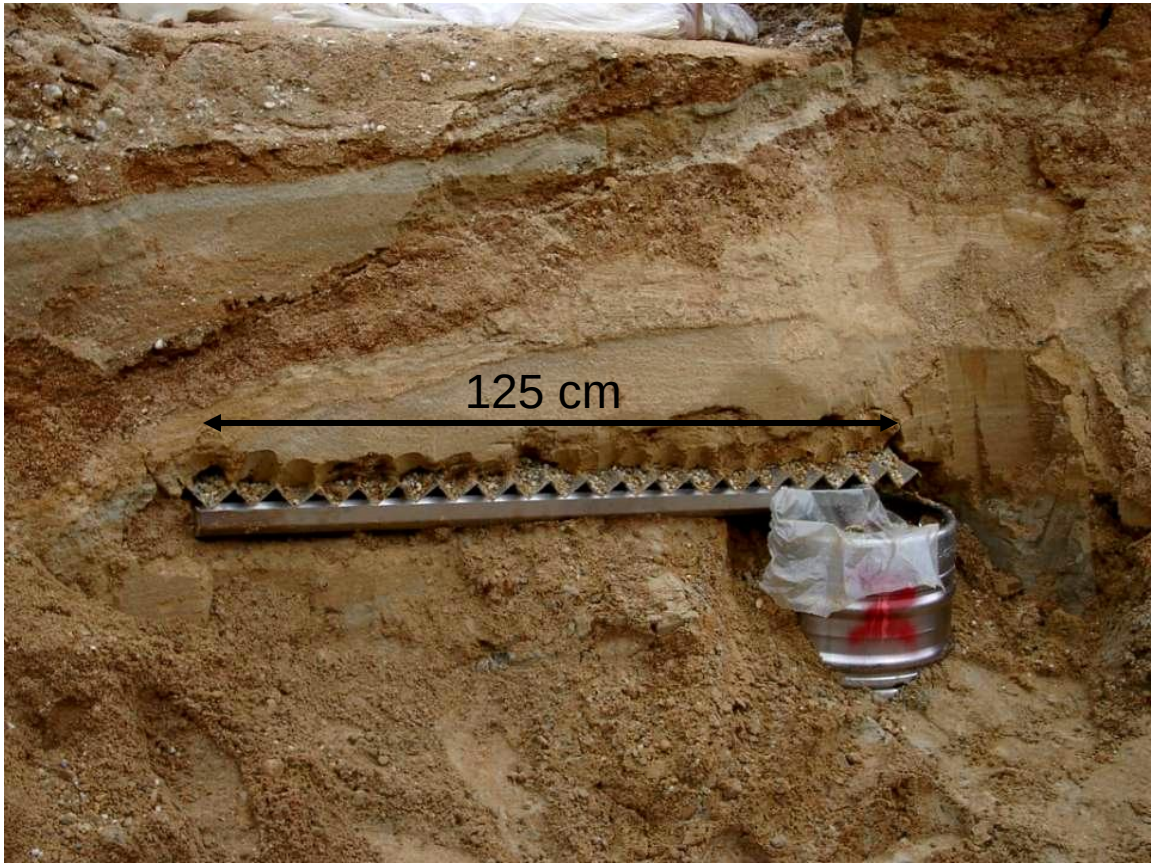






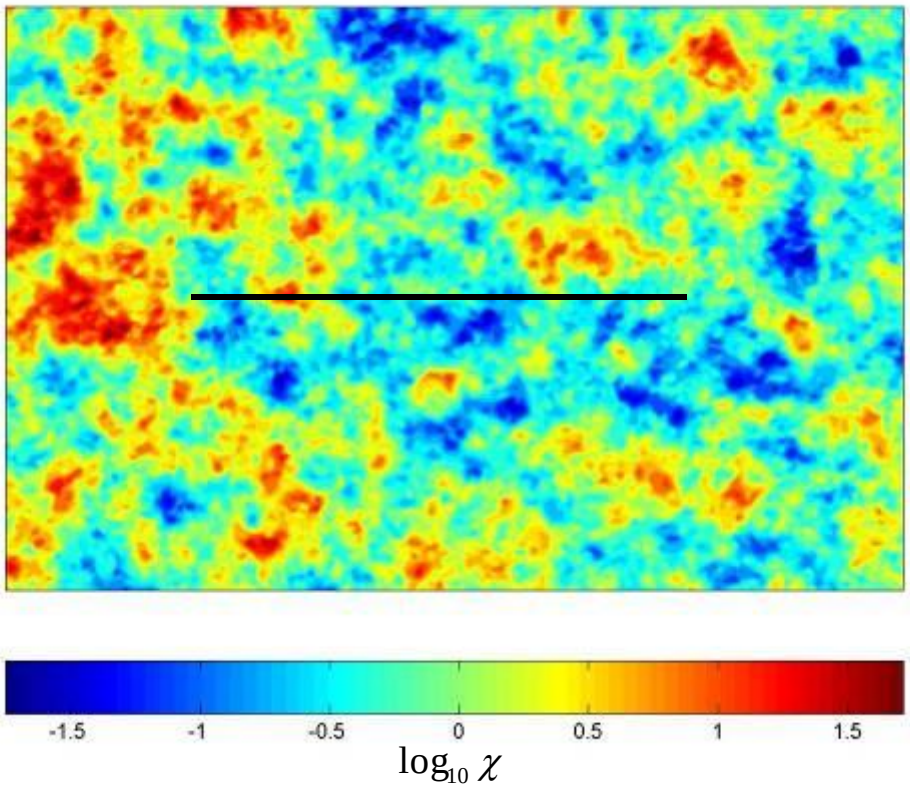
(2011)

water and solute collection in heterogeneous soils



(2009)

scaling factor as function of space



Grad der Heterogenität:

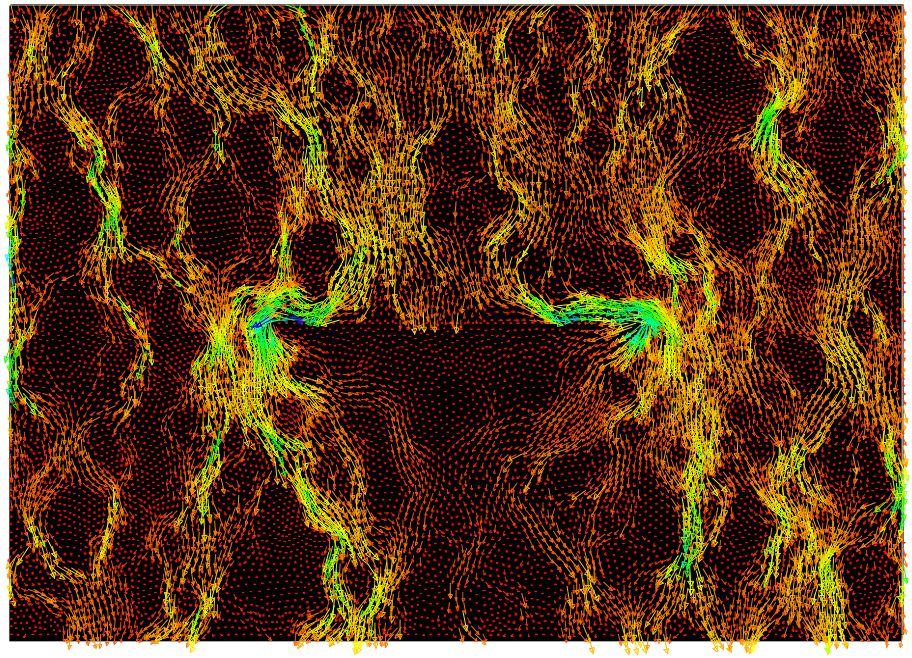
$$\sigma(\log_{10}(\chi)) = 0.5$$

Räuml. Verteilung der Heterogenität (Korrelationslängen):

$$\Lambda_x = 10 \text{ cm}$$

$$\Lambda_z = 10 \text{ cm}$$

scaling factor as function of space



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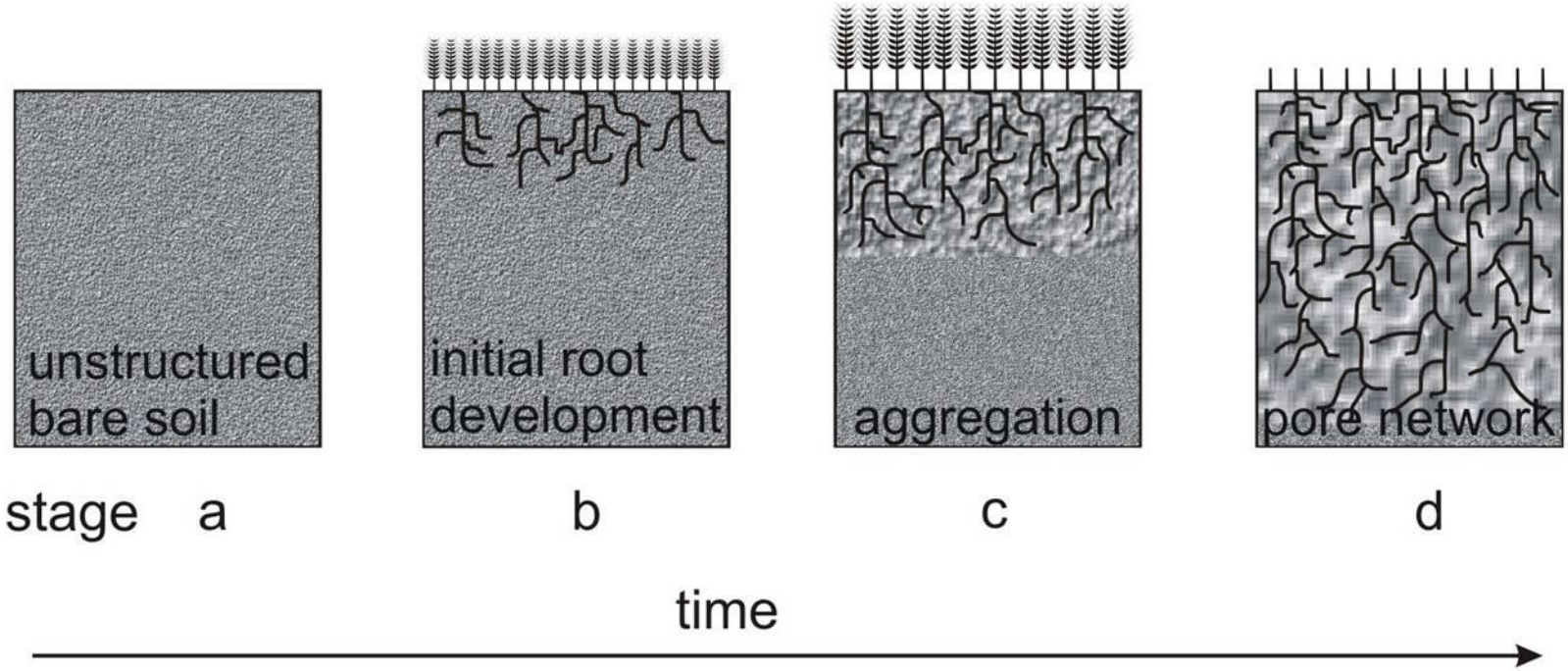
Räuml. Verteilung
der Heterogenität
(Korrelationslängen):

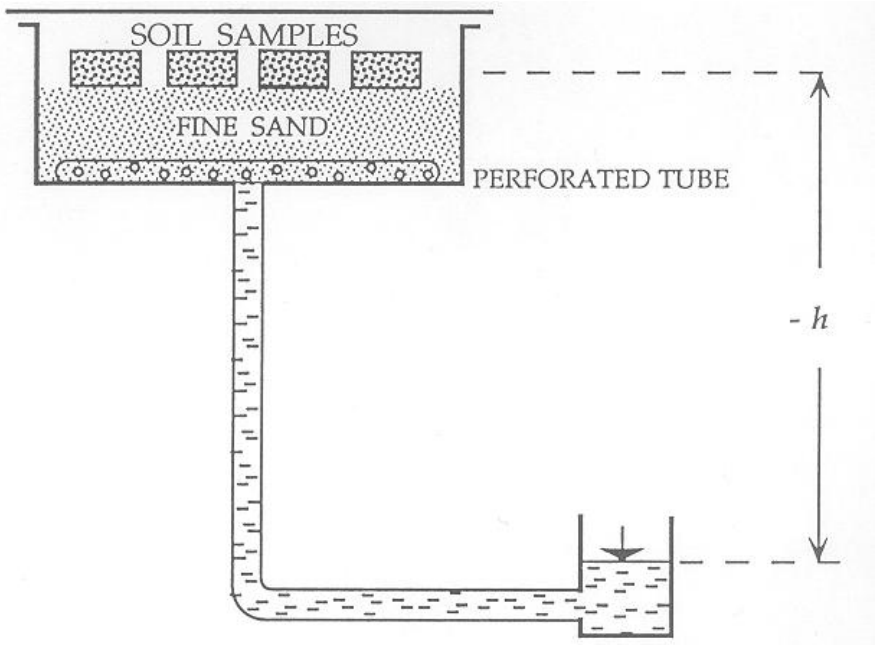
$$\Lambda_x = 10 \text{ cm}$$

$$\Lambda_z = 10 \text{ cm}$$

dynamic hydraulic properties and plant roots



Hydrostatische Experimente

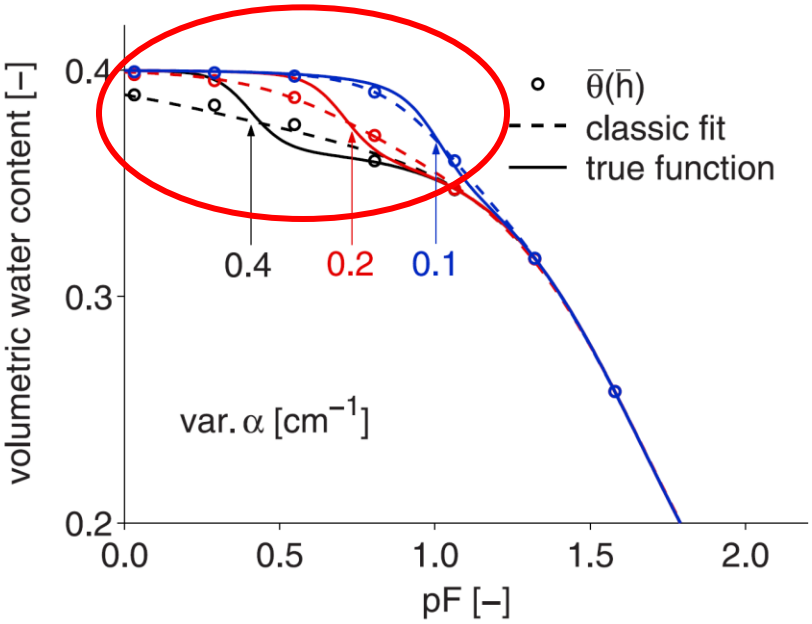


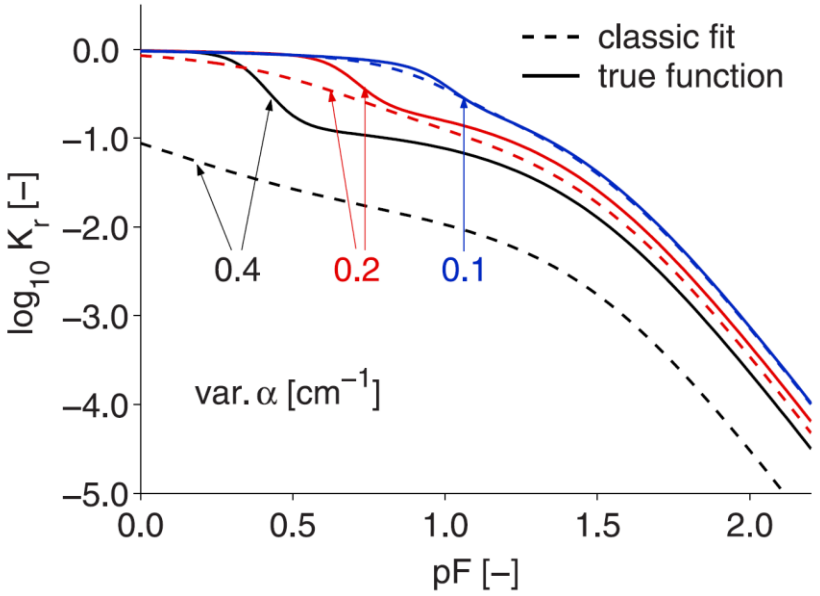
aus Kutilek und Nielsen, 1994

1. Schrittweise Erniedrigung von *h*
2. Warten auf hydraulische Gleichgewichtseinstellung
3. Bestimmung von mittlerem Wassergehalt der Säule und mittlerem Matrixpotenzial für jeden Schritt
4. Anpassung einer Retentionsfunktion an die Datenpaare

problem

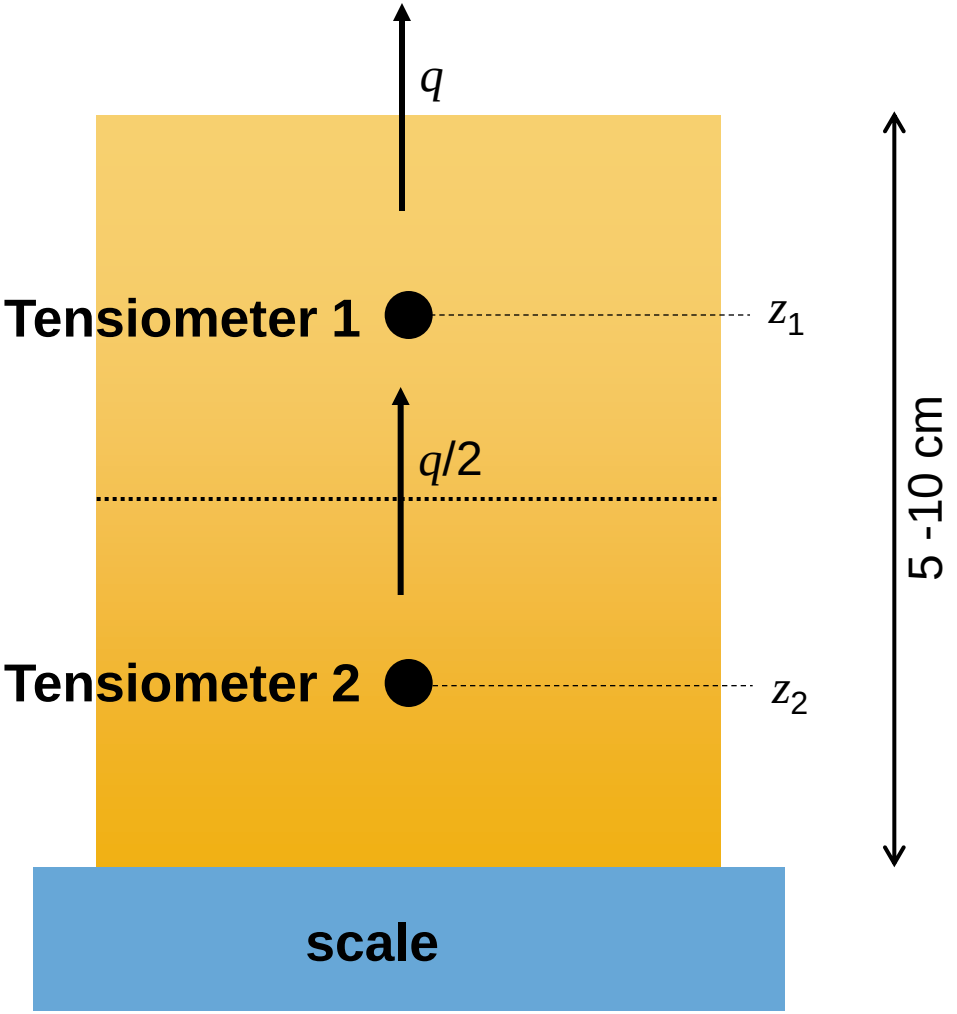
moisture range mainly
influenced by biopores





Peters and Durner, 2006 in WRR

evaporation method



$$\theta(\bar{h}) \approx \bar{\theta}(\bar{h})$$

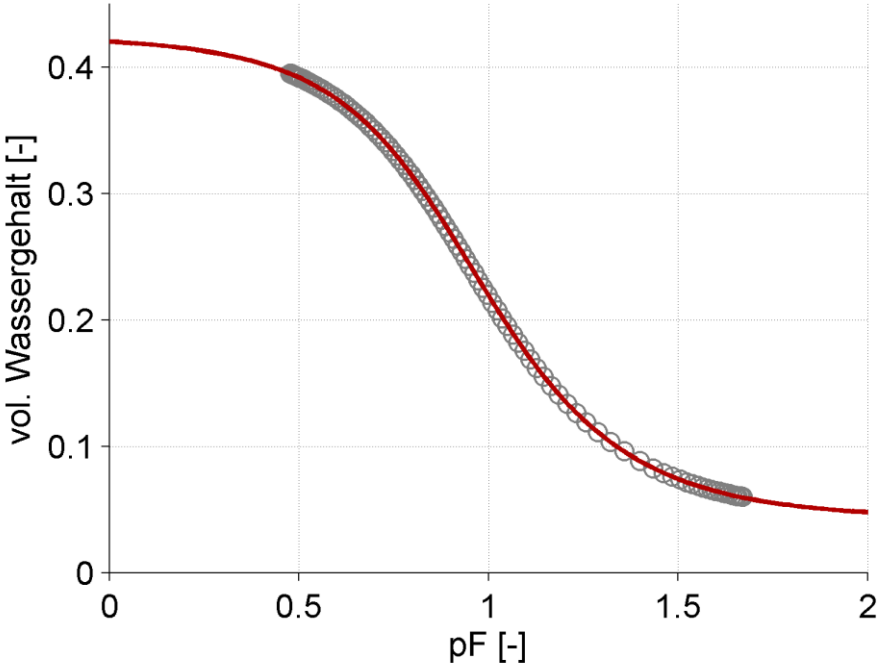
$$\frac{q}{2} \approx K(\bar{h})\left(\frac{\Delta h}{\Delta z}+1\right)$$

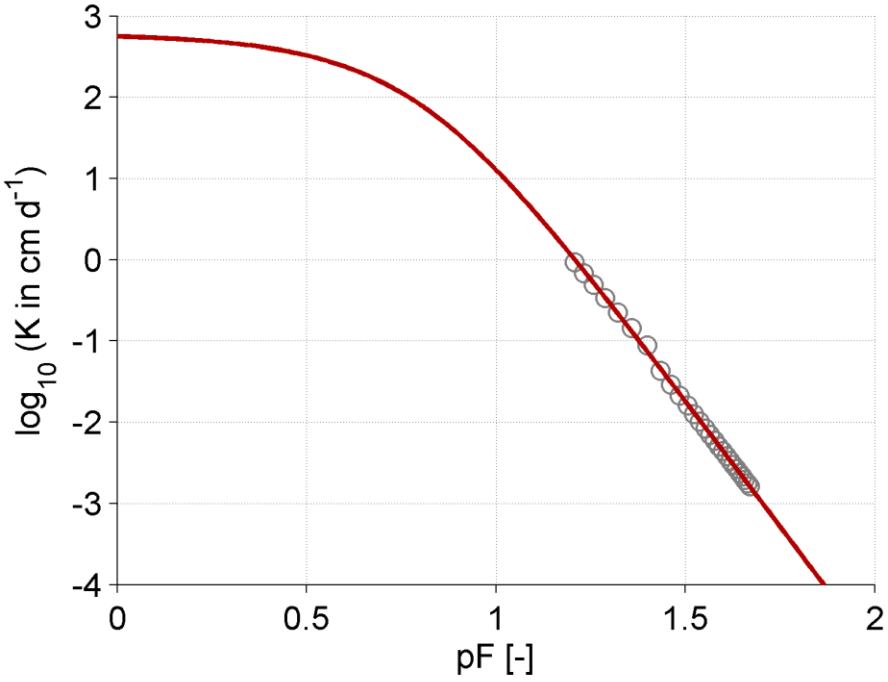
$$K(\bar{h}) \approx \frac{q/2}{\Delta h/\Delta z+1}$$

evaporation method

$$\theta(\bar{h}) \approx \bar{\theta}(\bar{h})$$

$$K(\bar{h}) \approx \frac{q/2}{\Delta h/\Delta z + 1}$$

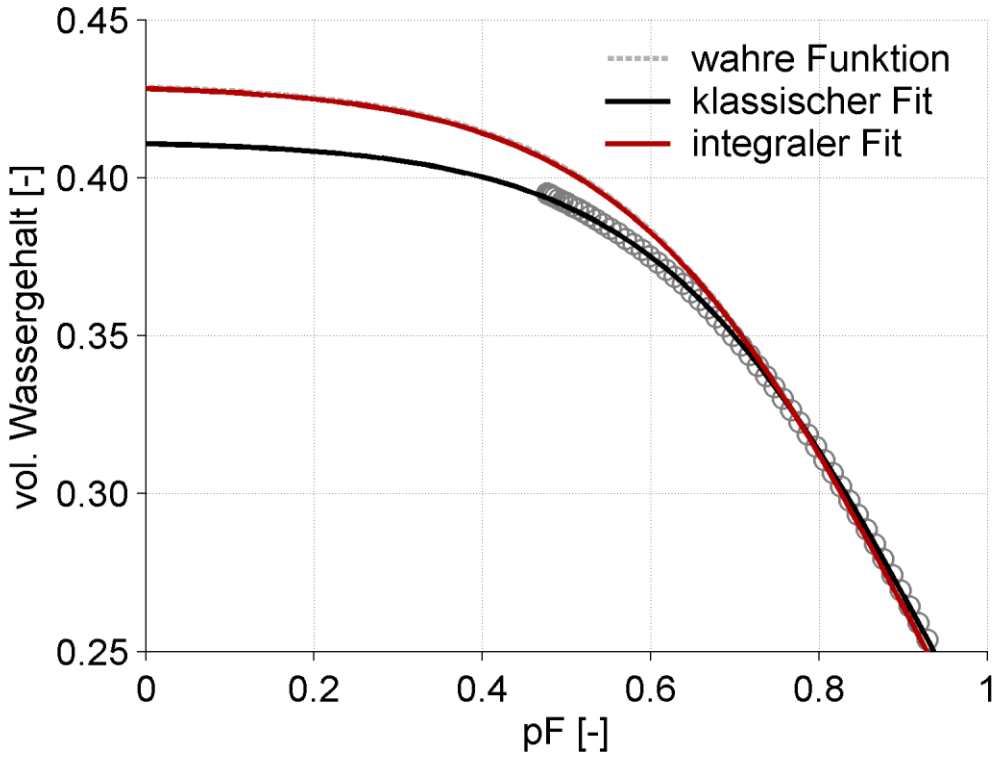




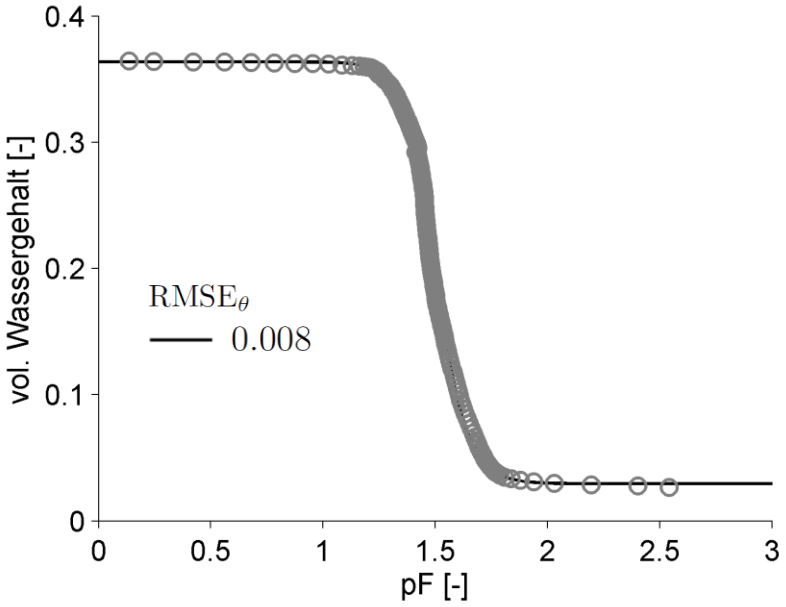
$$\Phi(\boldsymbol{b}) = w_\theta \sum_{i=1}^{r} w_{\theta_i} \left[\overline{\theta}_i - \hat{\theta}_i(\boldsymbol{b})\right]^2 + w_K \sum_{i=1}^{k} w_{K_i} \left[K_i - \hat{K}_i(\boldsymbol{b})\right]^2$$

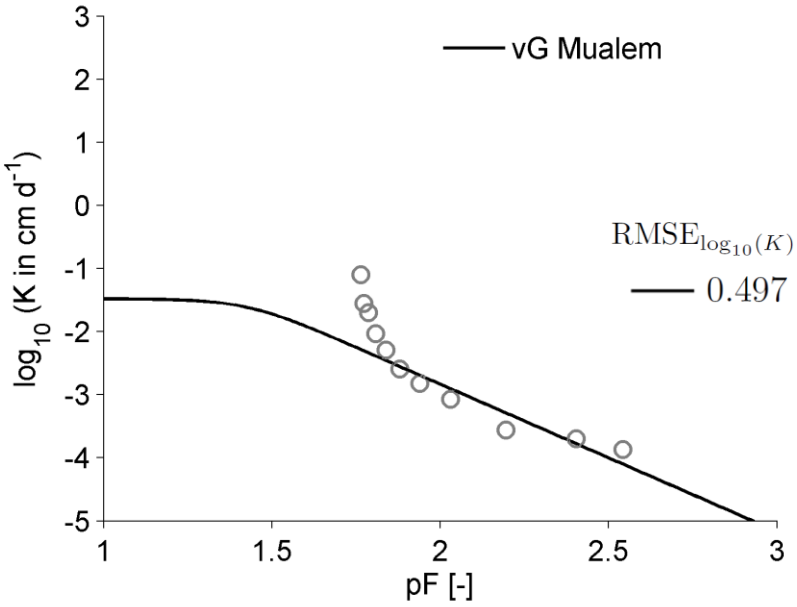
Peters and Durner, 2008 in JH

evaporation method



problem

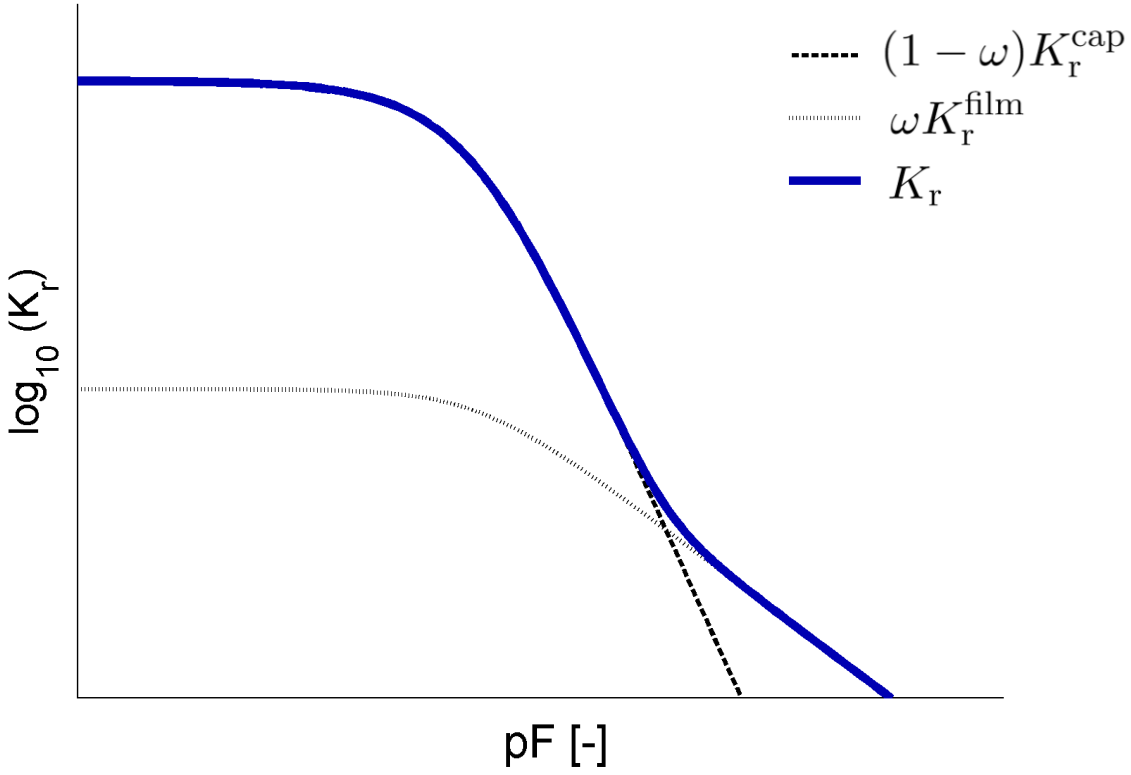

0.4
0.3
0.2
0.1
0
vol. Wassergehalt [-]
RMSE$_\theta$
0.008
0
0.5
1
1.5
2
2.5
3
pF [-]


3
2
1
0
-1
-2
-3
-4
-5
log$_{10}$ (K in cm d^{-1})
vG Mualem
RMSE$_{\log_{10}(K)}$
0.497
1
1.5
2
2.5
3
pF [-]

$$K_{\mathrm{r}}^{\mathrm{film}}(S_{\mathrm{e}}(h)) = S_{\mathrm{e}}^{\tau 2}$$

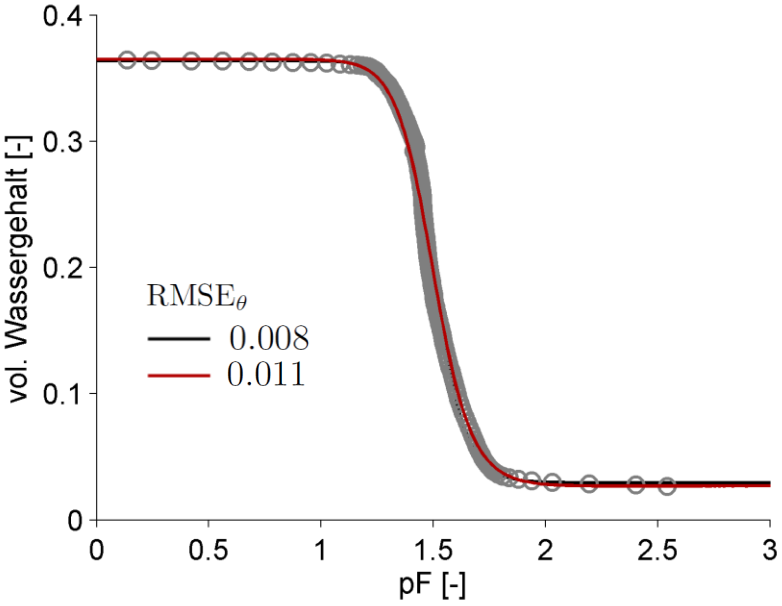
$$K_{\mathrm{r}}(S_{\mathrm{e}}(h)) = (1-\omega)K_{\mathrm{r}}^{\mathrm{cap}} + \omega K_{\mathrm{r}}^{\mathrm{film}}$$

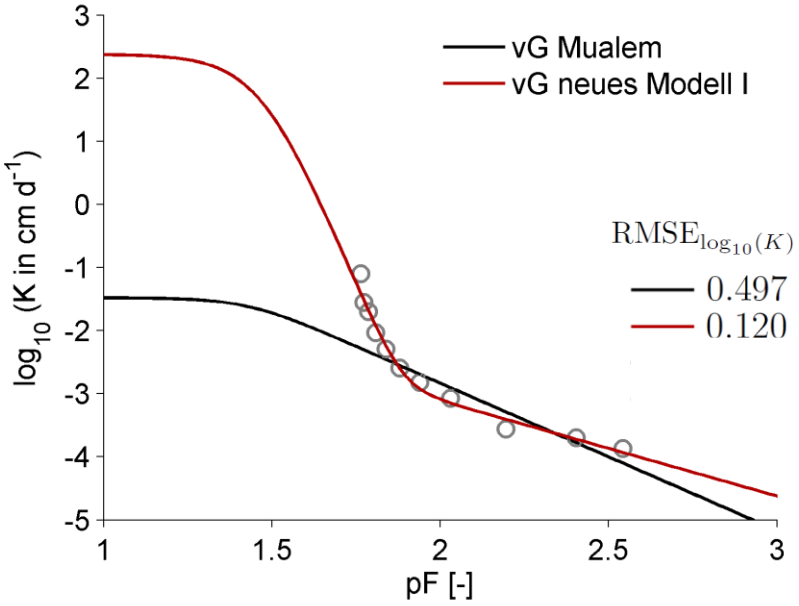
K-Modell



Peters und Durner, 2008 in WRR

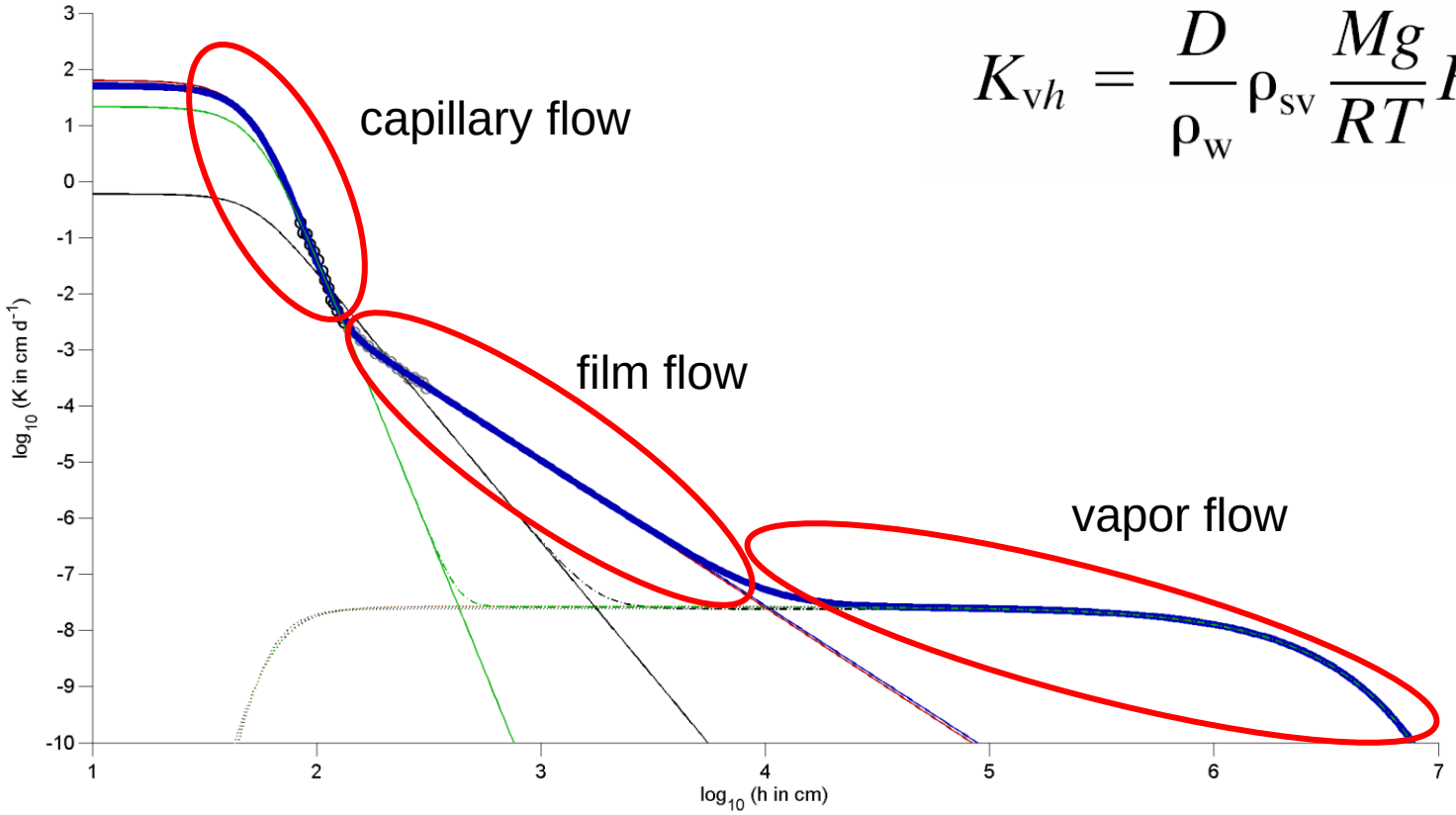
Model test


vol. Wassergehalt [-]
pF [-]
RMSE$_\theta$
0.008
0.011


log$_{10}$ (K in cm d^{-1})
pF [-]
vG Mualem
vG neues Modell I
RMSE$_{\log_{10}(K)}$
0.497
0.120

K-model

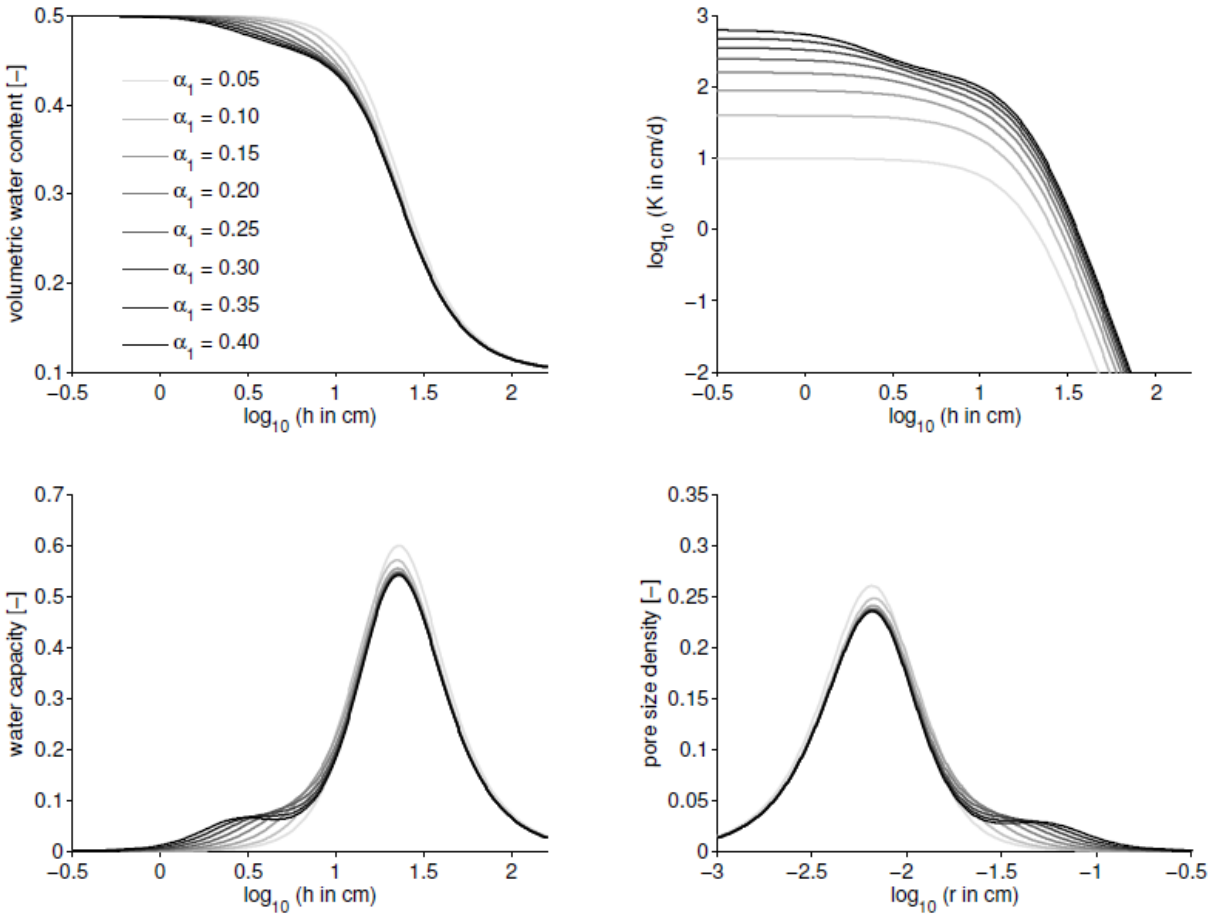
film and vapor transport

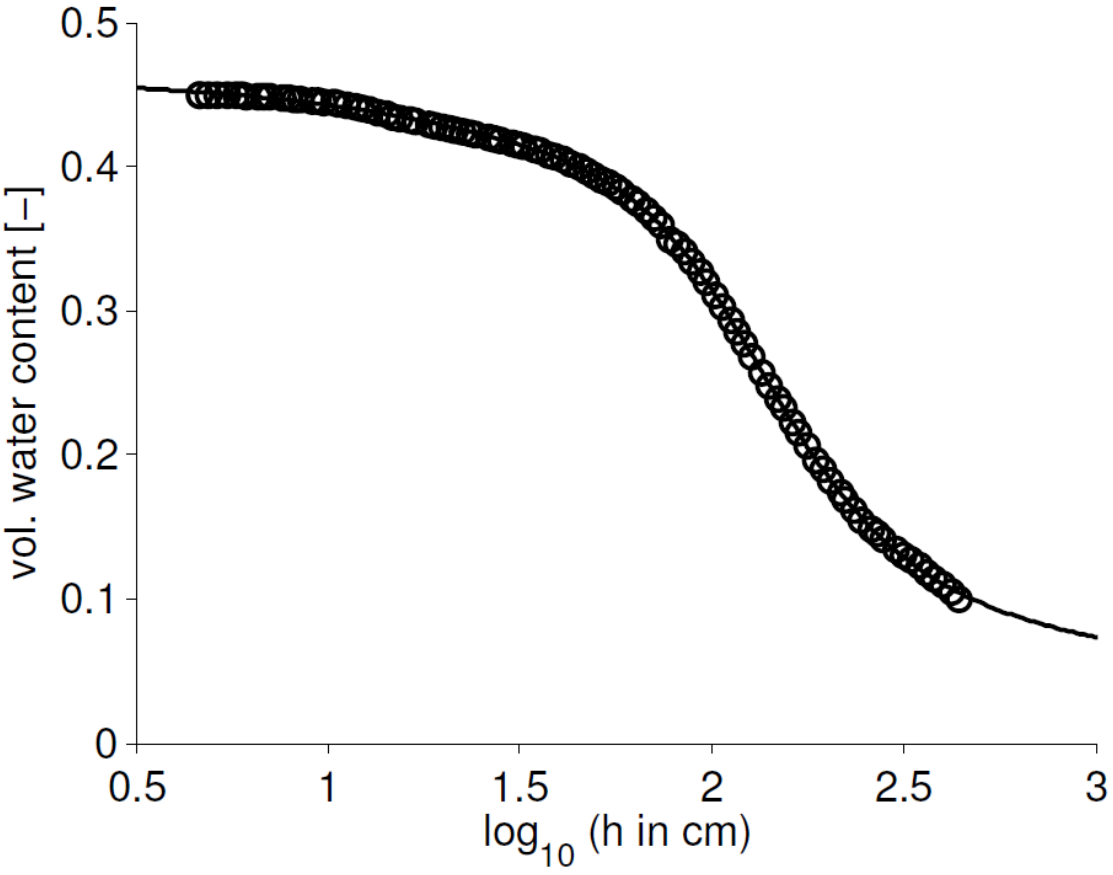


$$K_{vh} = \frac{D}{\rho_w} \rho_{sv} \frac{Mg}{RT} H_r$$

Peters and Durner, 2010 in WRR

scaling factor as function of time




0.5
0.4
0.3
0.2
0.1
0
vol. water content [–]
0.5
1
1.5
2
2.5
3
log10 (h in cm)