Objectives

• Test large-scale pedotransfer functions (Rosetta) on available Hanford data

• Develop site-specific PTFs for Hanford

• Compare performance of site-specific PTFs and Rosetta on data from the ILAW waste disposal area (correlations, errors, systematic errors)

Pedotransfer Functions:

• predict soil hydraulic parameters from surrogate data (texture, bulk density, organic matter content)

• cheaper, quicker than measurements. Applicable to widely available data.

• less accurate than measurements, but good enough?

Available data

200 East-West

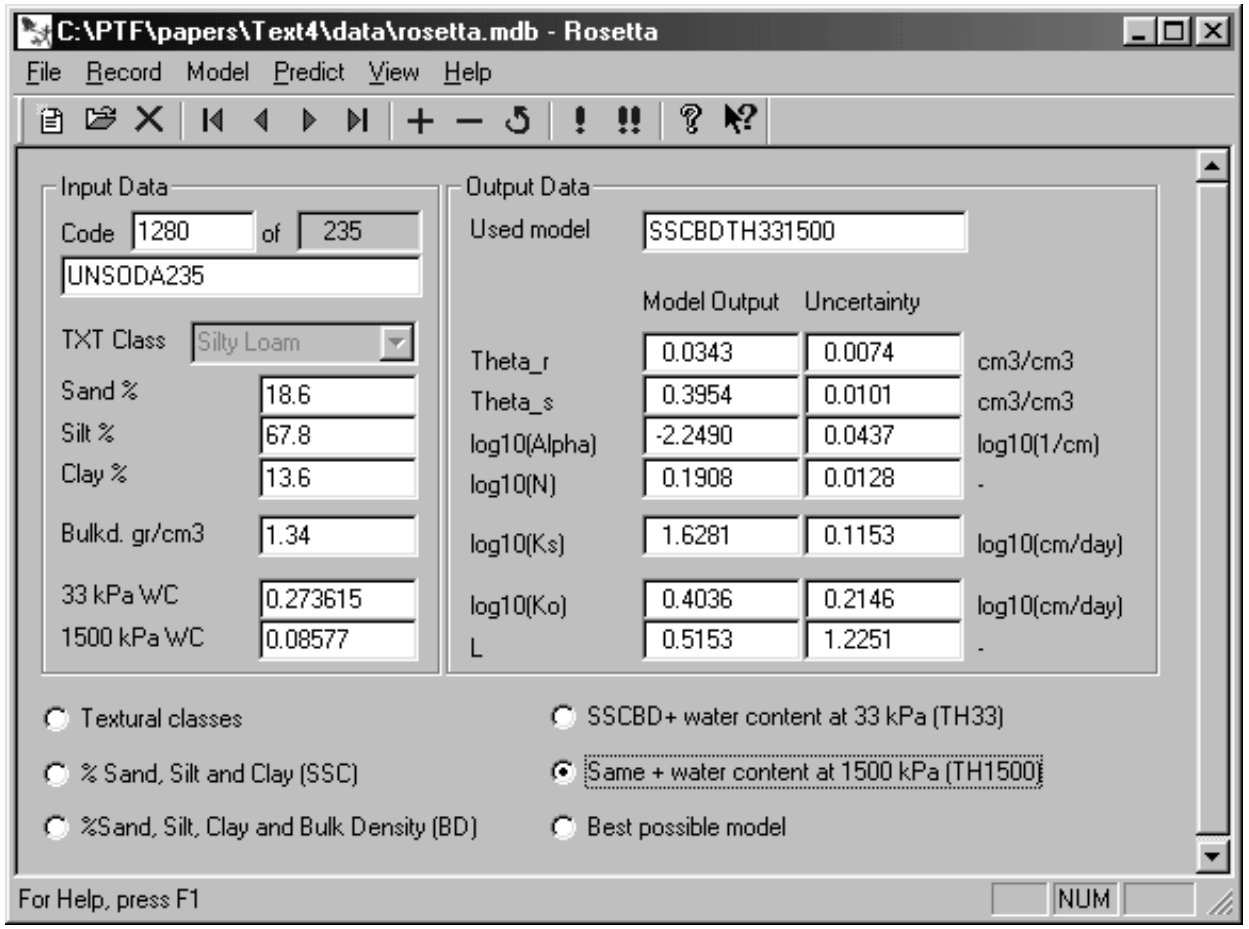
183 samples from 14 bore holes
Gravel %
Coarse sand, Fine sand, Silt, Clay
Bulk density (not all)
Retention data: 183 curves (153 usable, > 2500 points)
K_s(not all)

ILAW site

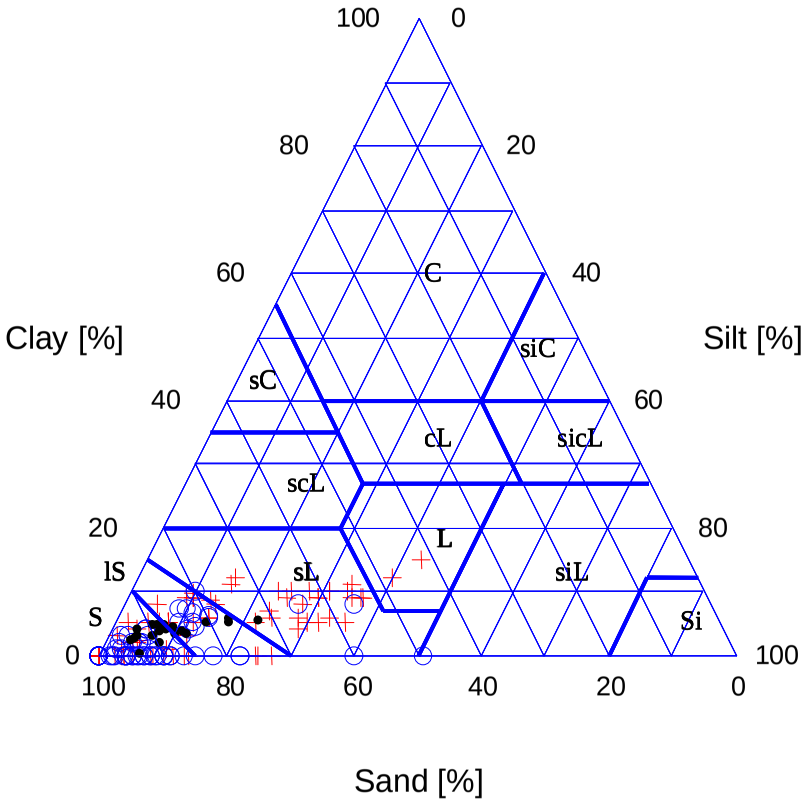
20 samples from one bore hole
15 particle size fractions
bulk density
water retention:
- 5-50 cm : 1 to 5 points (37 total, multistep outflow)
- 5m-50m : 4 points (80 total, pressure plate)
- > 50 m : 6 points (118 total, vapor adsorption)

K_s (20 total, constant and falling head)
K(h): 1 to 5 points from 5 to 50 cm (37 total, multistep outflow)

Rosetta: www.ussl.ars.usda.gov/models/models.htm



Hanford

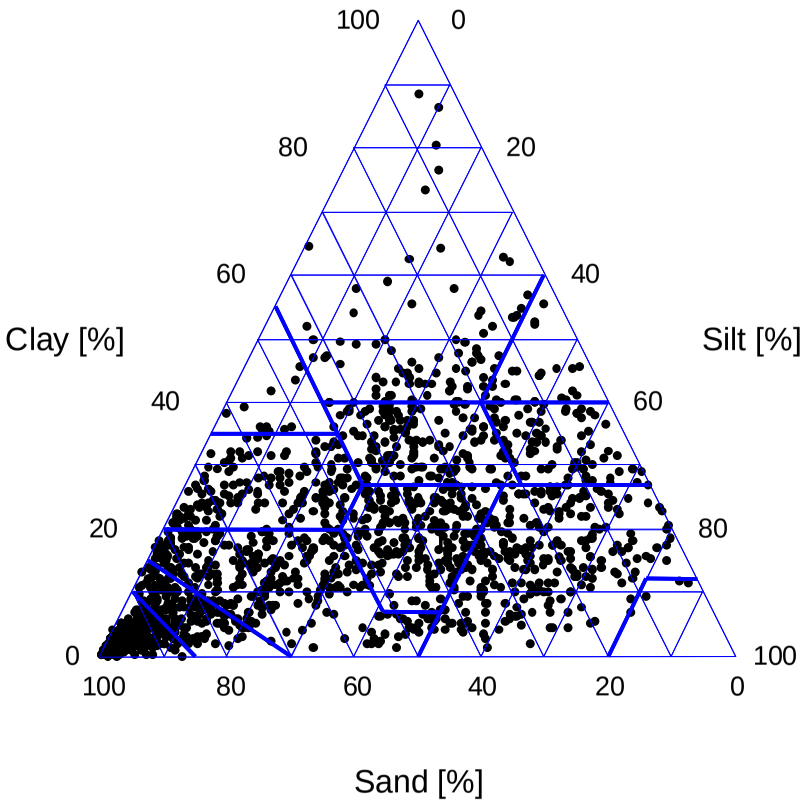


○ 200 East (N=105)

\+ 200 West (N=78)

● ILAW (N=20)

Rosetta

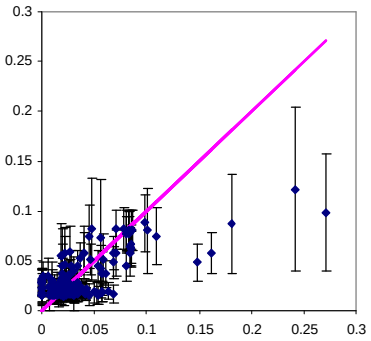


N=2134

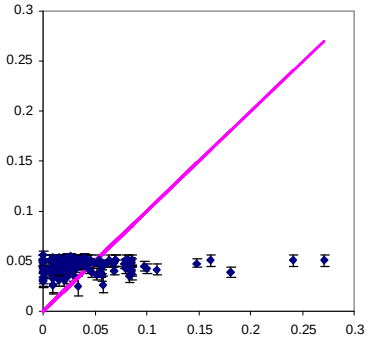
200 East-West data

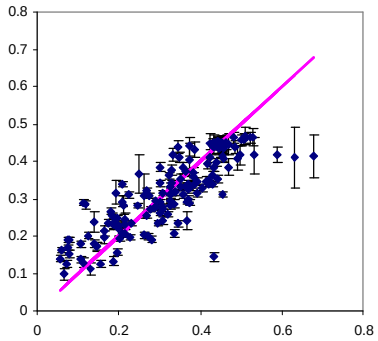
Hanford PTF

Rosetta

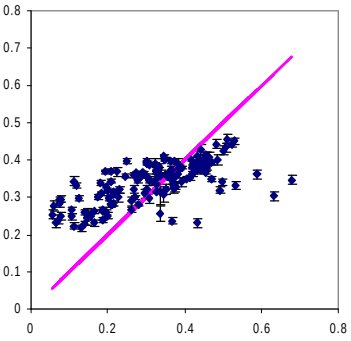


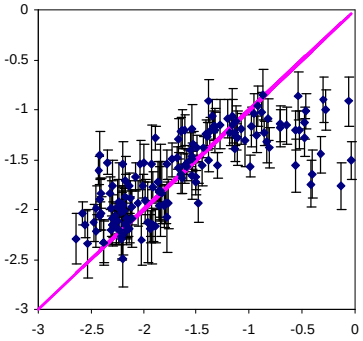
θ_r



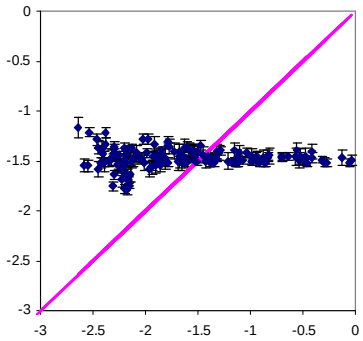


θ_s





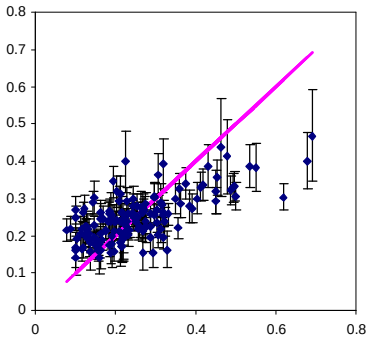
$\log(\alpha)$



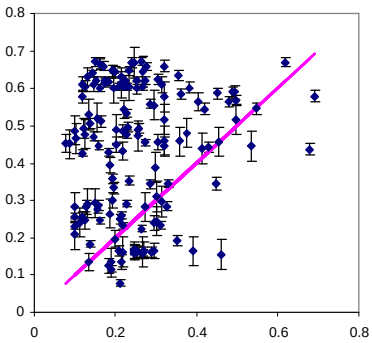
200 East-West data

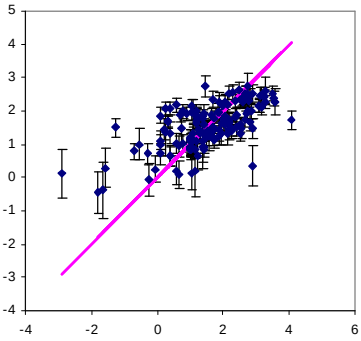
Hanford PTF

Rosetta

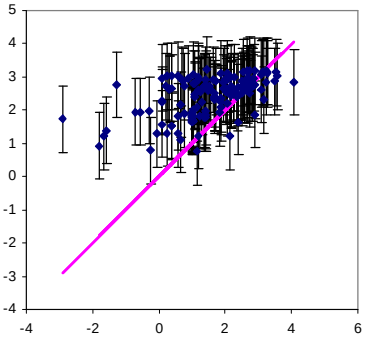


log(n)



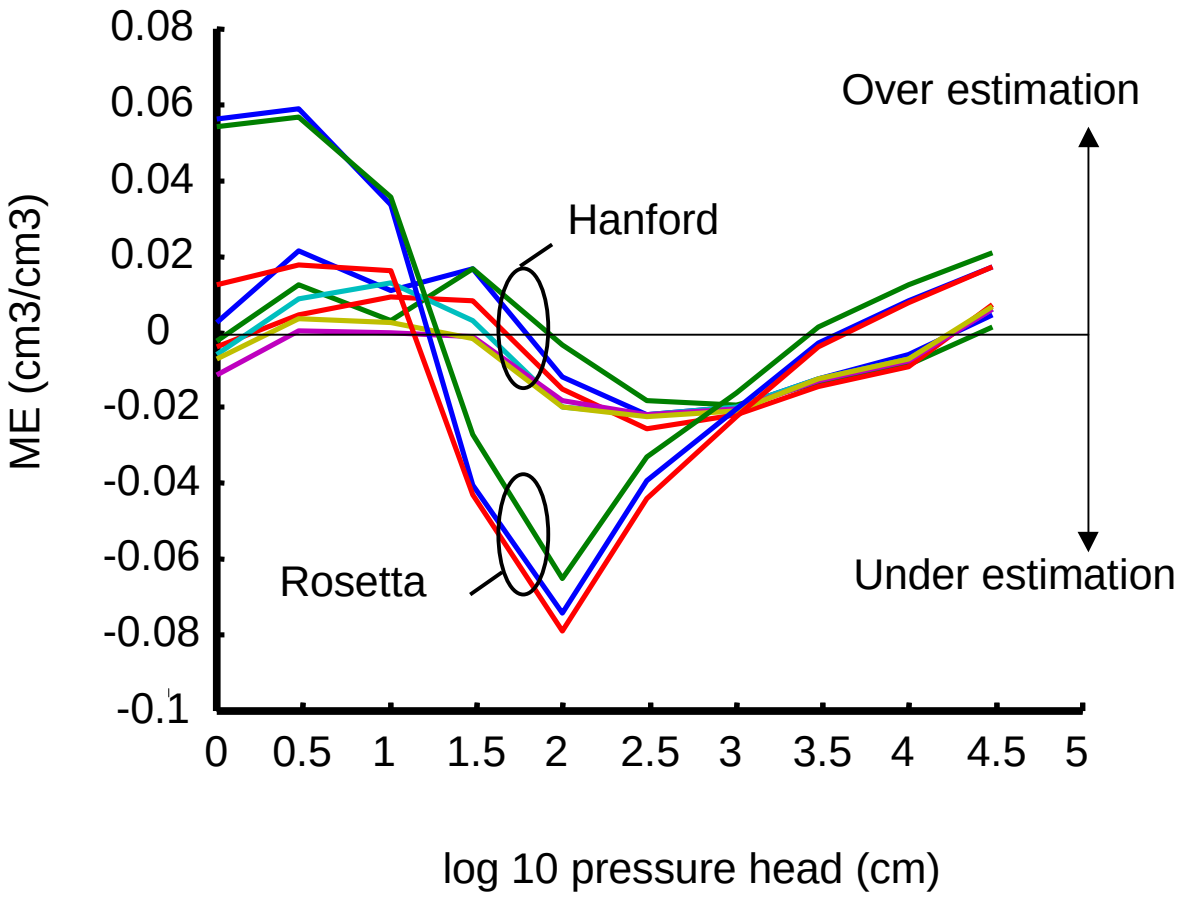


Log(K_s)



Mean Errors (ME)

200 East-West Area



Root Mean Square Errors for the ILAW Site

(Rosetta and Site Specific PTFs)

Input	Retention (cm^3/cm^3) 0-50 cm	5-50m	>50m	log(K_s)	Log($K(h)$) A[1]	B[2]
Rosetta						
1 Textural classes	0.049	0.028	0.042	0.47	1.11	0.67
2 Sand, silt, clay	0.054	0.021	0.036	0.31	0.96	0.61
3 Sand, silt, clay, bulk density	0.056	0.017	0.035	0.38	0.89	0.61
200 EW PTFs						
1 Sand, silt, clay	0.049	0.037	0.032	1.04	1.05	0.84
2 Coarse, fine sand, silt, clay	0.051	0.039	0.032	0.89	1.41	1.08
3 Gravel, (coarse, fine) sand, silt, clay	0.049	0.037	0.035	0.85	1.23	0.90

A: matching point is Ks

B: matching point predicted with Rosetta (from retention data)

Mean Errors for the ILAW Site

(Rosetta and Site Specific PTFs)

Input	Retention (cm^3/cm^3) 0-50 cm	5-50m	>50 m	$\log(K_s)$	Log($K(h)$) A[1]	B[2]
Rosetta						
1 Textural classes	0.024	0.023	0.023	0.11	-0.41	-0.53
2 Sand, silt, clay	0.021	0.021	0.035	-0.01	-0.45	-0.41
3 Sand, silt, clay, bulk density	-0.031	0.017	0.033	-0.22	-0.55	-0.41
200 EW PTFs						
1 Sand, silt, clay	0.034	0.035	0.031	-0.95	-1.06	-0.77
2 Coarse, fine sand, silt, clay	0.008	0.038	0.031	-0.80	-1.43	-1.03
3 Gravel, (coarse, fine) sand, silt, clay	0.034	0.036	0.034	-0.73	-1.24	-0.85

A: matching point is Ks

B: matching point predicted with Rosetta (from retention data)

Conclusions

- Site-specific PTFs better for the 200 E/W sites
- Poor performance of Rosetta on 200 E/W data probably related to coarseness of the sediments.
- For the ILAW site it seems that there is no difference in performance for retention. Rosetta is currently better for hydraulic conductivity.
- Use of K_s as matching point in the VG-Mualem equation leads to larger errors.
- More data are needed for the ILAW site (measurements in progress at USSL)
- Ultimately, we are not interested in the hydraulic properties, but in other relevant criteria such as risk of leaching, flux, etc.