

# 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

C:\VPTF\papers\Text4\data\Rosetta.mdb - Rosetta

File Record Model Predict View Help

Input Data Output Data

Code 1280 of 235 Used model SSCBDTH331500

UNSDA235

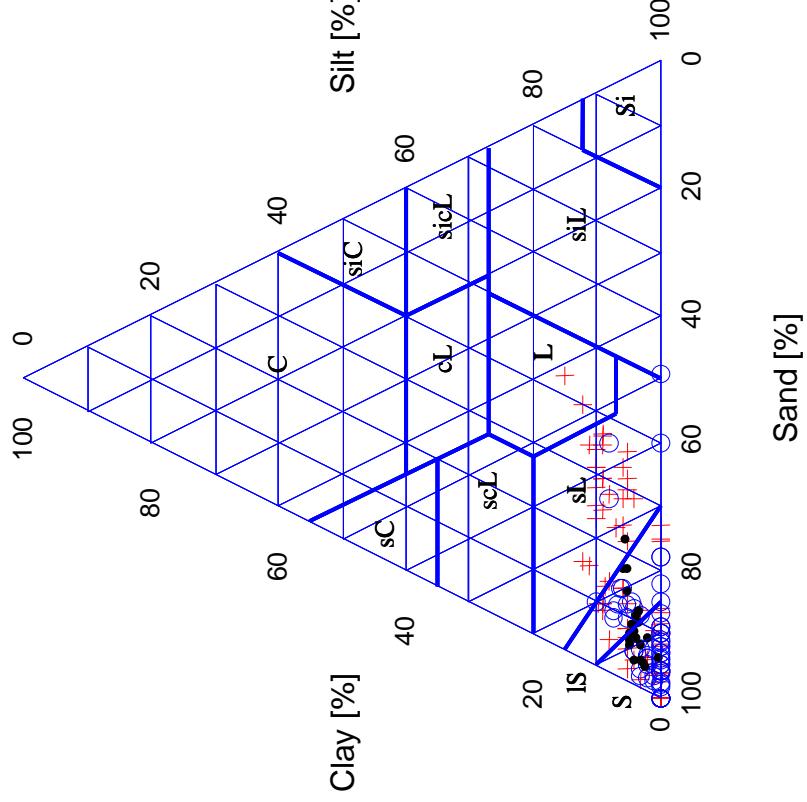
		Model Output	Uncertainty
TXT Class	Silty Loam	Theta_U	0.0343 0.0074 cm <sup>3</sup> /cm <sup>3</sup>
Sand %	18.6	Theta_s	0.3954 0.0101 cm <sup>3</sup> /cm <sup>3</sup>
Silt %	67.8	log10(Alpha)	-2.2490 0.0437 log10(1/cm)
Clay %	13.6	log10(N)	0.1908 0.0128 .
Bulkd. gr/cm <sup>3</sup>	1.34	log10(Ks)	1.6281 0.1153 log10(cm/day)
33 kPa w/C	0.273615	log10(Ko)	0.4036 0.2146 log10(cm/day)
1500 kPa w/C	0.08577	L	0.5153 1.2251 .

Textural classes  
 % Sand, Silt and Clay (SSC)  
 %Sand, Silt, Clay and Bulk Density (BD)  
 SSCBD+ water content at 33 kPa (TH33)  
 Same + water content at 1500 kPa (TH1500)  
 Best possible model

For Help, press F1

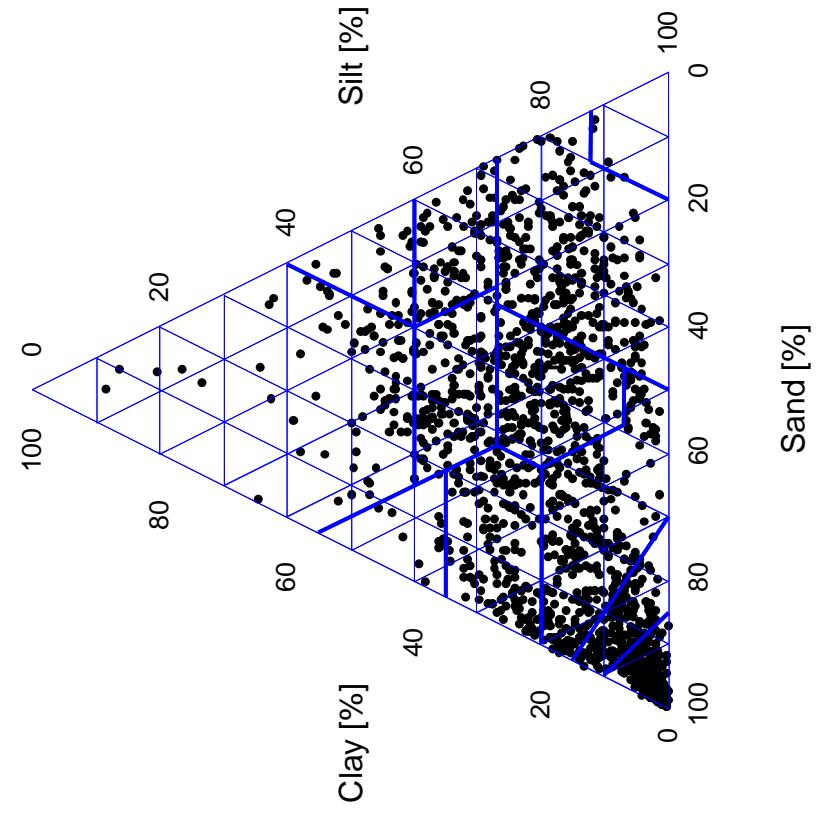
NUM

# Hanford



- 200 East (N=105)
- + 200 West (N=78)
- ILAW (N=20)

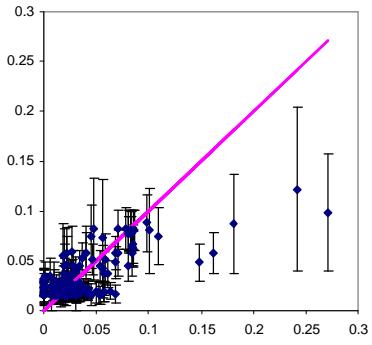
# Rosetta



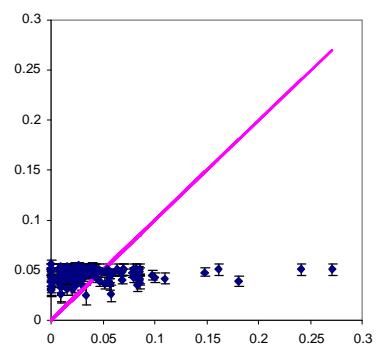
N=2134

# 200 East-West data

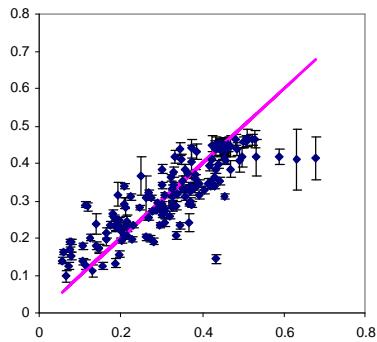
Hanford PTF



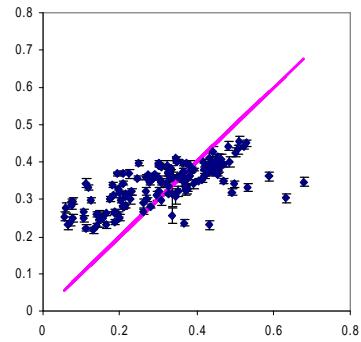
Rosetta



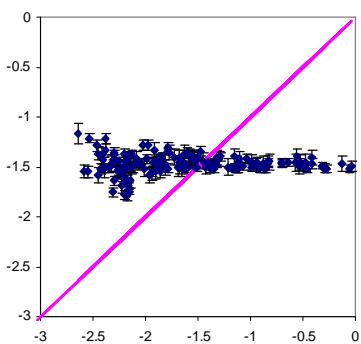
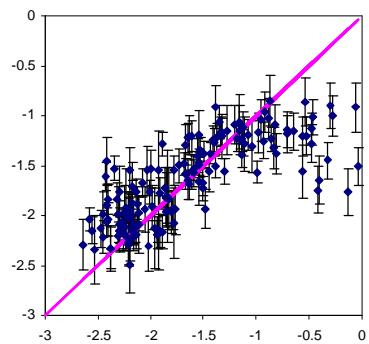
$\theta_r$



$\theta_s$

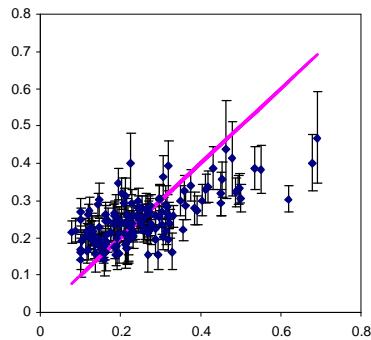


$\log(\alpha)$

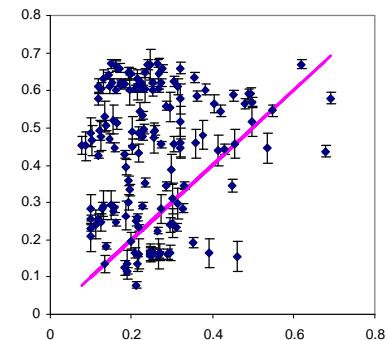


# 200 East-West data

Hanford PTF

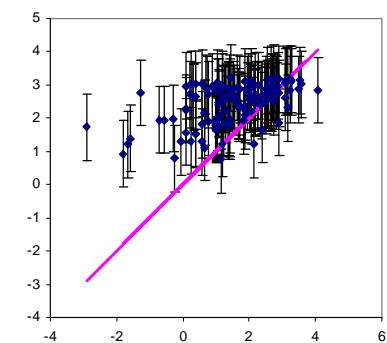
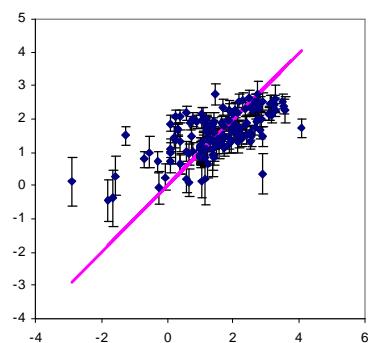


Rosetta



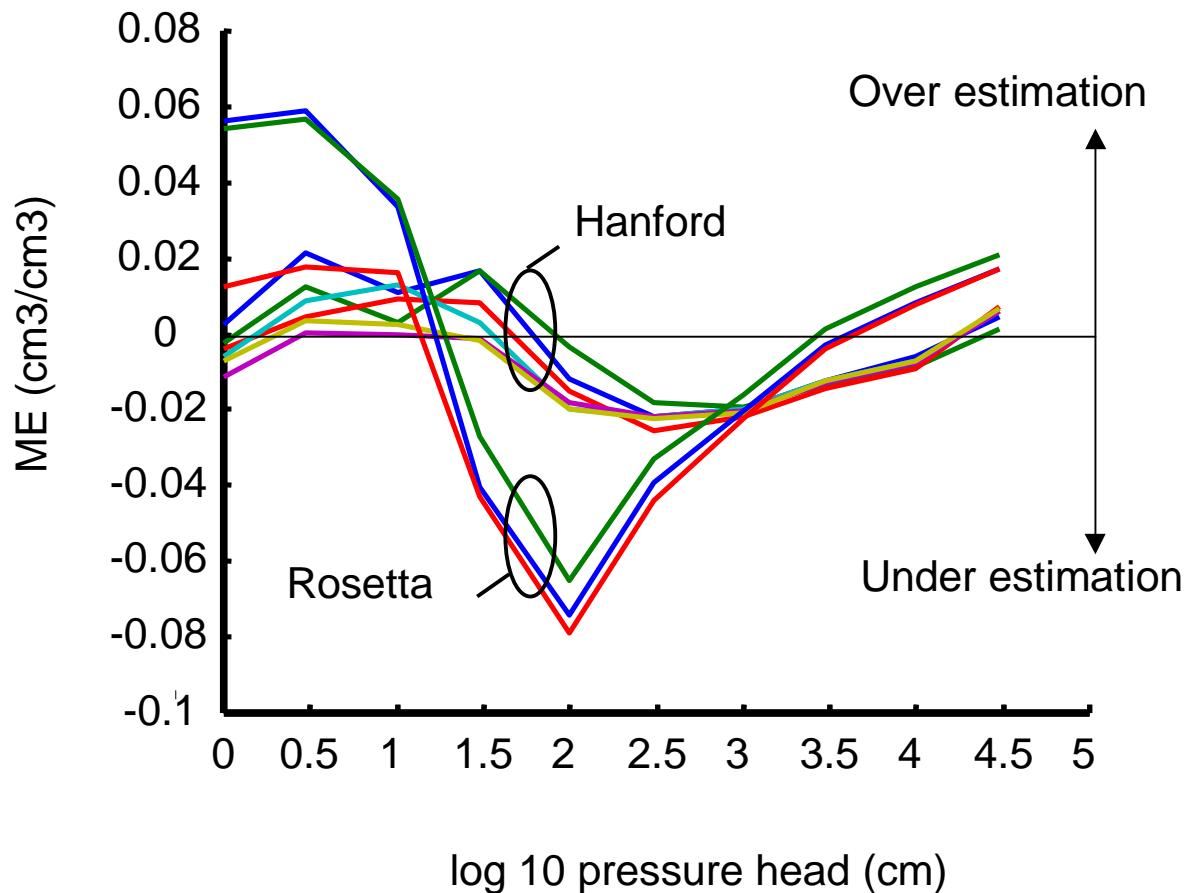
$\log(n)$

$\log(K_s)$



# Mean Errors (ME)

200 East-West Area



# Root Mean Square Errors for the ILAW Site

## (Rosetta and Site Specific PTFs)

Input	Retention ( $\text{cm}^3/\text{cm}^3$ )			$\log(K_s)$	$A^1$	$\log(K(h))$
	0-50 cm	5-50m	>50m			$B^2$
<b>Rosetta</b>						
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
<b>200 EW PTFs</b>						
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  $K_s$

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

# Mean Errors for the ILAW Site

## (Rosetta and Site Specific PTFs)

Input	Retention (cm <sup>3</sup> /cm <sup>3</sup> )			log(K <sub>s</sub> )	A <sup>1</sup>	Log(K(h)) B <sup>2</sup>
Rosetta	0-50 cm	5-50m	>50 m			
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
<b>200 EW PTFs</b>						
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 K<sub>s</sub>

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.