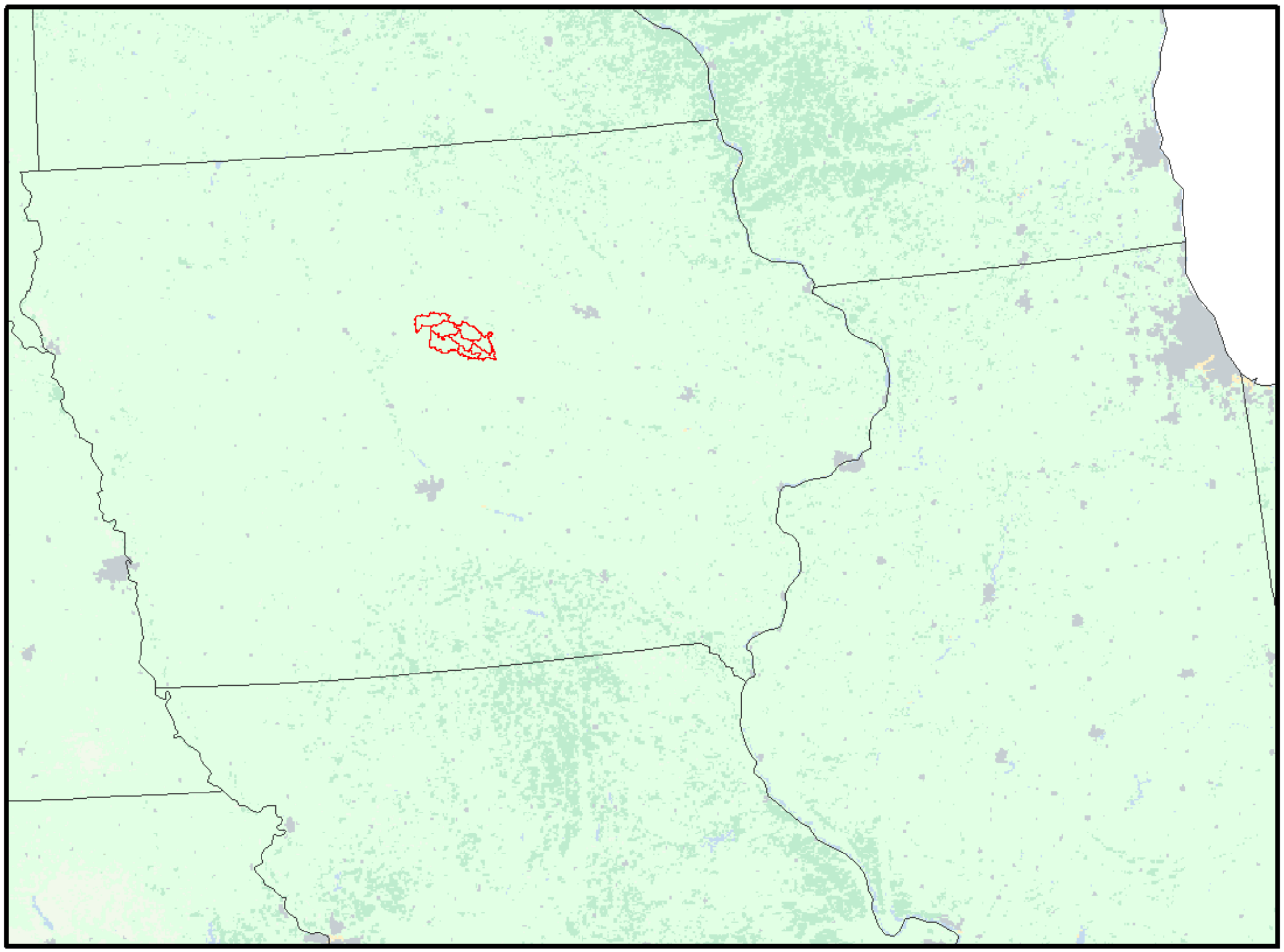
South Fork Watershed of the Iowa River:
In Situ Soil Moisture Validation

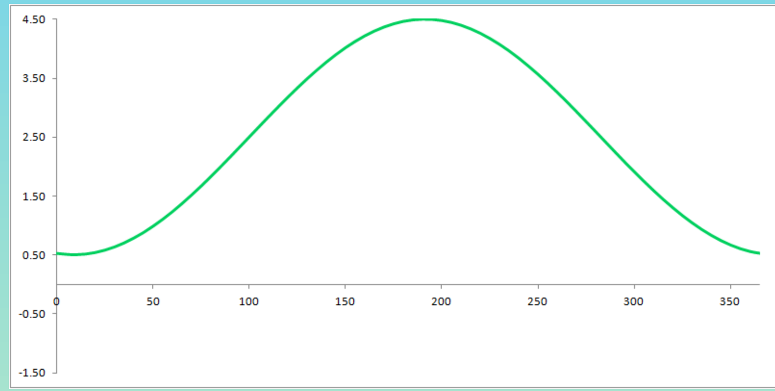


- A representative, agricultural location in central Iowa:
 (Hamilton & Hardin Counties)
- Prime farmland
- Provides numerous precipitation and soil moisture data products

USDA-ARS HRSL
Hydrology & Remote Sensing Lab
Beltsville, Maryland, USA

Calibration of an Hourly Soil Moisture Model: The Diagnostic Soil Moisture Equation (Pan et al, 2012)

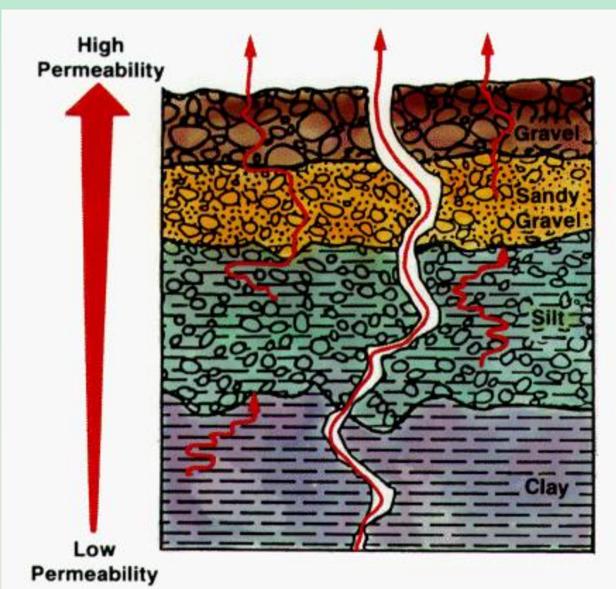
$y = \boldsymbol{\alpha}\sin(x-\mathbf{h}) + \mathbf{v}$



$\{\mathbf{v}, \boldsymbol{\alpha}, \mathbf{h}, \boldsymbol{\Theta}_{\mathbf{re}}, \boldsymbol{\Phi}_{\mathbf{e}}, \mathbf{C}_{\mathbf{4}}\}$

$$\beta = \sum_{i=2}^{i=n-1}\left[\frac{P_i}{\eta_i}\left(1-e^{-\frac{\eta_i}{z}}\right)e^{-\sum_{j=1}^{j=i-1}\left(\frac{\eta_j}{z}\right)}\right] + \frac{P_1}{\eta_1}\left(1-e^{-\frac{\eta_1}{z}}\right)$$

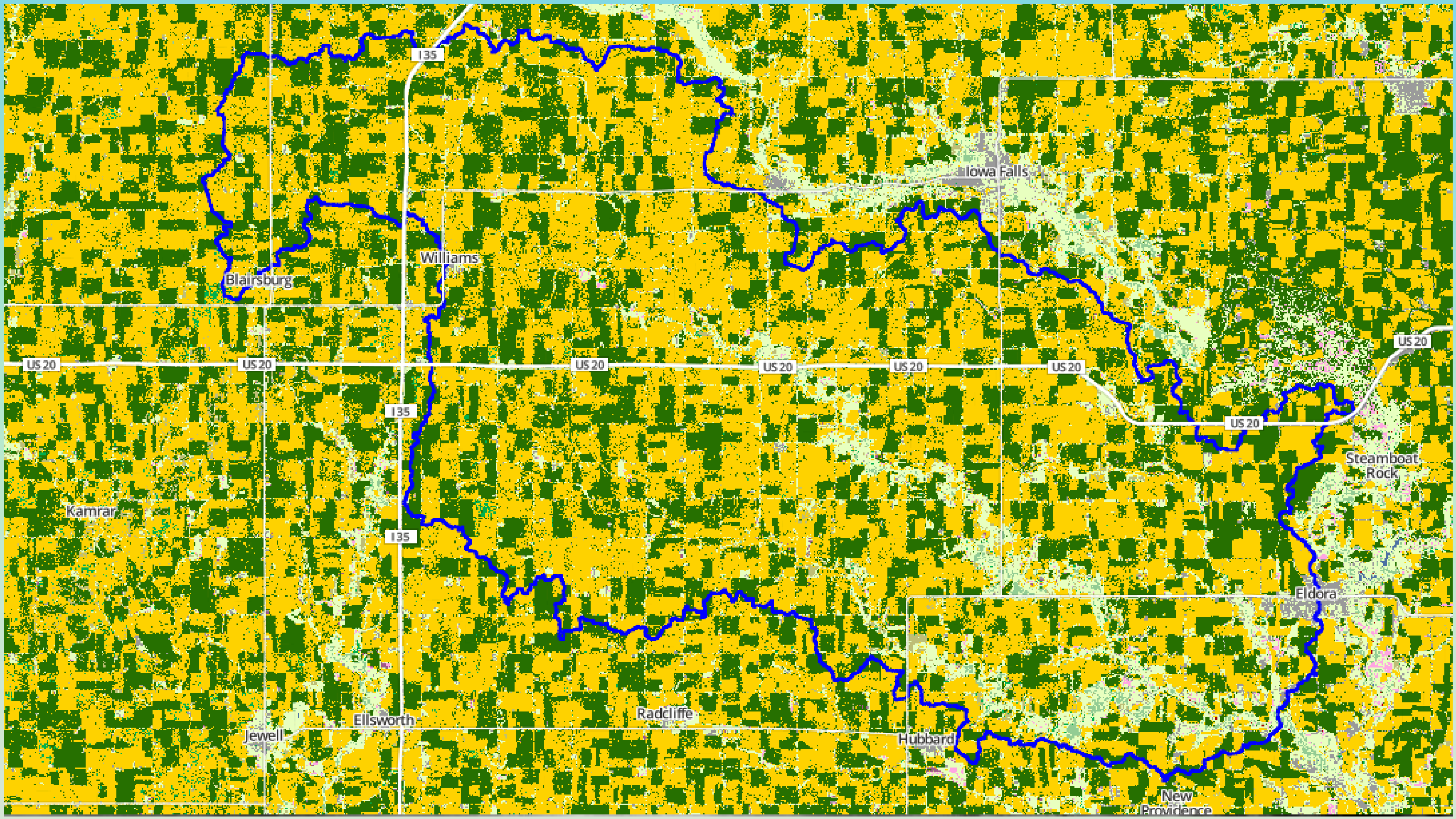
Residual Soil Moisture | Effective Porosity | Soil Drainage Constant



$$\theta_{estimated} = \theta_{re} + (\phi_e - \theta_{re})\left(1 - e^{-c_4\beta}\right)$$

USDA-ARS HRSL
Hydrology & Remote Sensing Lab
Beltsville, Maryland, USA

South Fork Watershed of the Iowa River: Joint Experiment for Crop Assessment and Monitoring (JECAM)



Precipitation & Soils

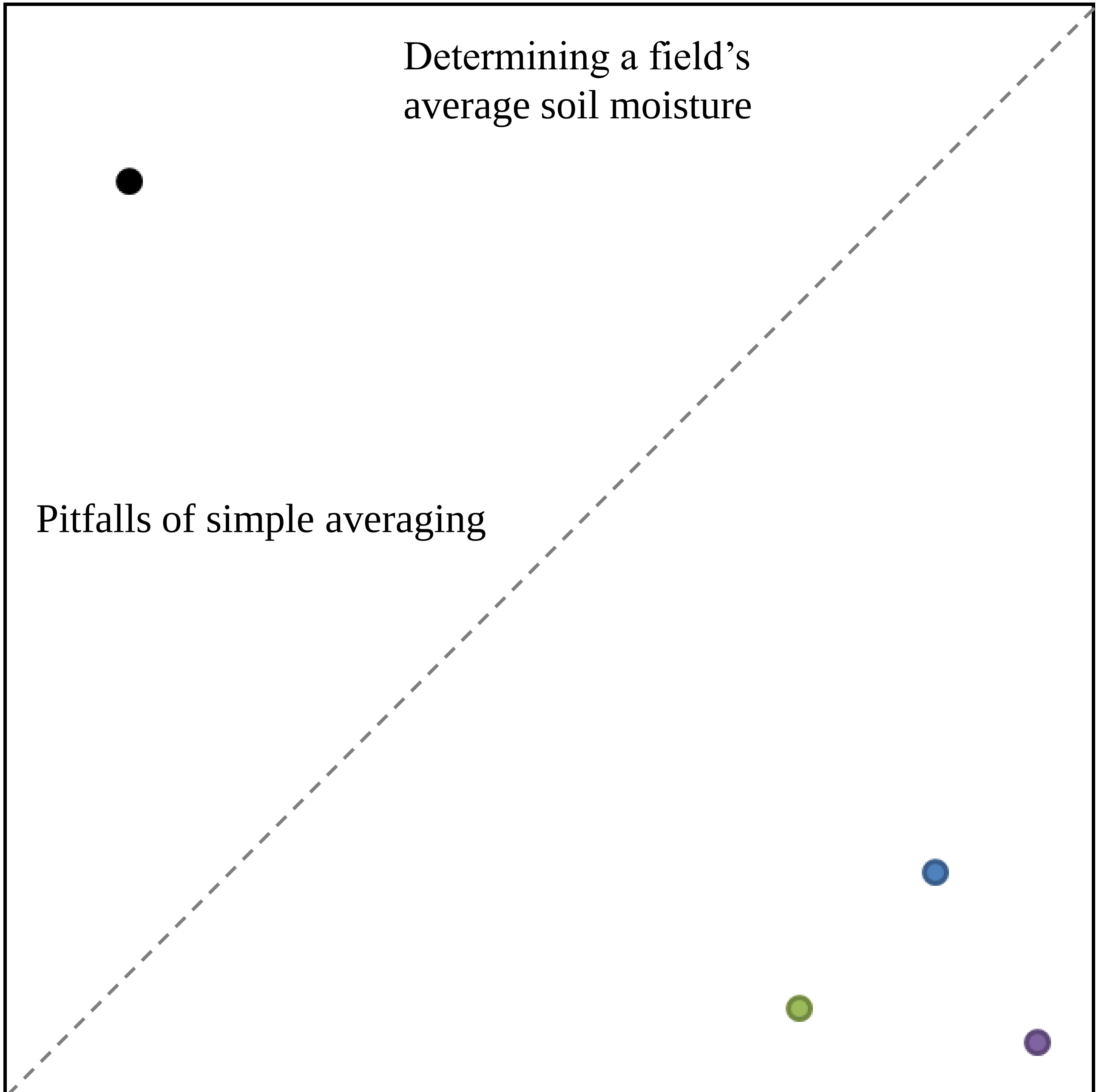
Elevation

Crop Distributions

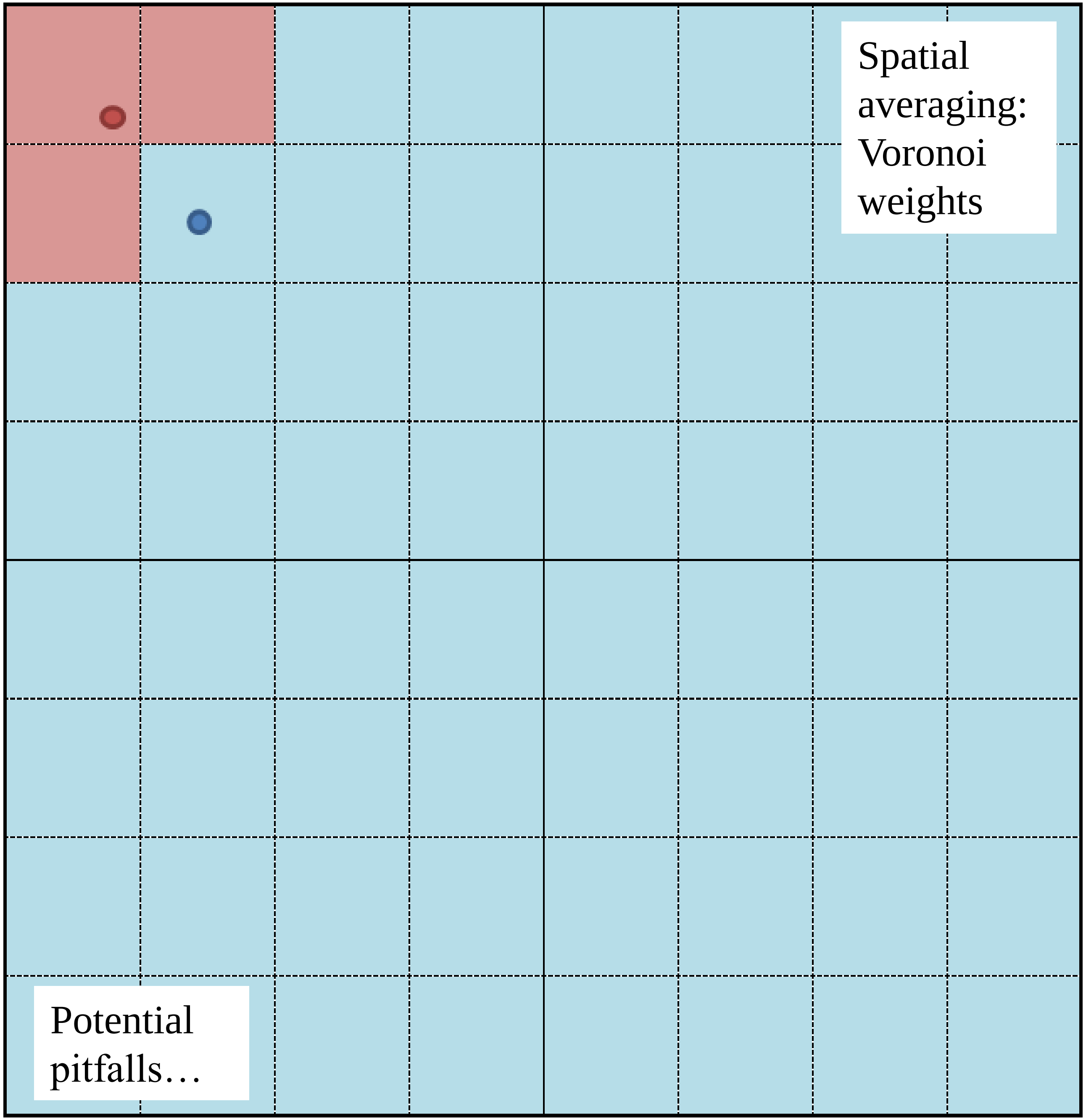
USDA-ARS HRSL

Hydrology & Remote Sensing Lab
Beltsville, Maryland, USA

Determining a field's average soil moisture

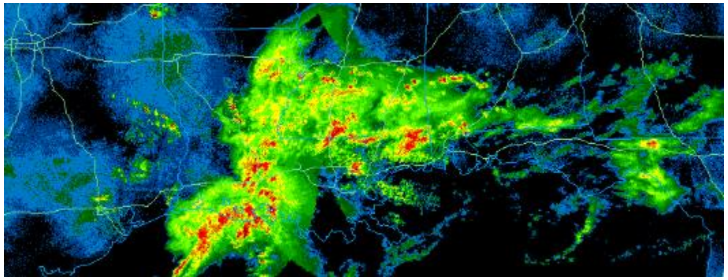


USDA-ARS HRSL
Hydrology & Remote Sensing Lab
Beltsville, Maryland, USA



USDA-ARS HRSL
Hydrology & Remote Sensing Lab
Beltsville, Maryland, USA

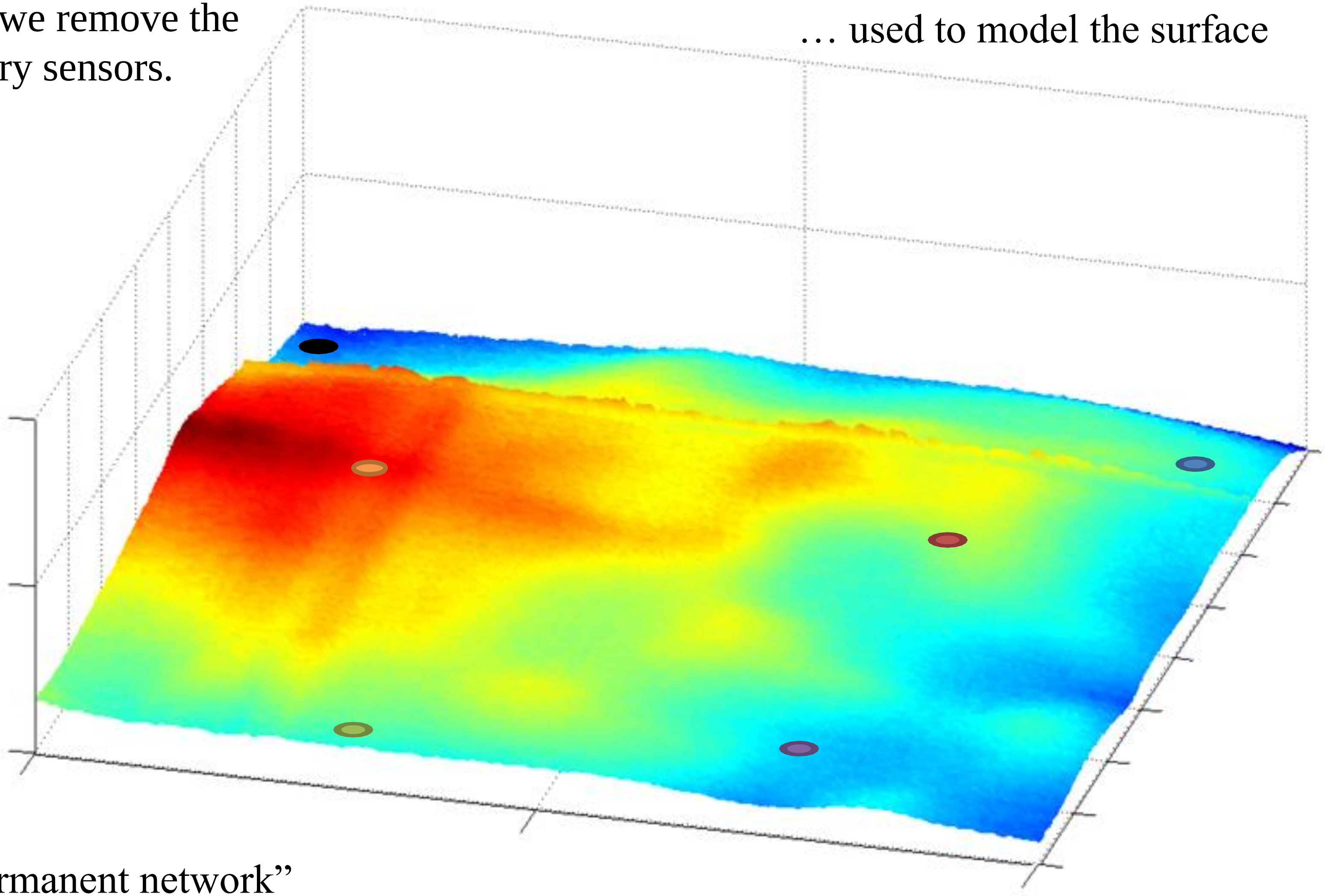
Replacement of missing values:
Anchor and model



$$\theta_x = f\{\theta_1, \theta_2, \theta_3, \theta_4, P_t, P_{t-1}, P_{t-2}, \ldots\}$$

Finally, we remove the temporary sensors.

The (more extensive) “temporary network”…
… used to model the surface



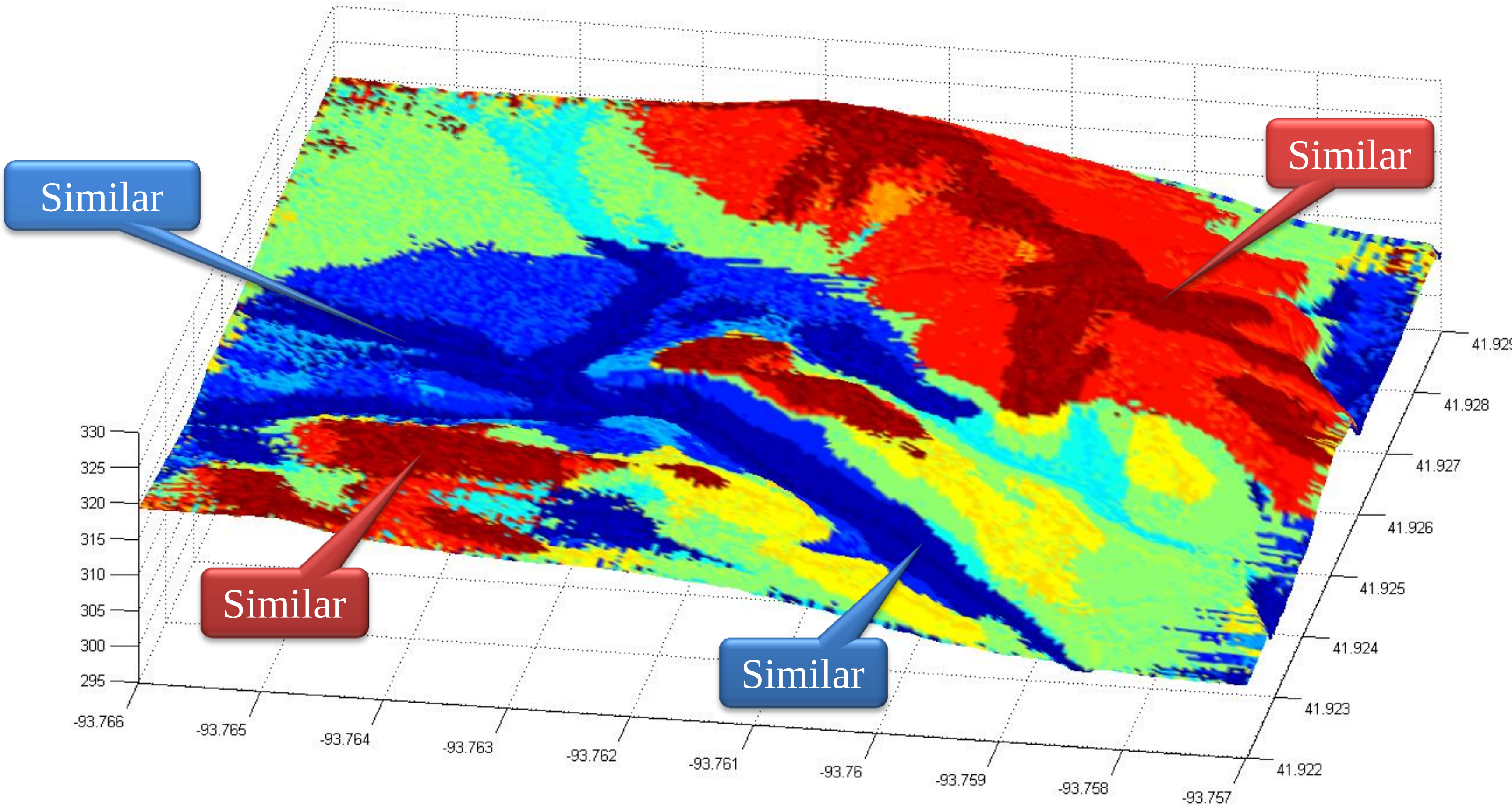
The “permanent network”

The modeled surface
can be integrated with
the remaining sensors.

USDA-ARS HRSL
Hydrology & Remote Sensing Lab
Beltsville, Maryland, USA

Hydrologic Weighting: Topographic and Edaphic Similarity

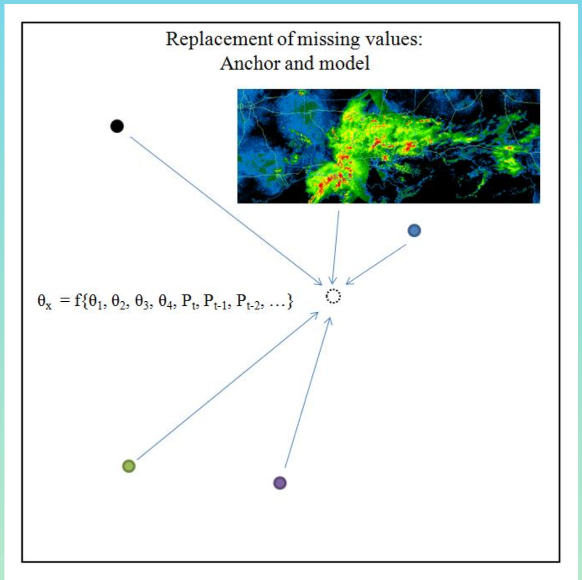
Ames, IA (Generated with LiDAR data)

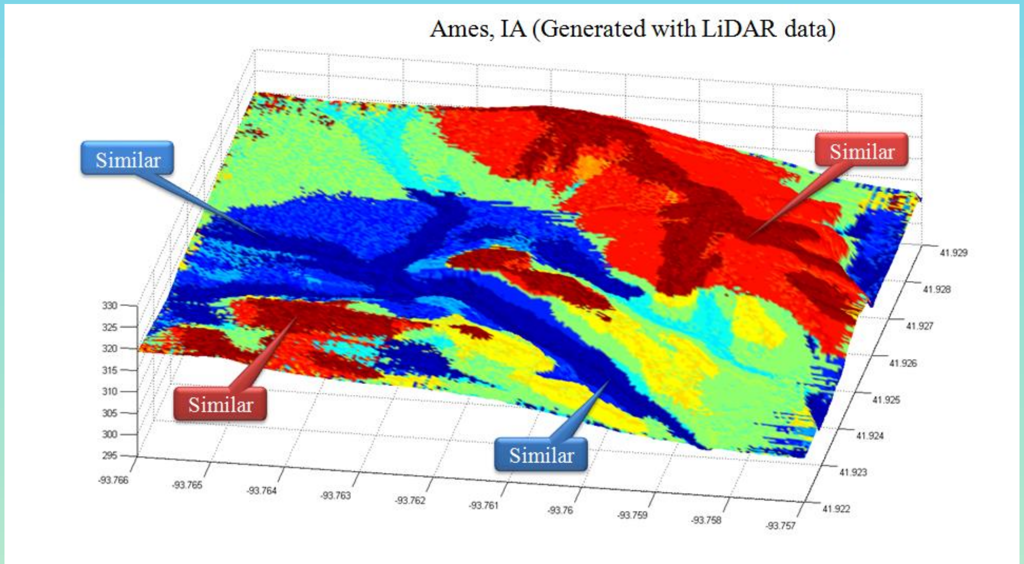


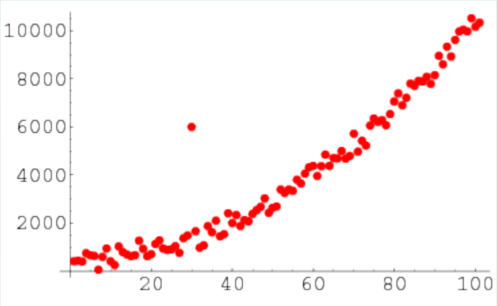
Next, soil type / texture can be
overlaid to ensure similarity

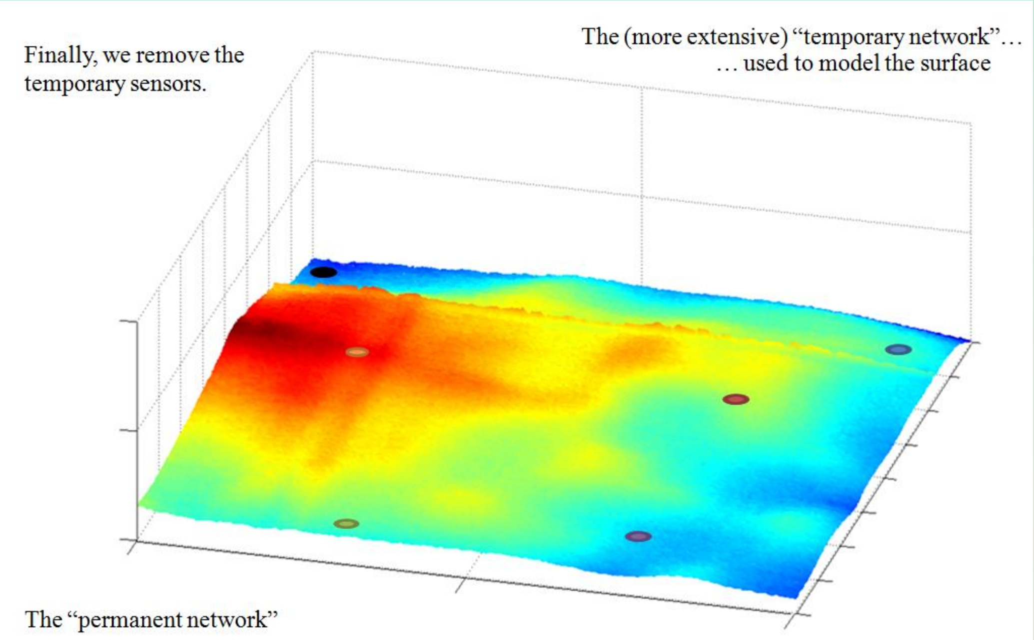
USDA-ARS HRSL
Hydrology & Remote Sensing Lab
Beltsville, Maryland, USA

Future Work: Sources of Error









USDA-ARS HRSL
Hydrology & Remote Sensing Lab
Beltsville, Maryland, USA