Recharge on Non-irrigated Land

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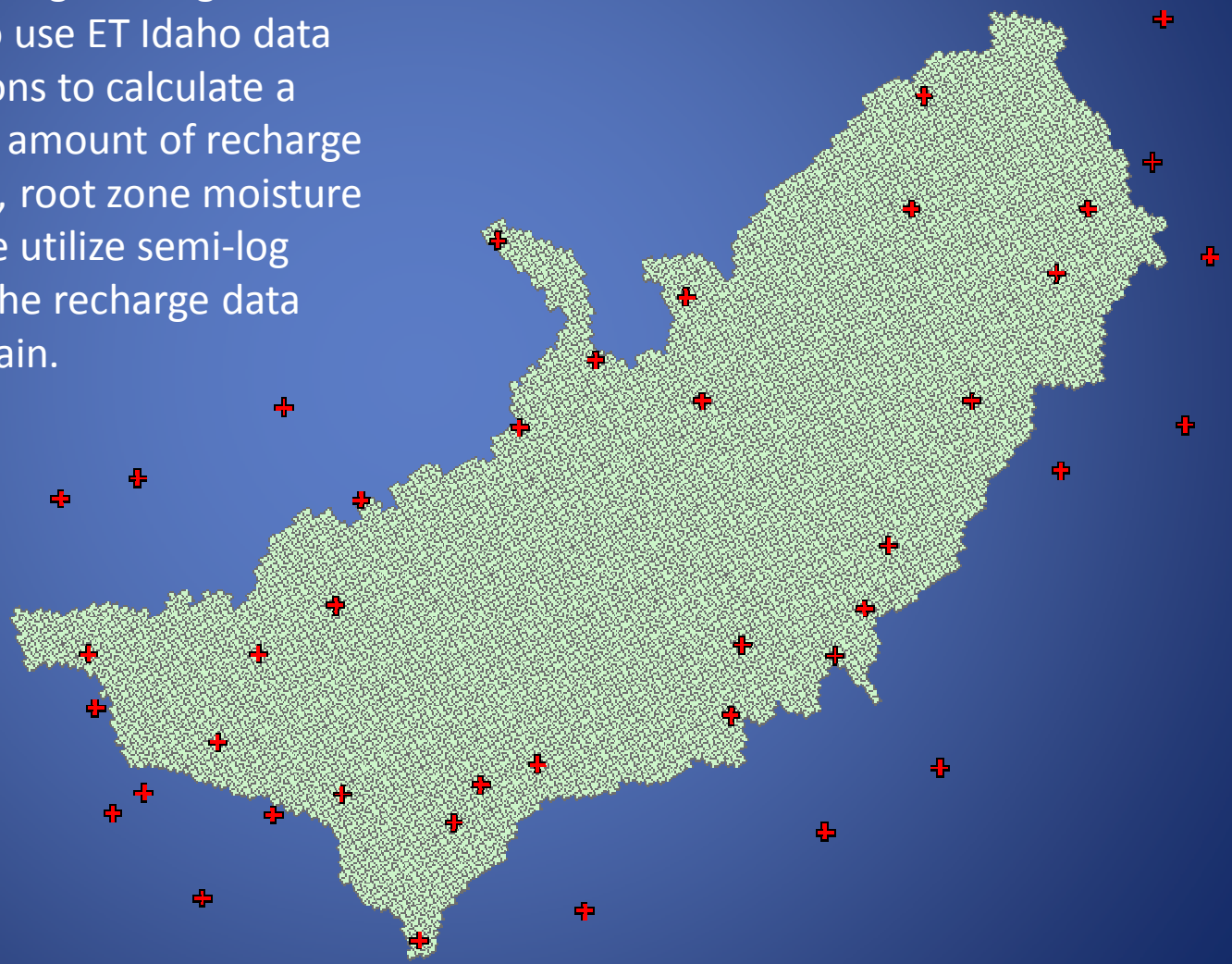
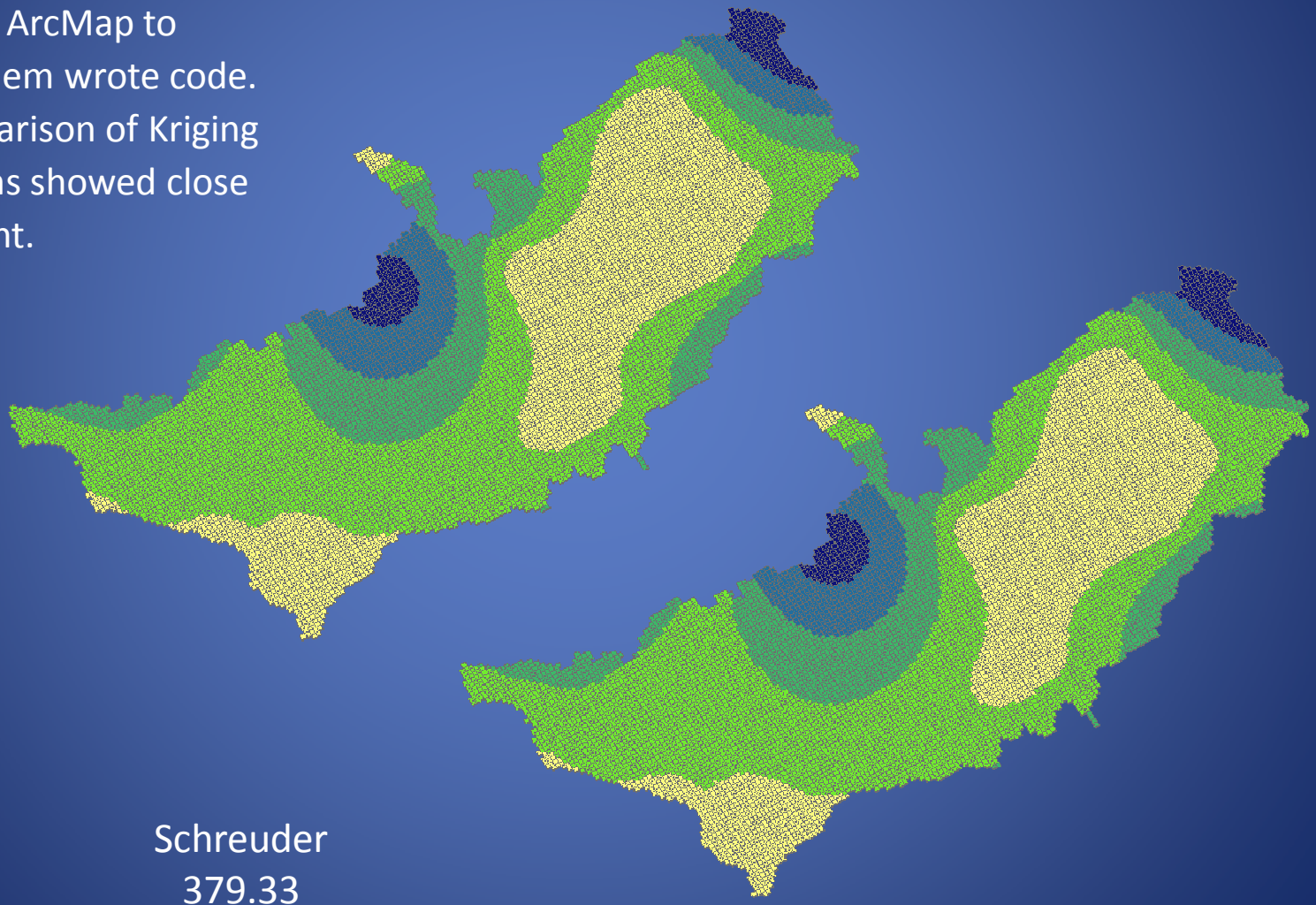
Recap - Our First Attempt at Calculating Recharge.

Our process for estimating recharge on non-irrigated land is to use ET Idaho data from 45 weather stations to calculate a proxy to represent the amount of recharge based on precipitation, root zone moisture and soil type. Then we utilize semi-log kriging to interpolate the recharge data across the model domain.



Recap - Interpolation with Kriging

- I employed Geostatistical Analyst in ArcMap to Krige, Willem wrote code.
- My comparison of Kriging algorithms showed close agreement.



McVay
381.65

Schreuder
379.33

Interpolation looked OK, but there were issues with calculating recharge

Recap - previous attempt generated three scenarios that confounded our process for estimating recharge.

$$Recharge = P - P\_rz \rightarrow Runoff + Dperc$$

There were three scenarios in the ET Idaho data that we needed to address.

1. Precipitation residing in root zone is negative.
    i. P – (-P_rz) results in abnormally large amount of recharge.

2. Precipitation residing in root zone is greater than gross precipitation.
    i. P – P_rz results in negative recharge value.

3. Dormant Turf precipitation residing in root zone is greater than that of Sage Brush.
    i. P – P_rz results in more recharge on Thick Soils than on Thin Soils and Lava.

Dr. Allen suggested an alternate proxy to estimate recharge.

Our New Attempt at Calculating Recharge.

We calculate the amount of recharge at each weather station using ET Idaho precipitation (P) and actual evapotranspiration (ETact) data. We represent recharge for the three general soil types of Thick Soil, Thin Soil and Lava Rock using the ET Idaho evapotranspiration data for Sage Brush (Thick) and Dormant Turf (Thin and Lava) covers.

For **THICK** and **THIN** Soils we use the following computation to calculate recharge (employing monthly Sage Brush and Dormant Turf data respectively).

$$Depletion_i = Depletion_{i-1} + ETact_i - P_i$$

Where:

Depletion = the end of month depletion of the "effective root zone" in month i or i-1.

ETact = Actual ET for month i.

P = Precipitation for month i.

And to calculate recharge:

If $Depletion_i < 0$ then

$Recharge_i = -Depletion_i$ and $Depletion_i$ is set to zero for use in next time step.

Else $Recharge_i = 0$

Our New Attempt at Calculating Recharge (continued).

For **LAVA**, we calculate recharge on a DAILY basis using the new method based on ETact and a storage term to represent adhesion of water to the rock. We use the following computation employing Dormant Turf data:

$$Depletion_i = Depletion_{i-1} + ETact - P_i$$

Where:

Depletion = the end of day depletion of the storage potential for day i or i-1.

ETact = Actual ET for day i.

P = Precipitation for day i.

and

If $Depletion_i > storage$ then

$Depletion_i = storage$

And to calculate recharge:

If $Depletion_i < 0$ then

$Recharge_i = -Depletion_i$ and $Depletion_i$ is set to zero for use in next time step.

Else $Recharge_i = 0$

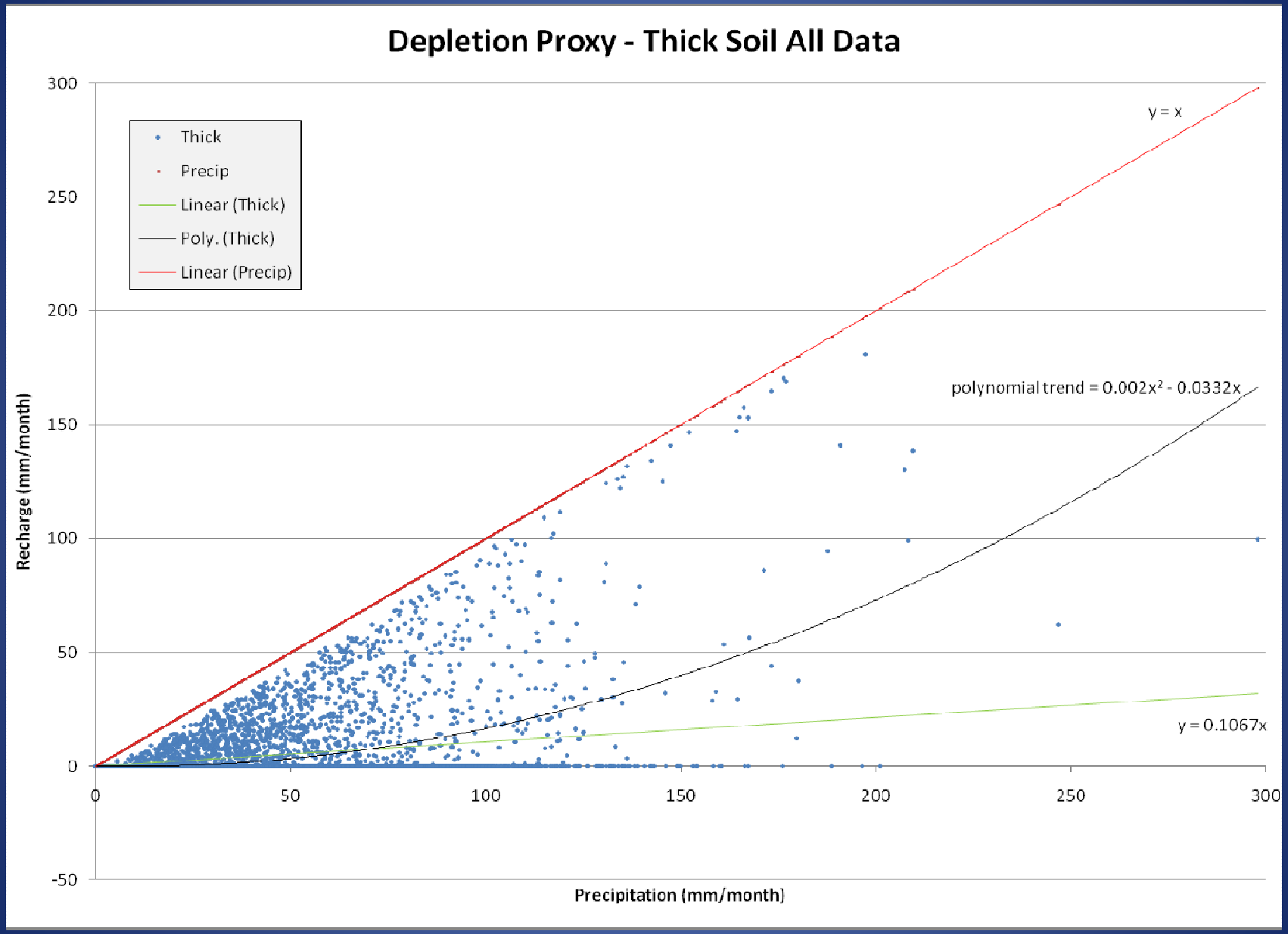
Some data concerns with the data from ET Idaho that erode confidence in this process for estimating recharge.

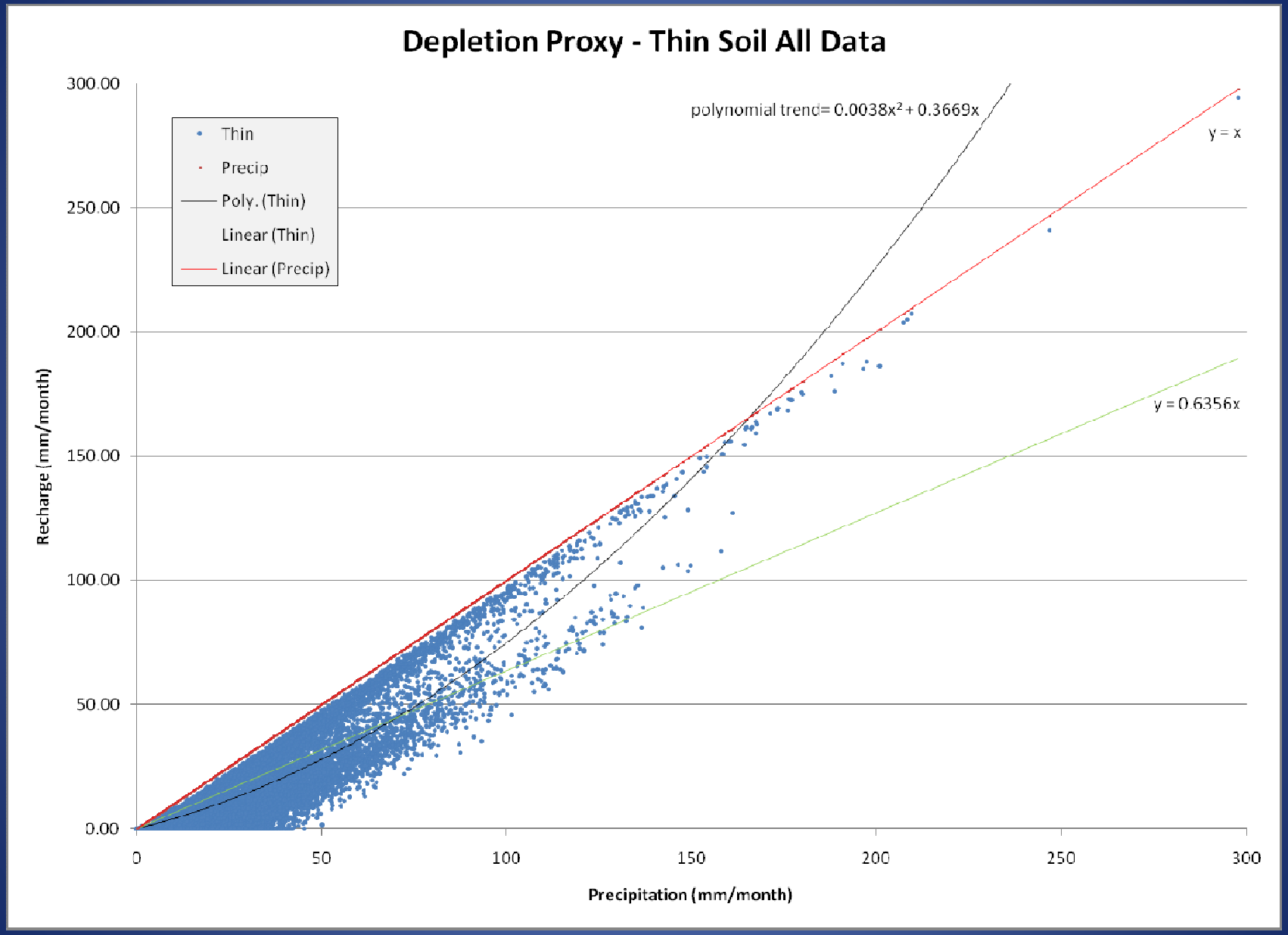
1. Some of the daily totals do not equal the monthly totals.
   i. Example of precipitation disparity at Aberdeen weather station May 1980.
   ii. Monthly data reports 2.79 mm/day (2.79 x 31 days is 86.49 mm/month) .
   iii. Summing daily data results in 88.2 mm/month (88.2/31 days is 2.85 mm/day).

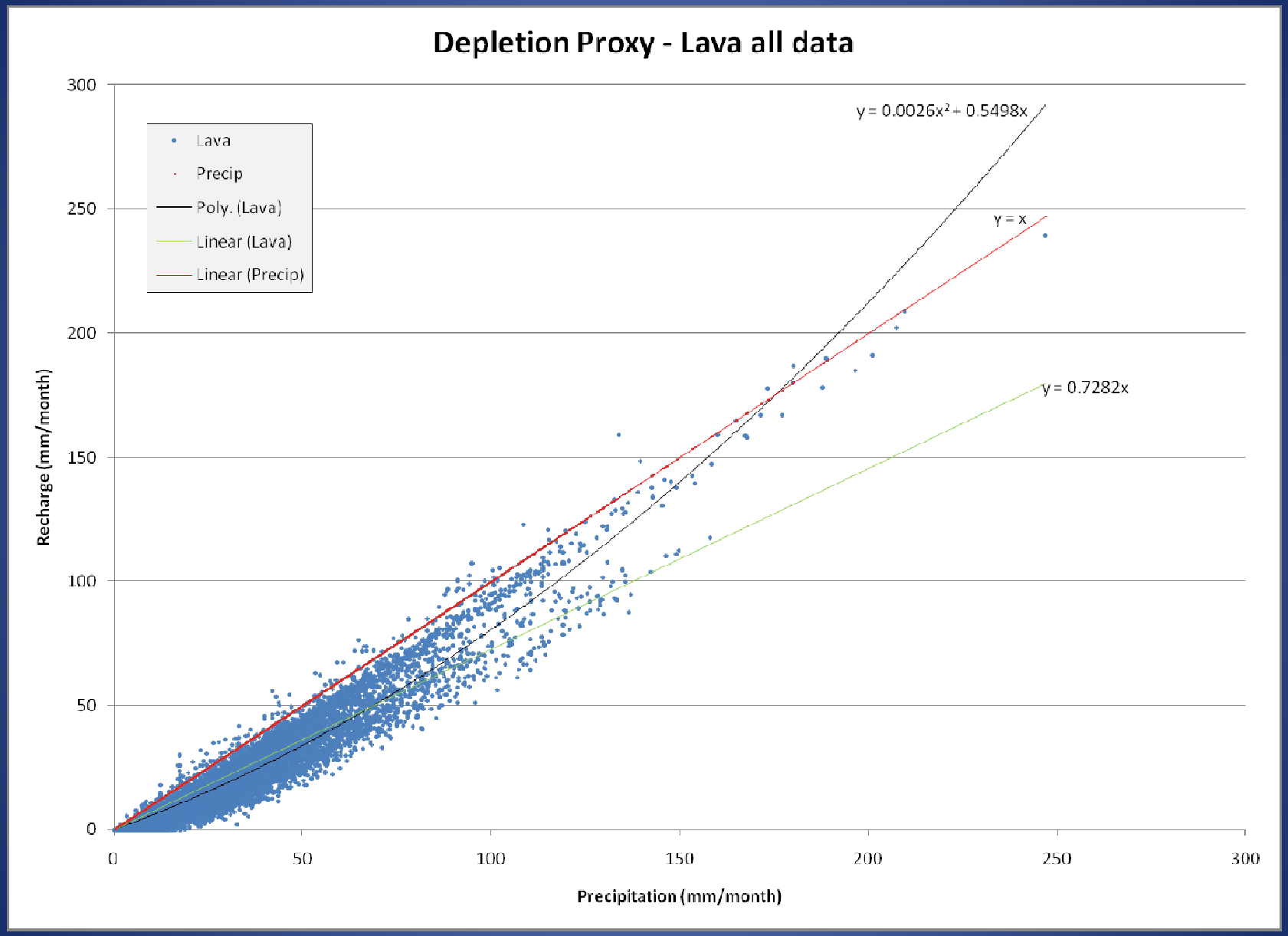
2. Some daily ETact values are negative.
   i. Small negative daily values; negative MONTHLY ETact values are never calculated.

3. This proxy still results in occasional calculated recharge values that are greater than precipitation for Lava soil cover.

More importantly, our proxy does not seem represent the physical system well enough for estimating recharge.


Depletion Proxy - Thick Soil All Data
Thick
Precip
Linear (Thick)
Poly. (Thick)
Linear (Precip)
y = x
polynomial trend = 0.002x² - 0.0332x
y = 0.1067x
Recharge (mm/month)
Precipitation (mm/month)
300
250
200
150
100
50
0
-50
0
50
100
150
200
250
300


Depletion Proxy - Thin Soil All Data
polynomial trend= 0.0038x² + 0.3669x
y = x
y = 0.6356x
Thin
Precip
Poly. (Thin)
Linear (Thin)
Linear (Precip)
Recharge (mm/month)
Precipitation (mm/month)
300.00
250.00
200.00
150.00
100.00
50.00
0.00
0
50
100
150
200
250
300


Depletion Proxy - Lava all data
Lava
Precip
Poly. (Lava)
Linear (Lava)
Linear (Precip)
y = 0.0026x² + 0.5498x
y = x
y = 0.7282x
Recharge (mm/month)
Precipitation (mm/month)
0
50
100
150
200
250
300

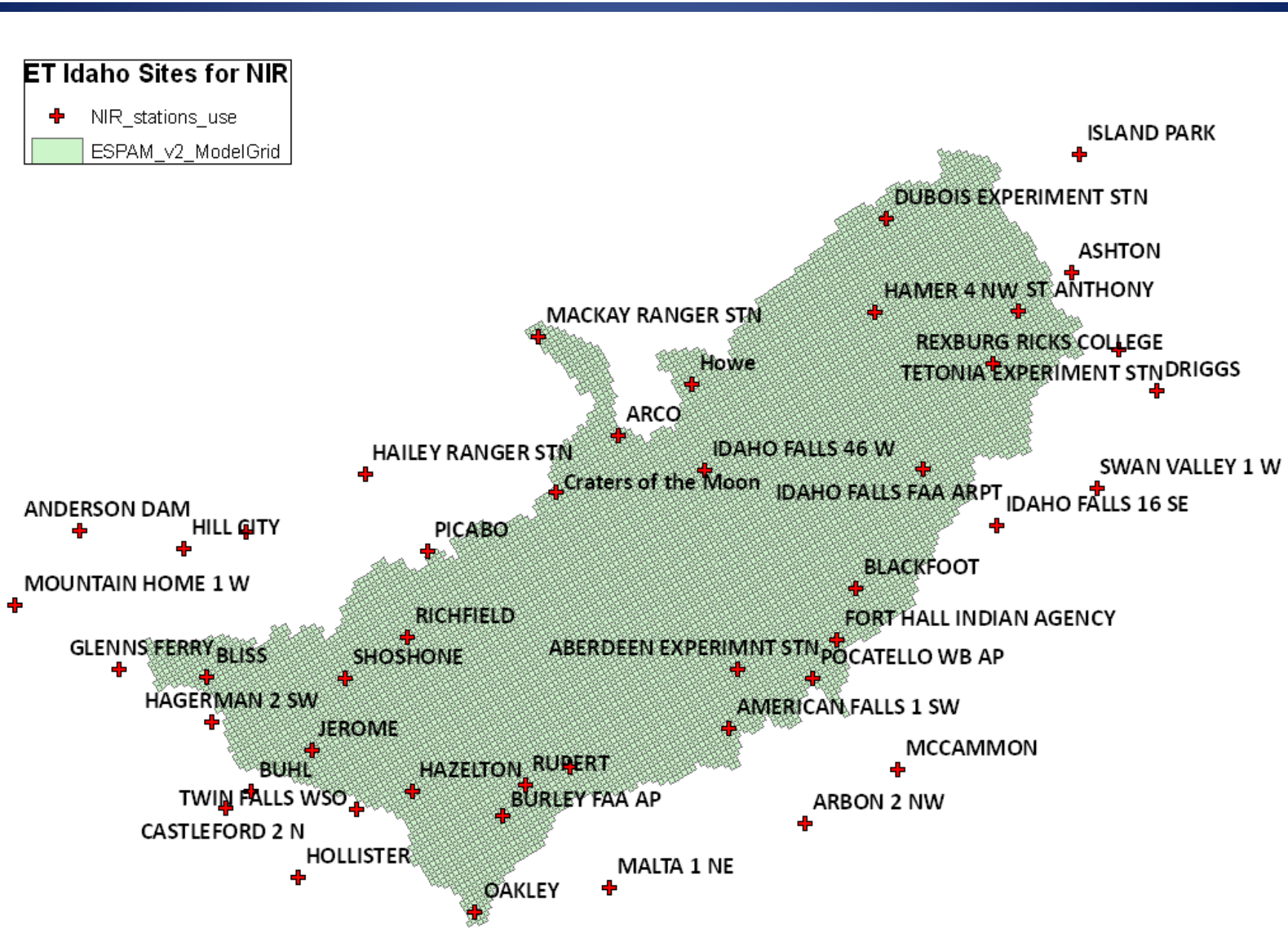
Recharge Calculation Summary

- It appears that the Dormant Turf method may not be an adequate proxy for recharge on non-irrigated land.
- ET Idaho data and code should be checked to determine the magnitude/significance of the negative ETact values and the precipitation totals disparity.

Recommendations:

- Employ ESPAM 1.1 method for estimating recharge on non-irrigated land for ESPAM 2.0.
- Continue to investigate algorithms for recharge on non-irrigated land for future versions of the model.

Any Questions?


ET Idaho Sites for NIR
NIR_stations_use
ESPAM_v2_ModelGrid
ISLAND PARK
DUBOIS EXPERIMENT STN
ASHTON
HAMER 4 NW
ST ANTHONY
MACKAY RANGER STN
REXBURG RICKS COLLEGE
Howe
TETONIA EXPERIMENT STN
DRIGGS
ARCO
HAILEY RANGER STN
IDAHO FALLS 46 W
SWAN VALLEY 1 W
Craters of the Moon
IDAHO FALLS FAA ARPT
IDAHO FALLS 16 SE
ANDERSON DAM
HILL CITY
PICABO
BLACKFOOT
MOUNTAIN HOME 1 W
RICHFIELD
FORT HALL INDIAN AGENCY
GLENNS FERRY
BLISS
SHOSHONE
ABERDEEN EXPERIMNT STN
POCATELLO WB AP
HAGERMAN 2 SW
AMERICAN FALLS 1 SW
JEROME
MCCAMMON
BUHL
HAZELTON
RUPERT
TWIN FALLS WSO
BURLEY FAA AP
ARBON 2 NW
CASTLEFORD 2 N
HOLLISTER
MALTA 1 NE
OAKLEY