10/05/2015

Phase-6 Watershed Model Updates

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- Phase-6 prototype was revised since July version, and was presented at the Modeling Workgroup's September Call.

- Further changes were made to include:
    - Revised wetland land-use classes
    - New canopy cover land-use classes
    - Minor revisions to land-river segmentations
    - Receiving *riparian pasture deposition* loads

from July Quarterly

5.3 Spatially variable lag-time

- The USGS sampled 46 springs between 1996-1997. Chemical isotopic tracers were used for estimating the ages of groundwater.

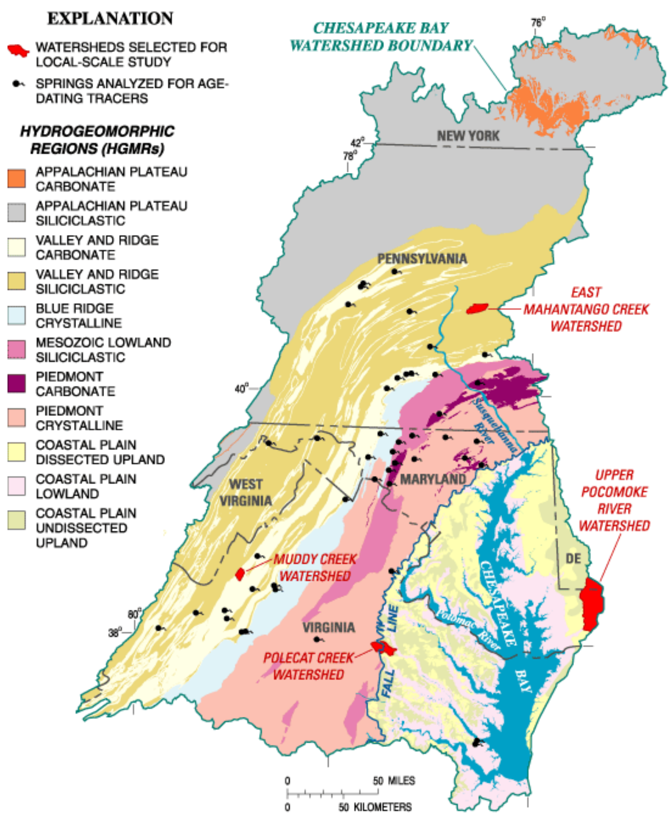


Figure 2. Location of springs and local-scale watersheds sampled in different hydrogeomorphic regions (HGMRs) in the Chesapeake Bay watershed (modified from Lindsey and others, 2003).

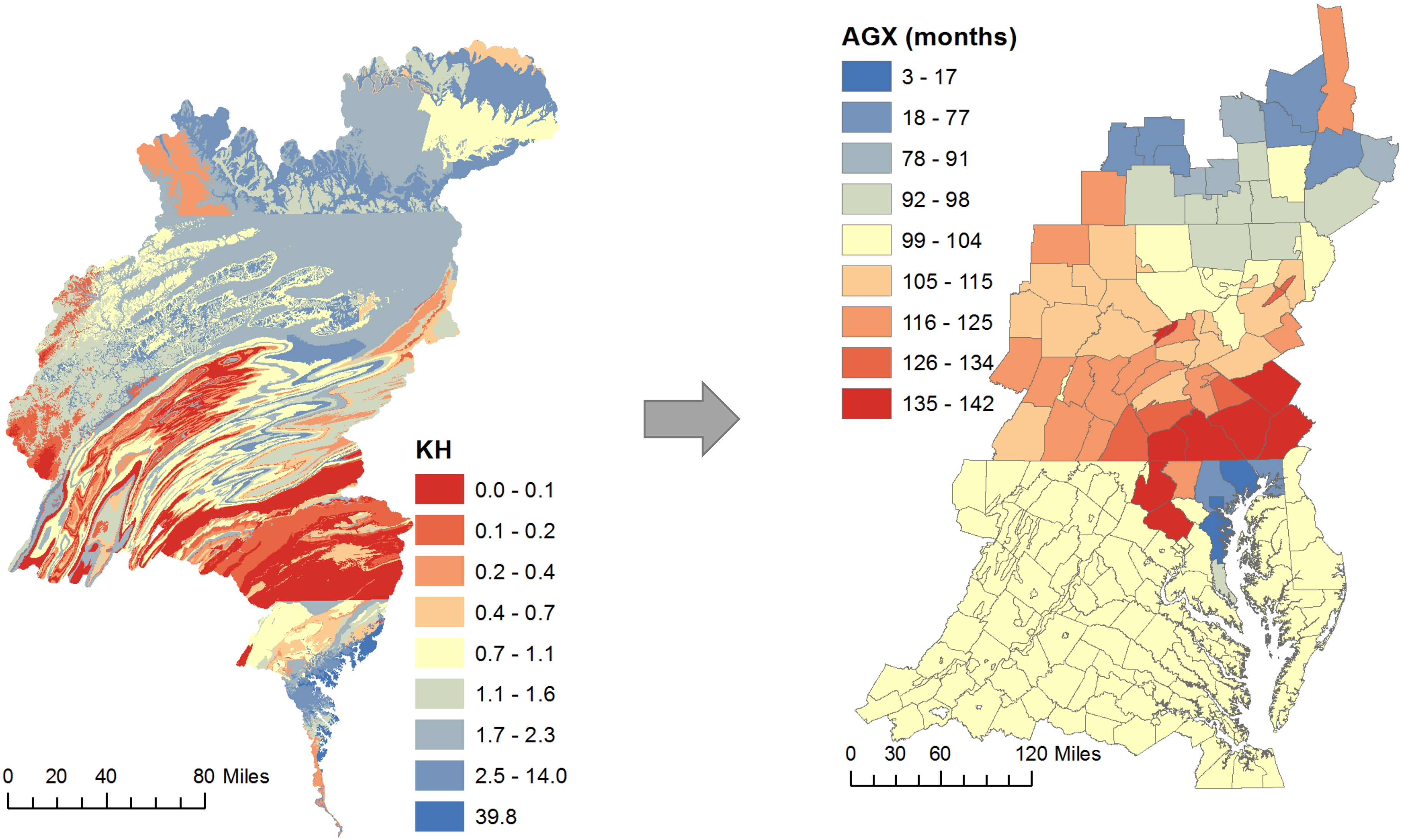
- "The median age of all samples was 10 years, with 25 percent of the samples having an age of 7 years or less and 75 percent of the samples having an age of up to 13 years."

- The study did not find differences in age between the HGRMs.

Phillips and Lindsey, http://md.water.usgs.gov/publications/fs-091-03/html/

from July Quarterly

5.3 Spatially variable lag-time



Weibull Equation for Fitting Base-Flow Age Distributions

$$CF = 1 - \exp(-K(t - t_o)^n)$$

CF = the cumulative fraction of the base flow

K = the time constant $[t^{-1}]$ = 1/(median travel time)

t_o = 1 year = the minimum travel time in the distribution

n = exponent that controls the slope of the distribution

n = 1 (exponential)

n < 1 (flatter than exponential)

n > 1 (steeper than exponential)

Sanford, 2015

Weighted Weibull Equation

subscripts E and L stand for early and late time

$$CF_E = 1 - \exp\left(- K_E (t - t_o)^{n_E}\right)$$

$$CF_L = 1 - \exp\left(- K_L (t - t_o)^{n_L}\right)$$

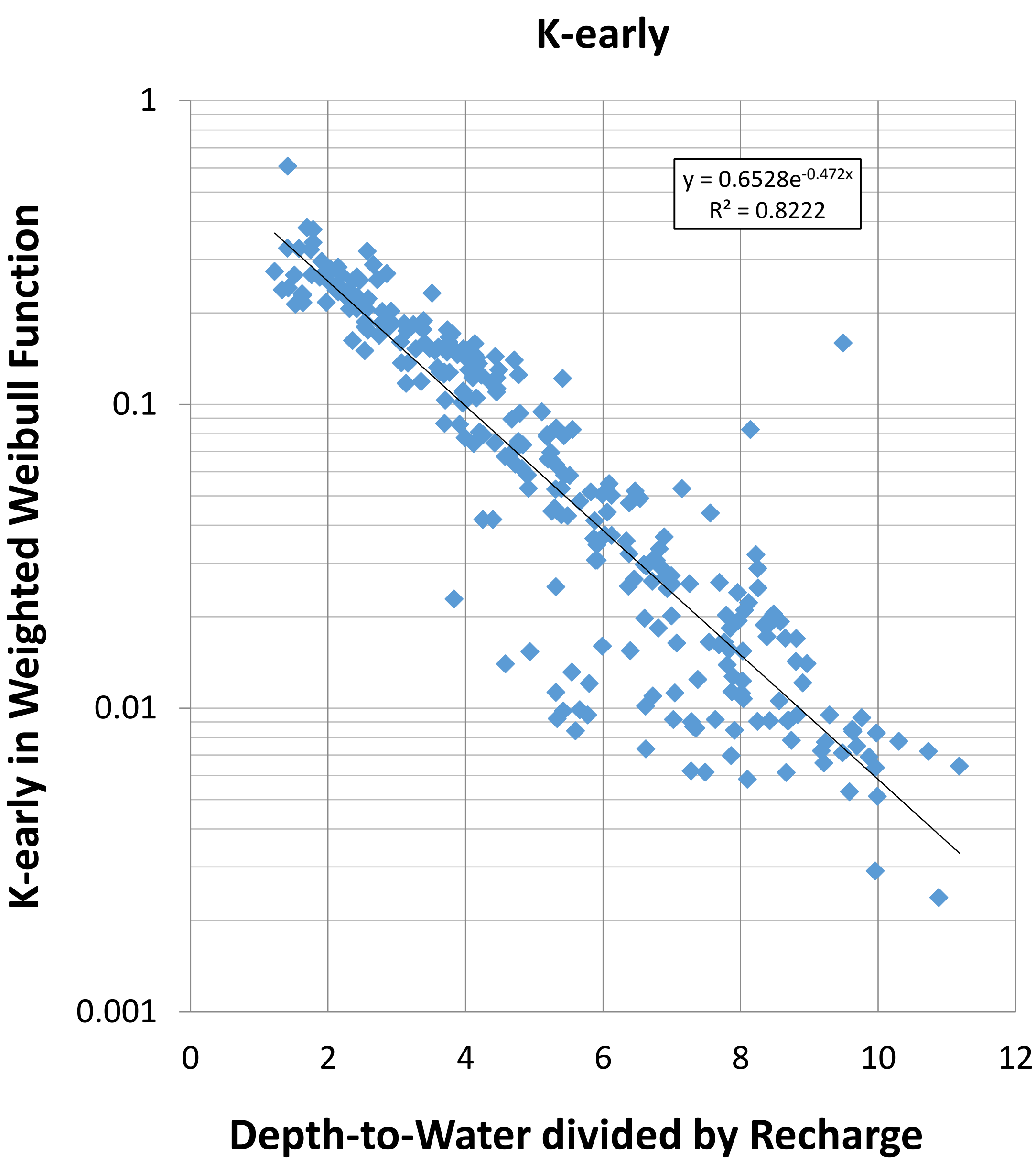
the two are weighted linear by early and late flows

so $CF = (1\text{-}CF)*CF_E + CF*CF_L$

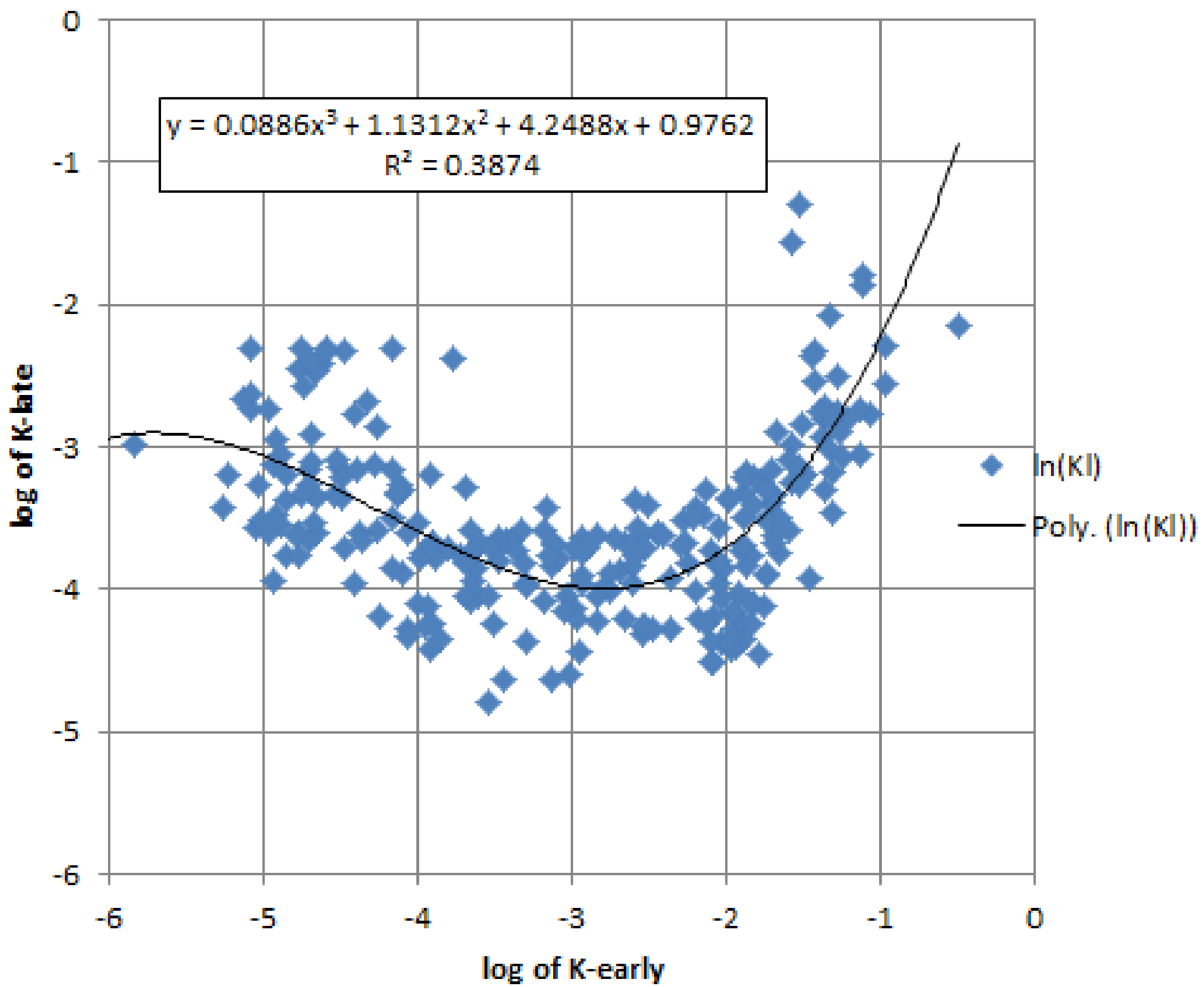
or $CF = CF_E/(1+CF_E-CF_L)$

note that if $K_E = K_L$ and $n_E = n_L$ then $CF_E = CF_L$ and the equations collapse to one unweighted Weibull equation

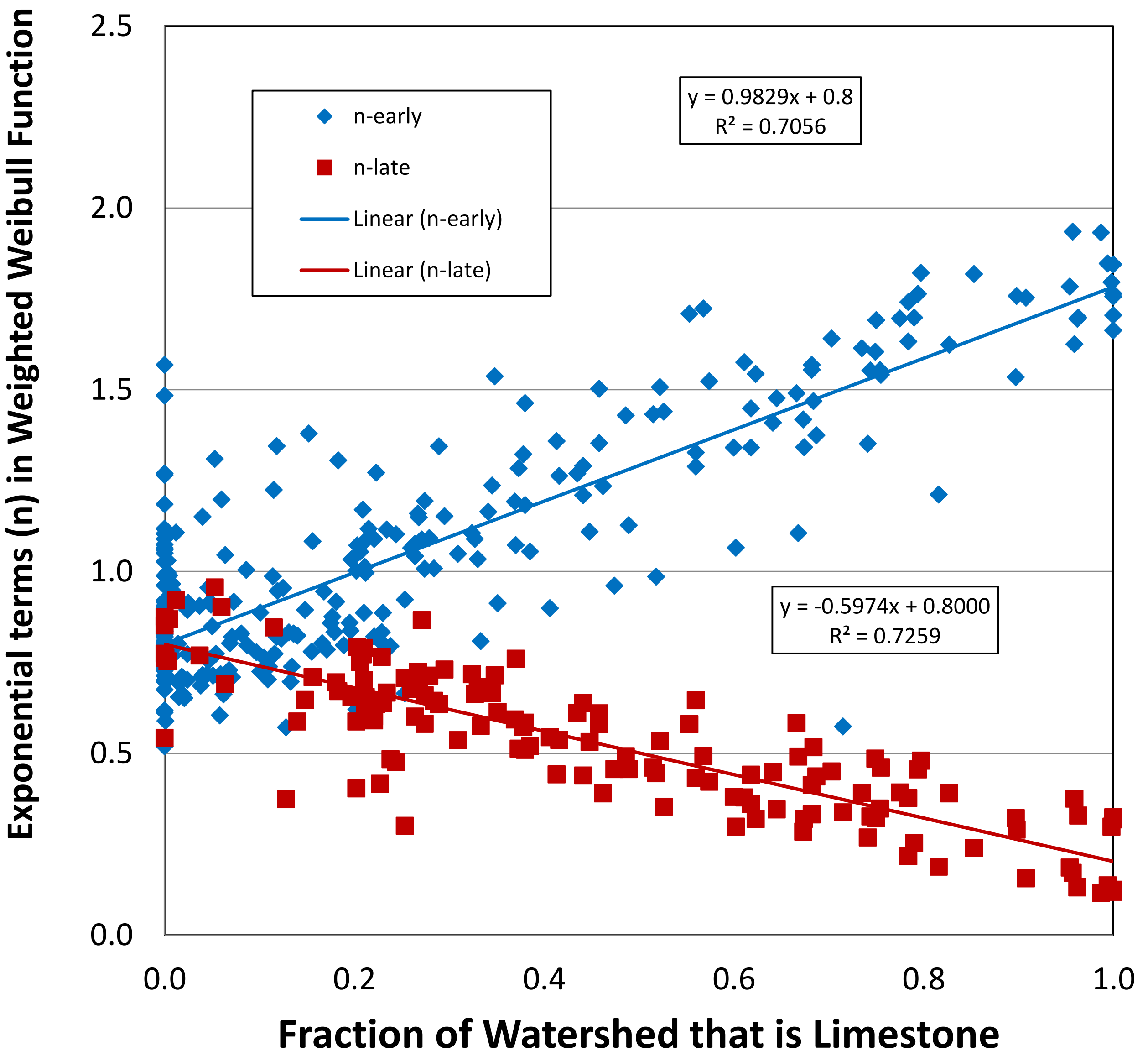
Sanford, 2015



Sanford, 2015

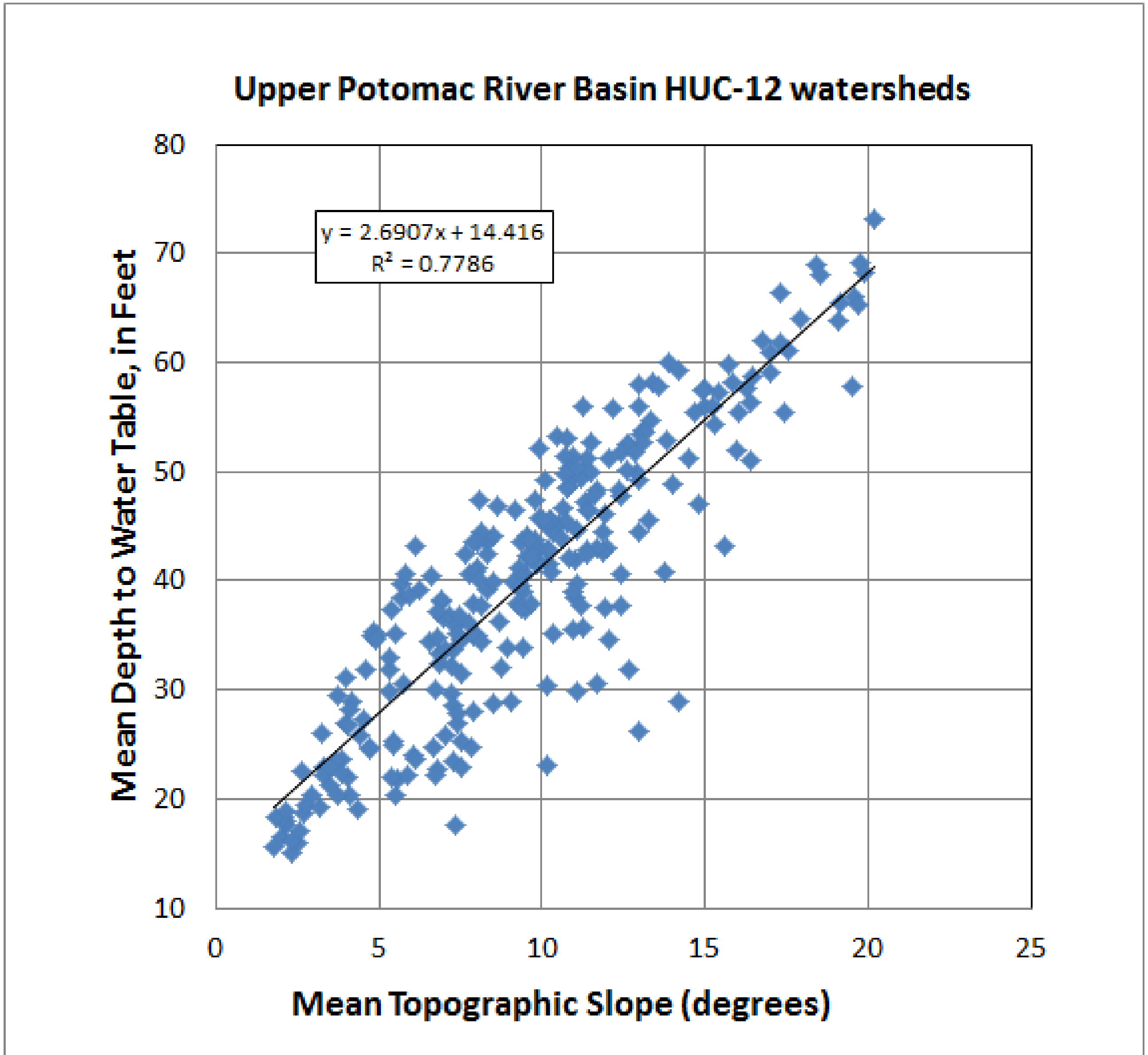


Sanford, 2015

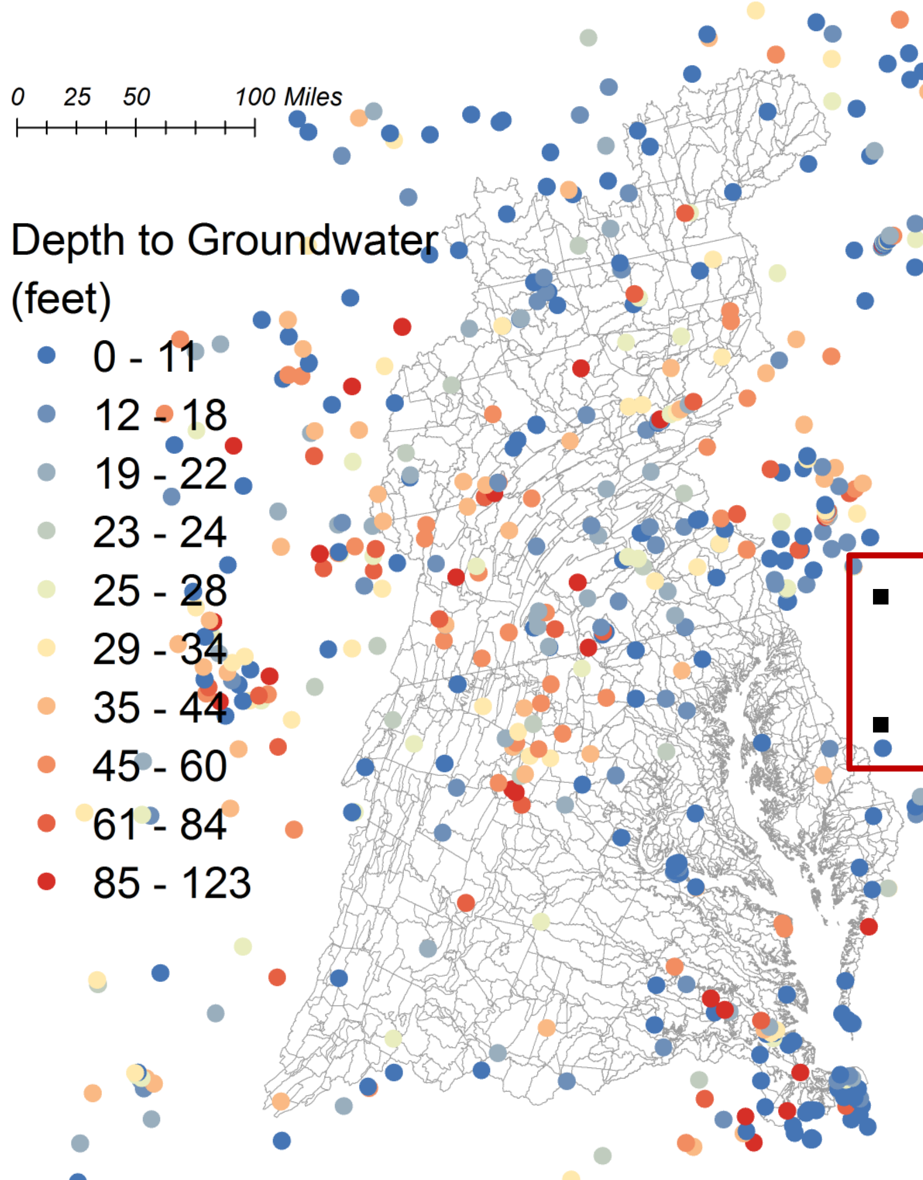


Sanford, 2015

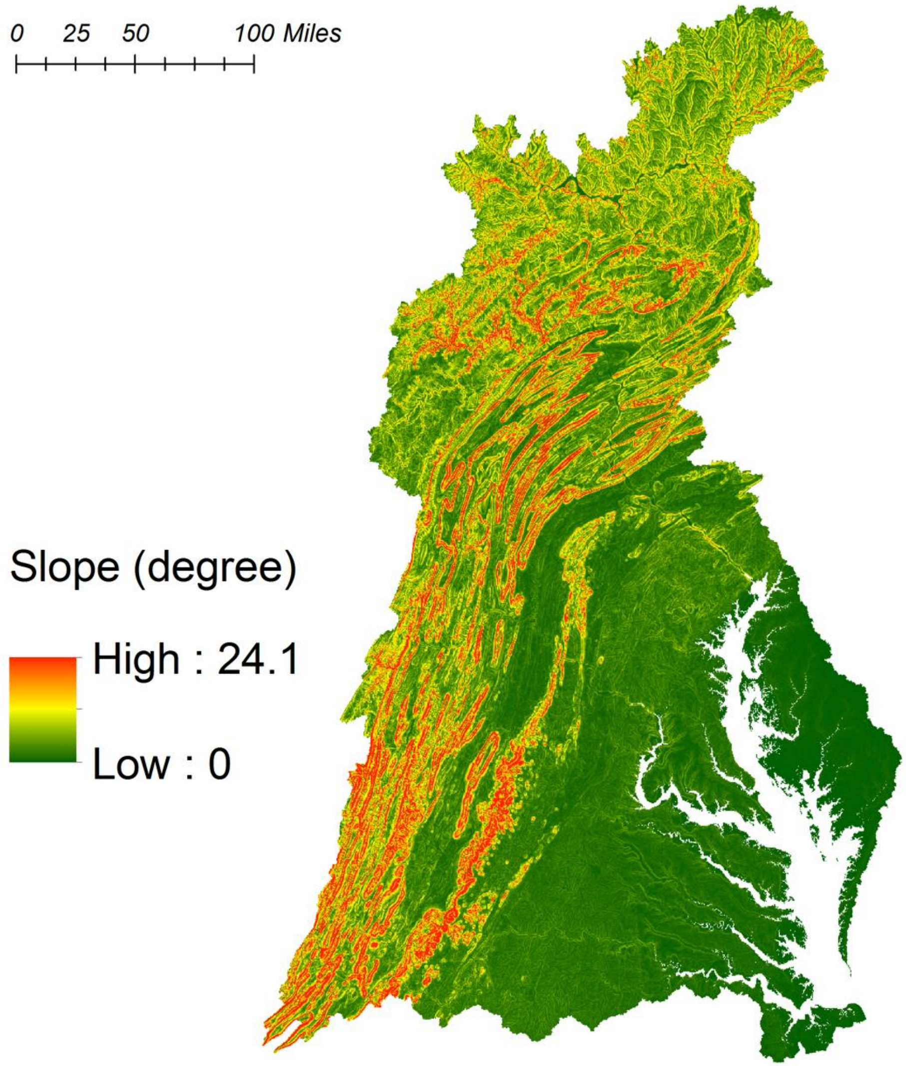
Sanford shows a relationship between topographic slope and average depth to water table.

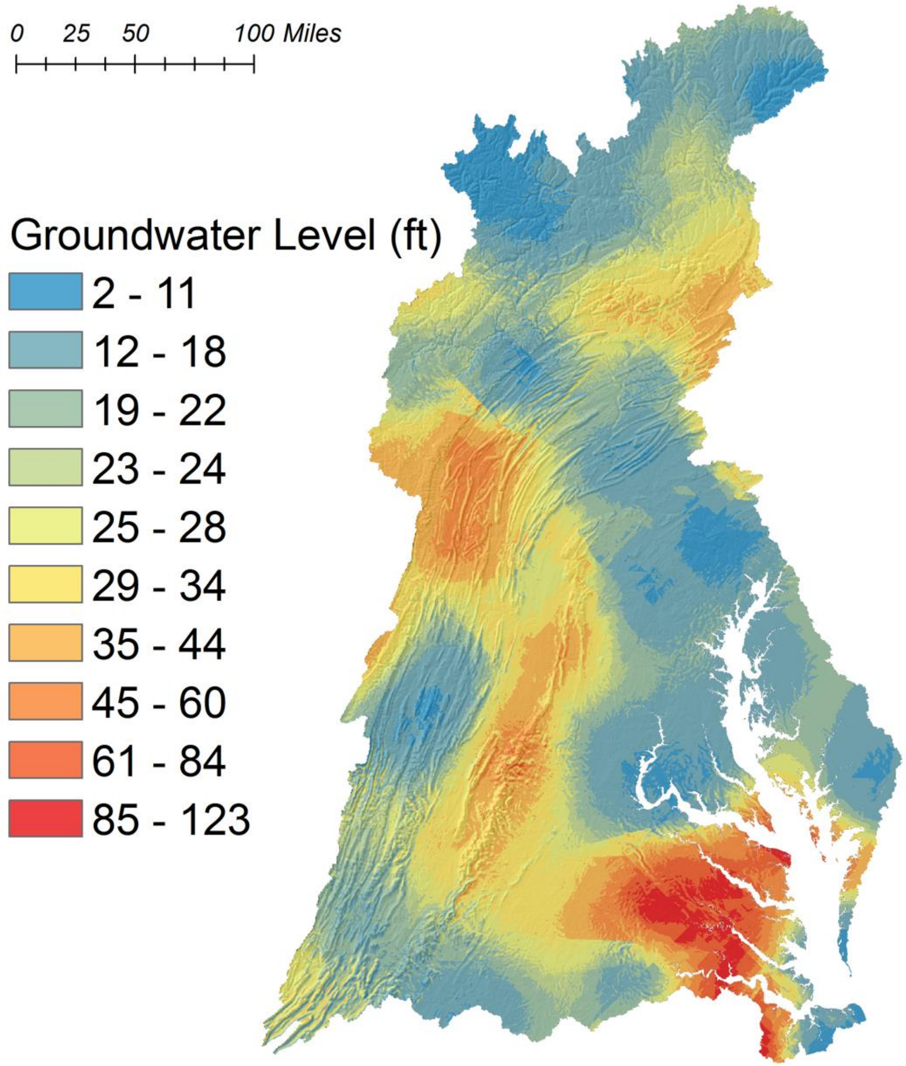


Groundwater Level Observations



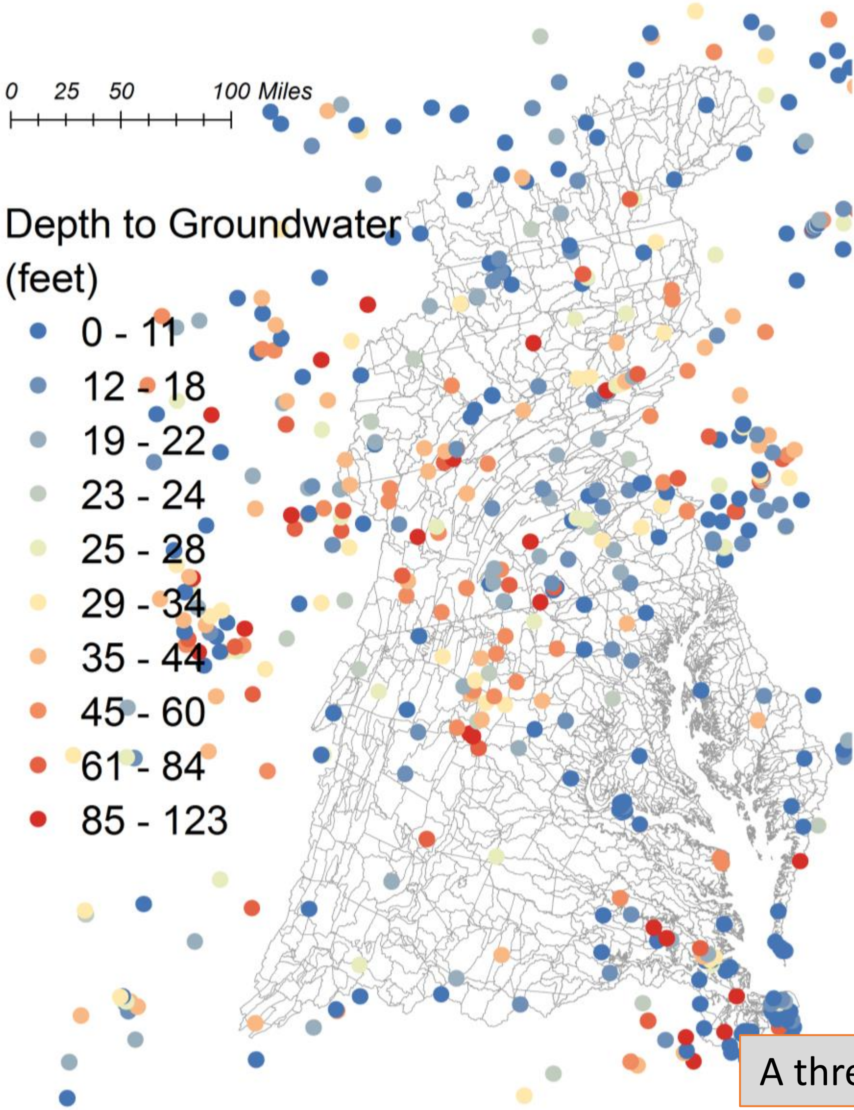
- 817 monitoring stations in the region
- 384 falls in the Chesapeake Watershed


0 25 50 100 Miles
Slope (degree)
High : 24.1
Low : 0

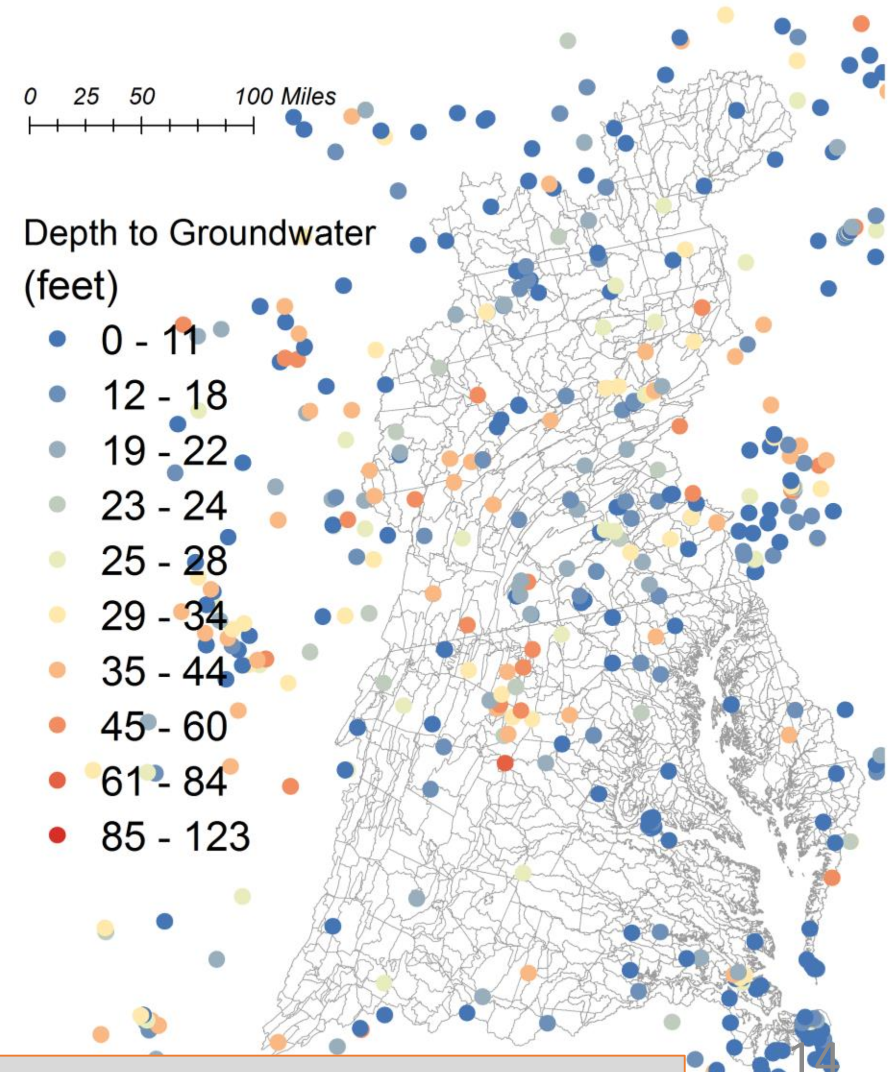

0
25
50
100 Miles
Groundwater Level (ft)
2 - 11
12 - 18
19 - 22
23 - 24
25 - 28
29 - 34
35 - 44
45 - 60
61 - 84
85 - 123

Groundwater Level Observations

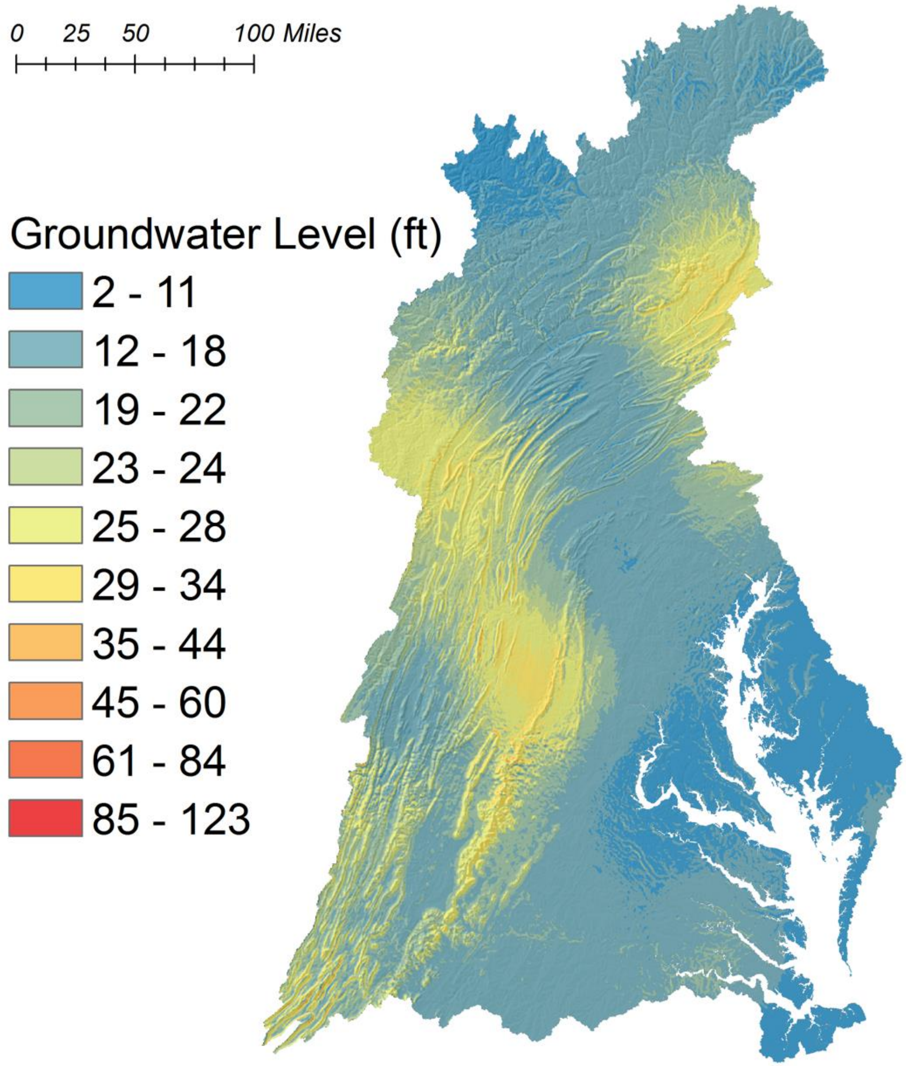
All observation wells



Selected observation wells



A threshold of 75 ft for well/hole depth was applied.


0 25 50 100 Miles
Groundwater Level (ft)
2 - 11
12 - 18
19 - 22
23 - 24
25 - 28
29 - 34
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85 - 123