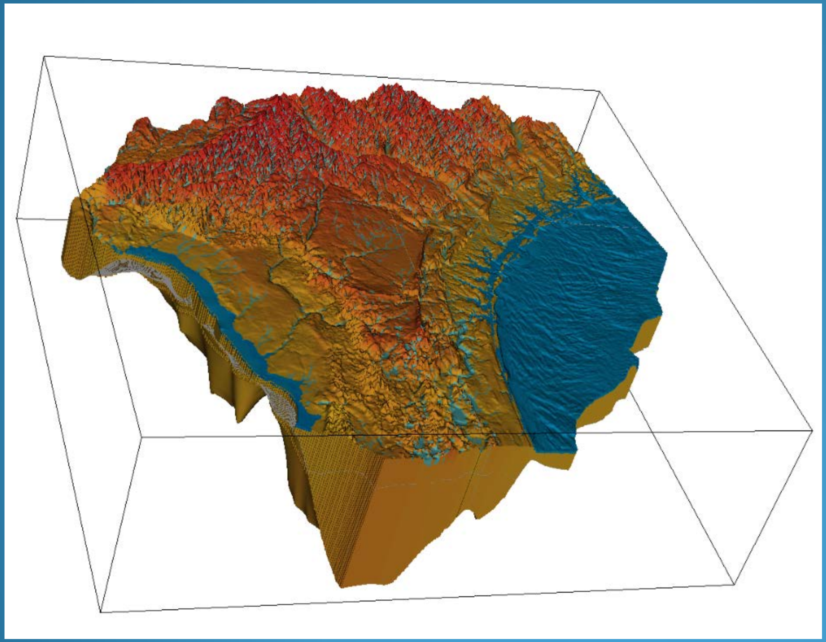
NFSEG Version 1.1 Traditional Sensitivity Analysis and Composite-Scaled Sensitivities



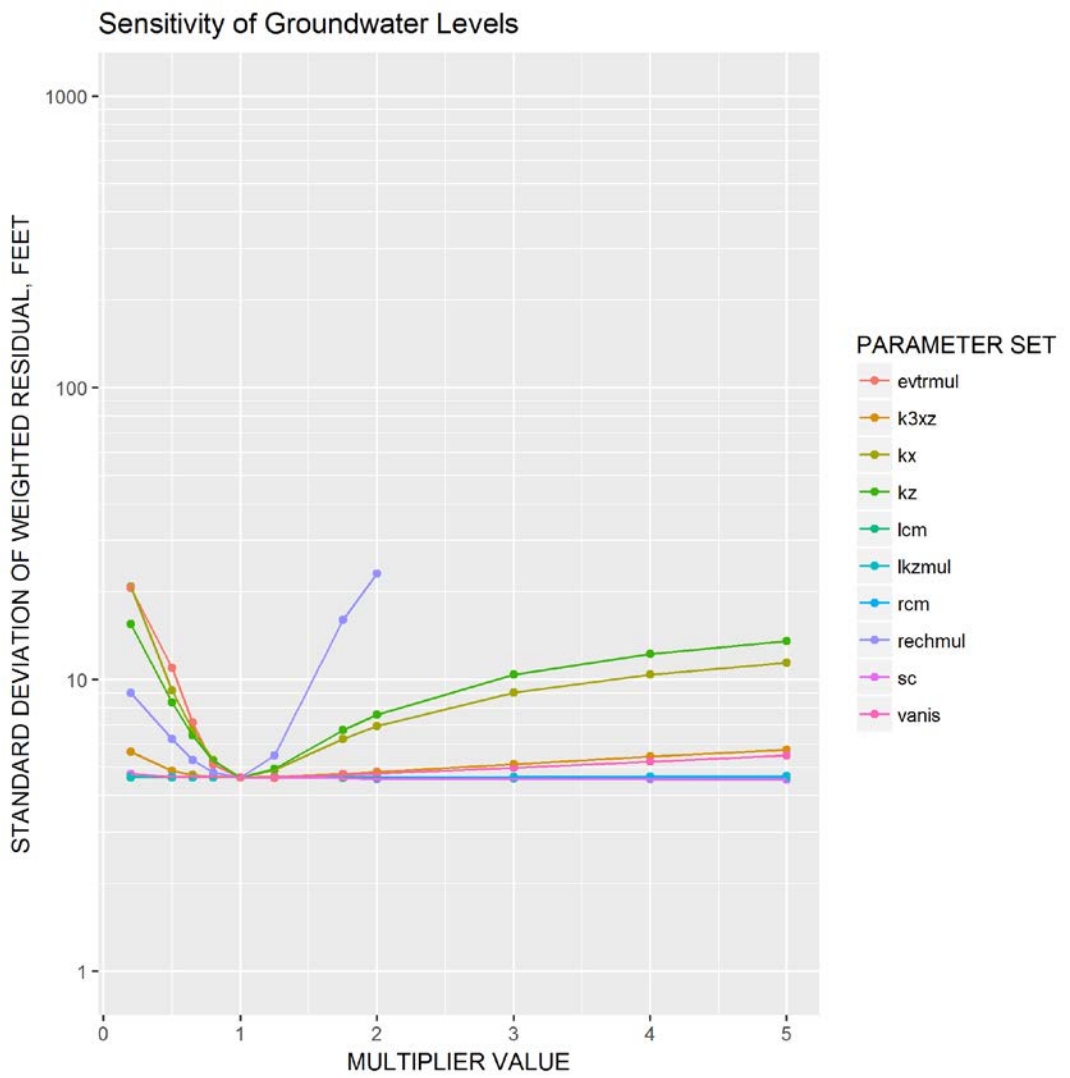
April 18, 2018

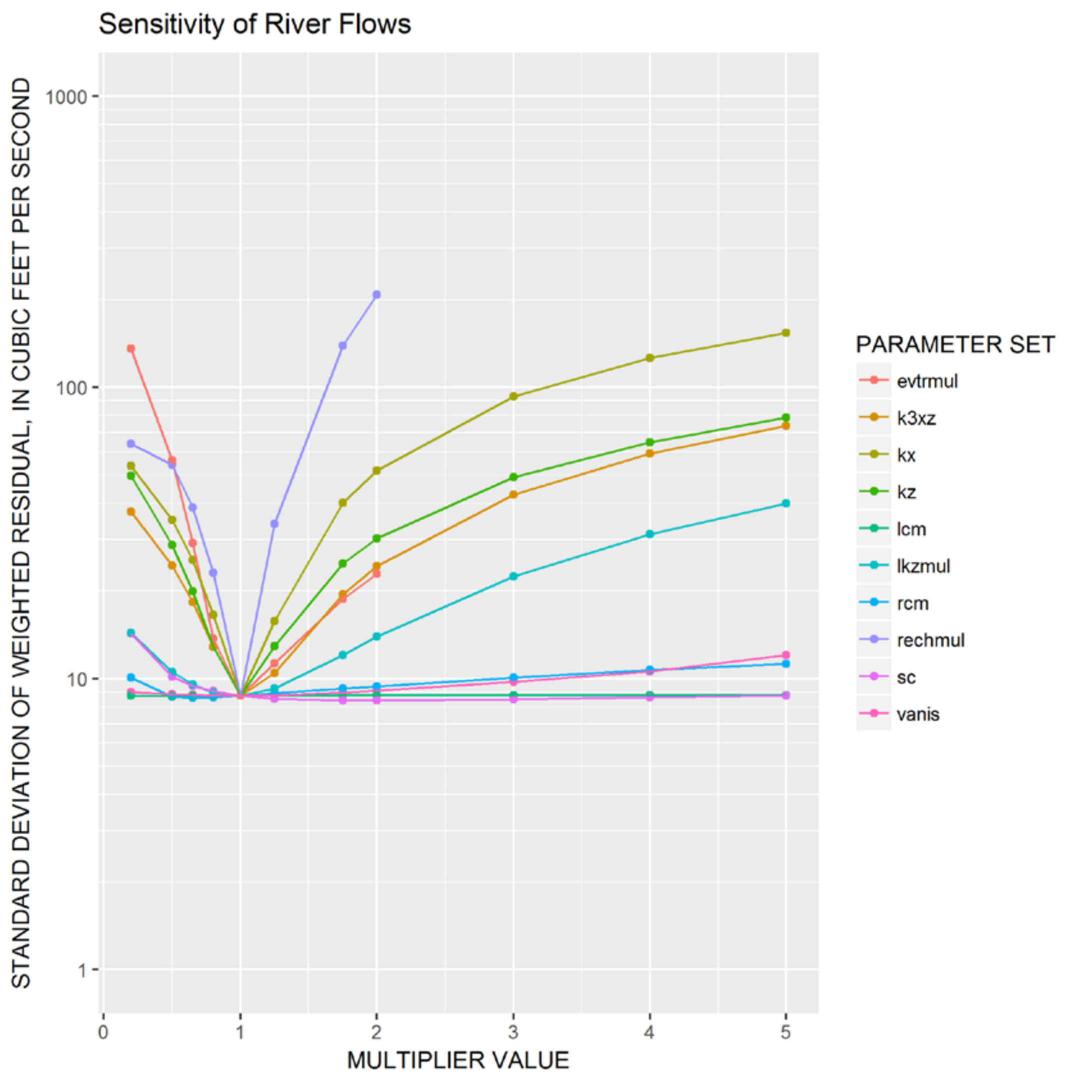
Objective and Background

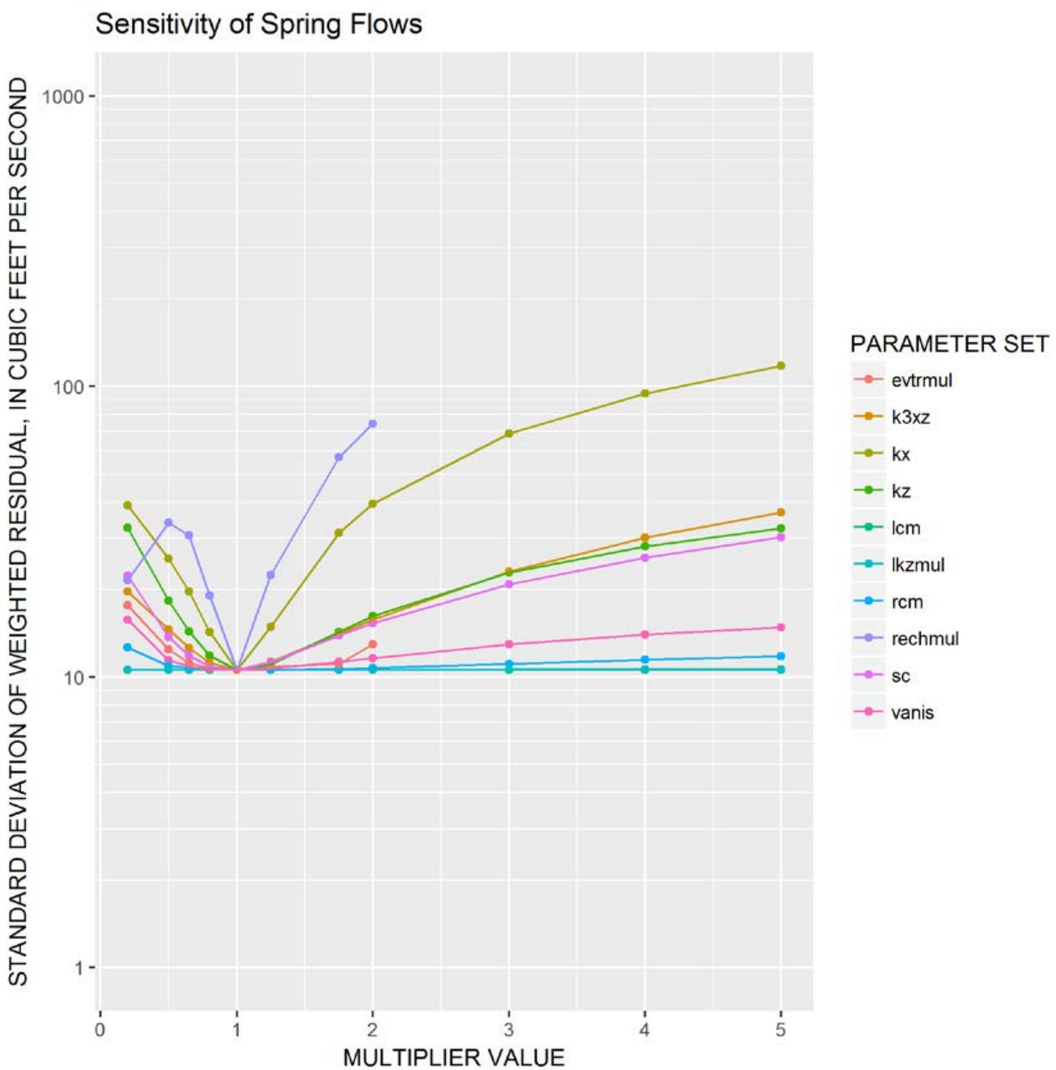
- Evaluate sensitivity of model parameters
  - **Traditional Sensitivity Analysis**:
    - PEST parameter groups organized into sets of related groups
    - Evaluate change in model response to variations in sets of parameter groups
    - Model response quantified as standard deviation and mean of weighted residuals
    - Required > 100 simulations
  - **Composite-scaled sensitivities**:
    - Aggregate measure of sensitivity of a given parameter to sum of weighted observations
    - Scaled by calibrated value of parameter

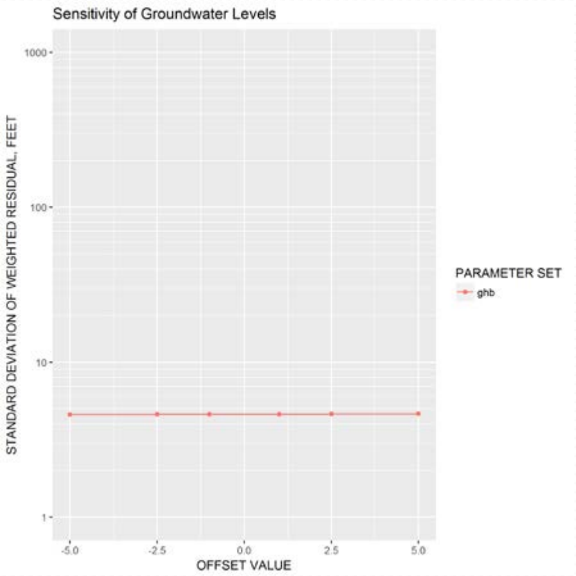
Parameter Groups

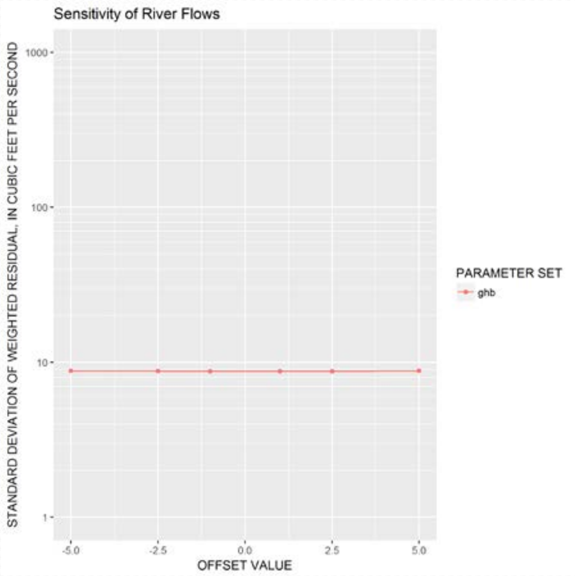
Parameter Set Name	Description
kx	Horizontal hydraulic conductivity pilot points in layers 1, 3, 5, and 7
kz	Vertical hydraulic conductivity pilot points in layers 2, 4, and 6
k3xz	Vertical hydraulic conductivity multipliers in layers 2, 4, and 5 where the middle confining unit of the Floridan aquifer system is assumed to be absent
vanis	Vertical anisotropy for each layer
lcm	Lakebed conductance multipliers
rcm	Riverbed conductance multipliers
sc	Spring conductance multipliers for each spring
rechmul	Recharge multipliers
evtrmul	Maximum saturated evapotranspiration rate multipliers
lkzmul	Vertical hydraulic conductivity conductance multipliers beneath lakes
ghb	GHB lateral source heads

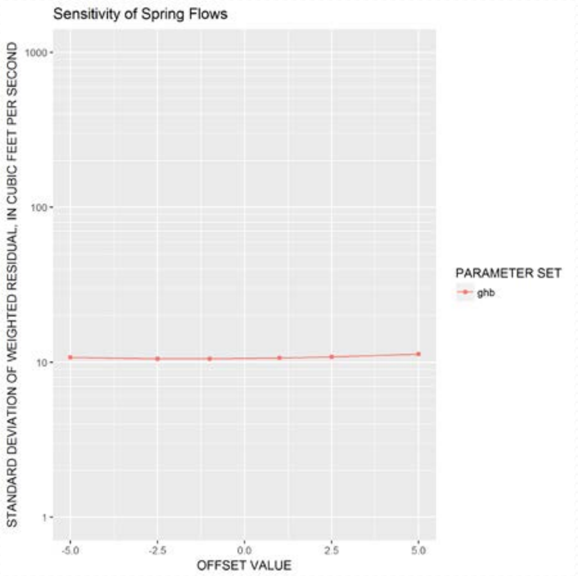

Sensitivity of Groundwater Levels
1000
100
10
1
STANDARD DEVIATION OF WEIGHTED RESIDUAL, FEET
0
1
2
3
4
5
MULTIPLIER VALUE
PARAMETER SET
evtrmul
k3xz
kx
kz
lcm
lkzmul
rcm
rechmul
sc
vanis


Sensitivity of River Flows
STANDARD DEVIATION OF WEIGHTED RESIDUAL, IN CUBIC FEET PER SECOND
1000
100
10
1
0
1
2
3
4
5
MULTIPLIER VALUE
PARAMETER SET
evtrmul
k3xz
kx
kz
lcm
lkzmul
rcm
rechmul
sc
vanis


Sensitivity of Spring Flows
STANDARD DEVIATION OF WEIGHTED RESIDUAL, IN CUBIC FEET PER SECOND
1000
100
10
1
0
1
2
3
4
5
MULTIPLIER VALUE
PARAMETER SET
evtrmul
k3xz
kx
kz
lcm
lkzmul
rcm
rechmul
sc
vanis


Sensitivity of Groundwater Levels
STANDARD DEVIATION OF WEIGHTED RESIDUAL, FEET
1000
100
10
1
-5.0
-2.5
0.0
2.5
5.0
OFFSET VALUE
PARAMETER SET
ghb


Sensitivity of River Flows
STANDARD DEVIATION OF WEIGHTED RESIDUAL, IN CUBIC FEET PER SECOND
1000
100
10
1
-5.0
-2.5
0.0
2.5
5.0
OFFSET VALUE
PARAMETER SET
ghb


Sensitivity of Spring Flows
STANDARD DEVIATION OF WEIGHTED RESIDUAL, IN CUBIC FEET PER SECOND
1000
100
10
1
-5.0
-2.5
0.0
2.5
5.0
OFFSET VALUE
PARAMETER SET
ghb

Traditional Sensitivity Summary

- Groundwater Levels:
  - most sensitive to recharge, Kh, Kz, and ETmax multipliers
- Baseflows:
  - most sensitive to changes in recharge, Kh, ETmax, Kz, and conductance multipliers beneath lakes (for multipliers > 1.25)
- Simulated springflows were most sensitive to changes in recharge, Kh, Kv, and spring conductance

Composite Scaled Sensitivities

Parameter group values were computed for four sets of observations:

- All observations combined
- All groundwater level observations
- Spring flow observations
- All river baseflow observations

$$css_i = \sum_{j=1}^{N} \left| \frac{\partial y_j}{\partial k_i} \right| k_i w_j$$

where:

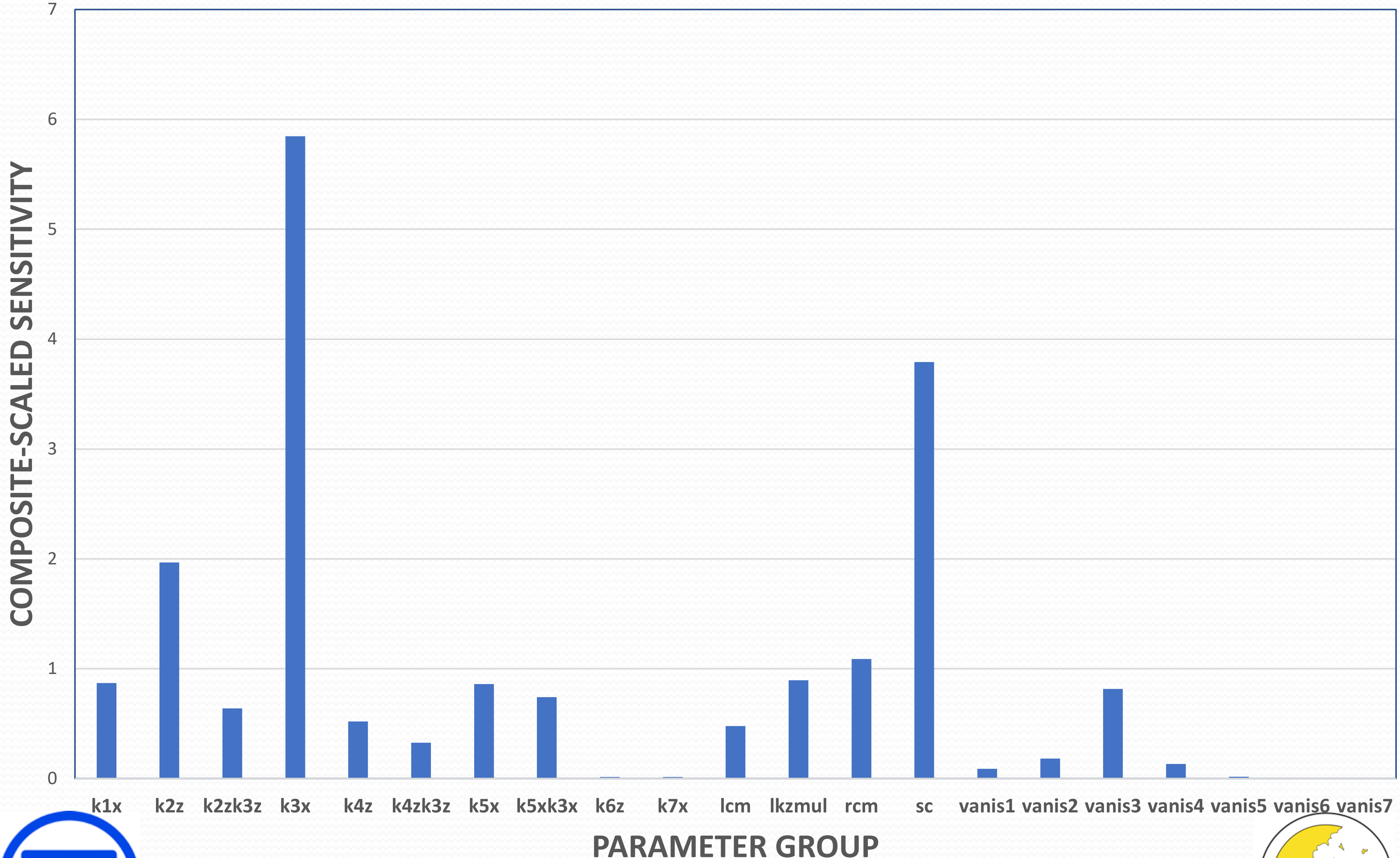
css_i : composite-scaled sensitivity for PEST parameter, k_i

N : total number of observations,

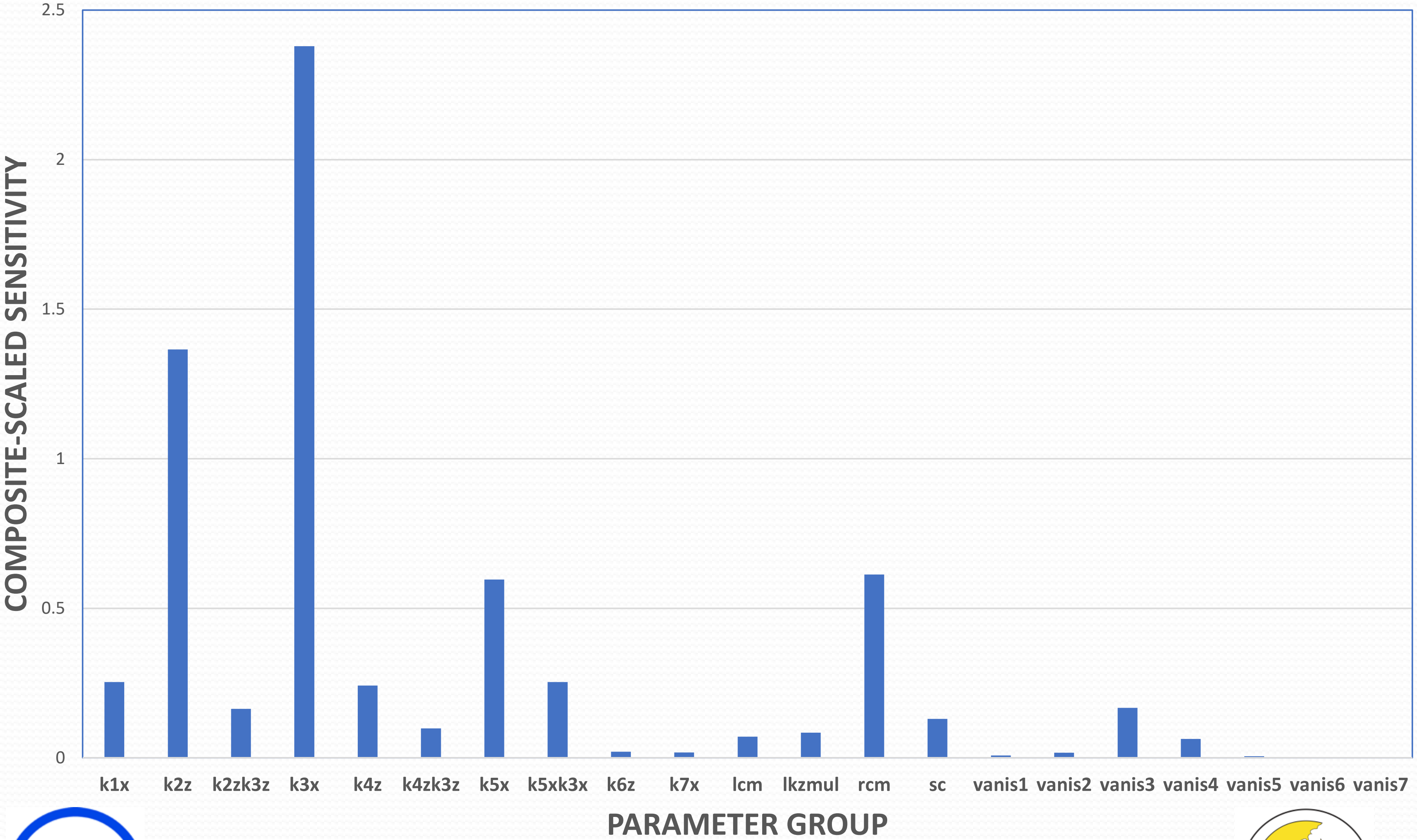
$\frac{\partial y_j}{\partial k_i}$: sensitivity of observation, y_j, with respect to parameter, k_i, and

w_j : weight assigned to observation, y_j.

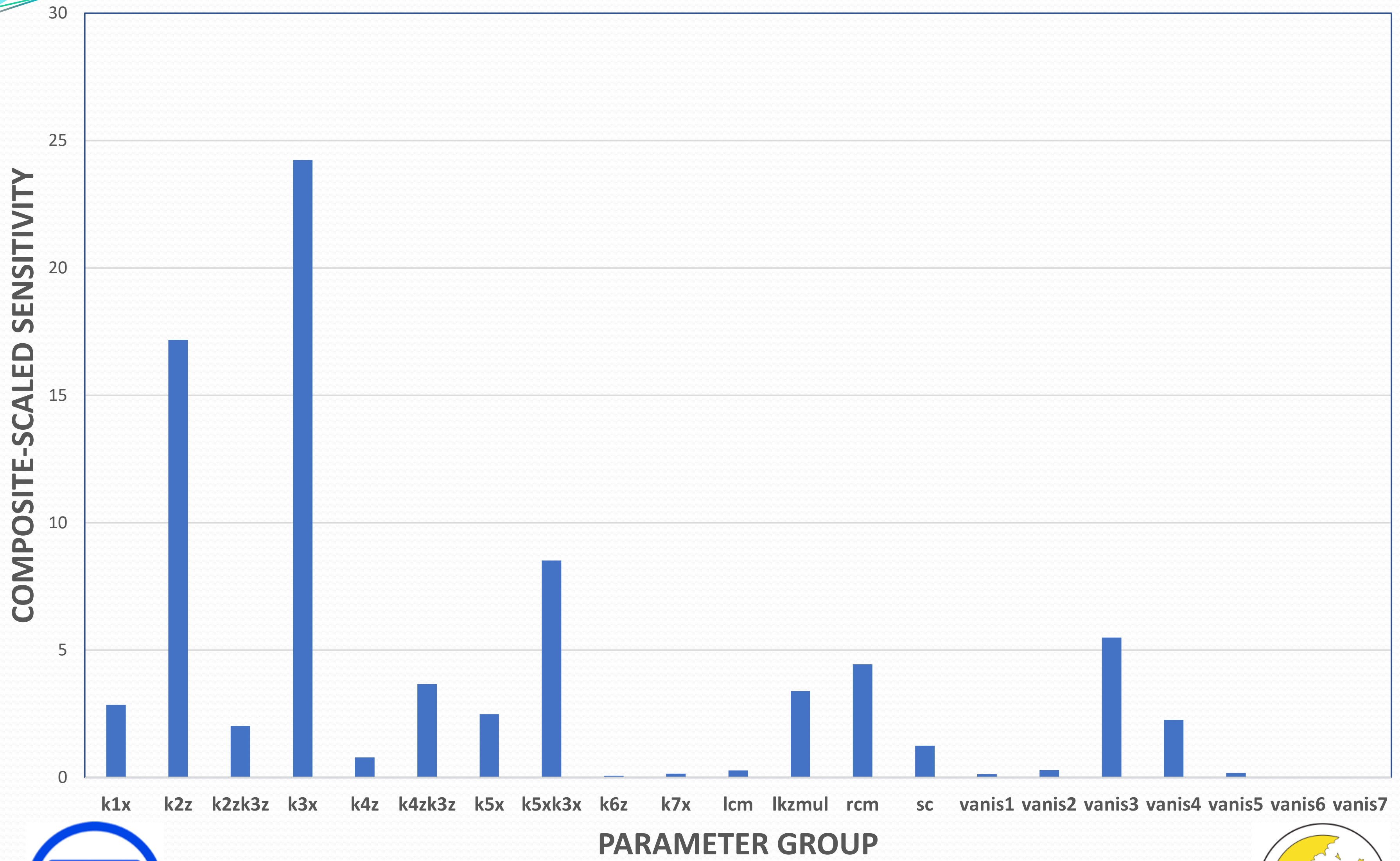
ALL OBSERVATIONS



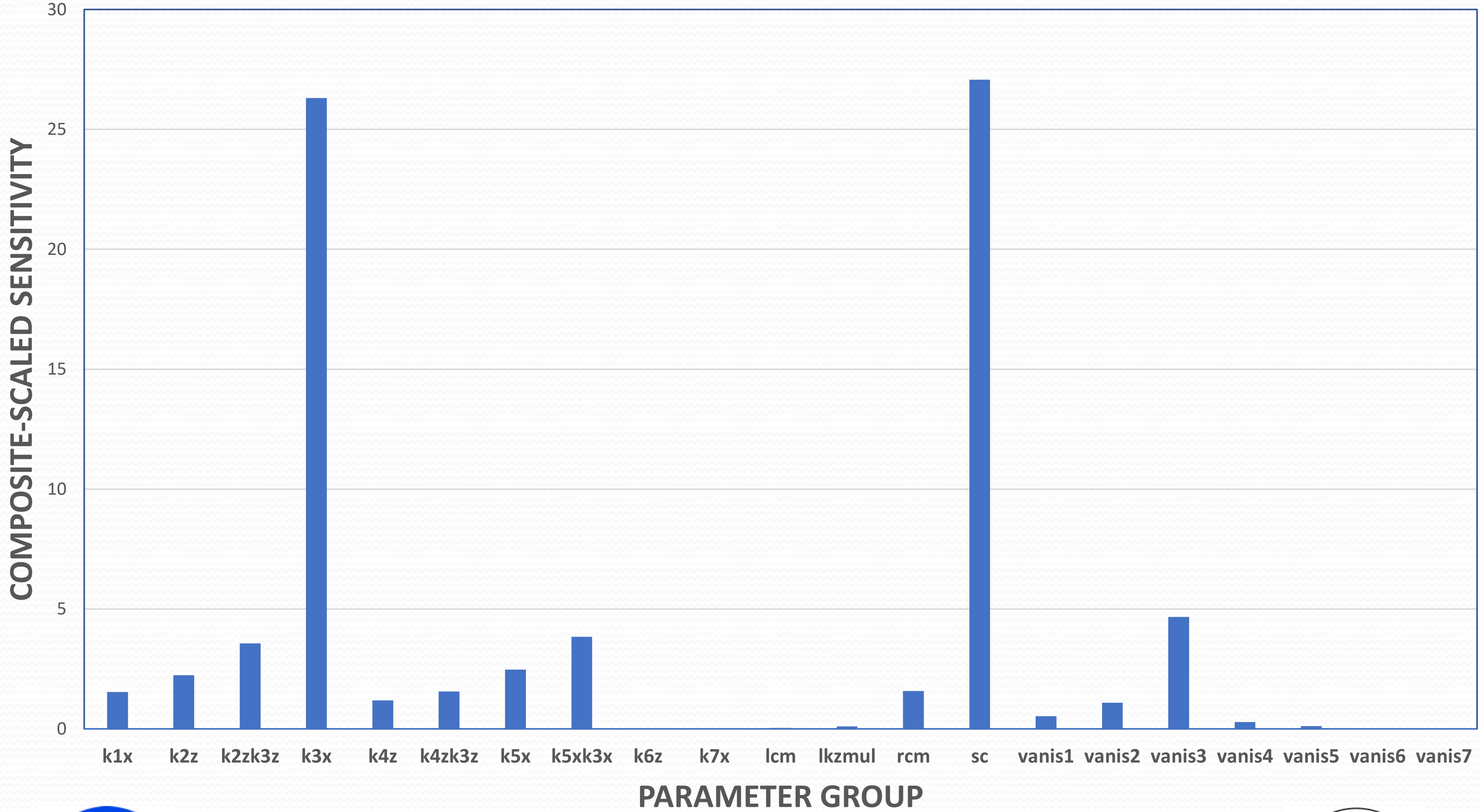
GROUNDWATER LEVEL OBSERVATIONS



BASEFLOW OBSERVATIONS



SPRING FLOW OBSERVATIONS



Composite Scaled Sensitivities Summary

- Layer 3 horizontal hydraulic conductivity (k3x)
  - high css values across all sets of observations
- Layer 2 vertical hydraulic conductivity (k2z)
  - large css values with respect to groundwater levels and baseflows when considered individually
- Springflow conductance (sc)
  - large css values when all observations were considered and when springflows were considered individually