Mead Westvaco Industrial Facility

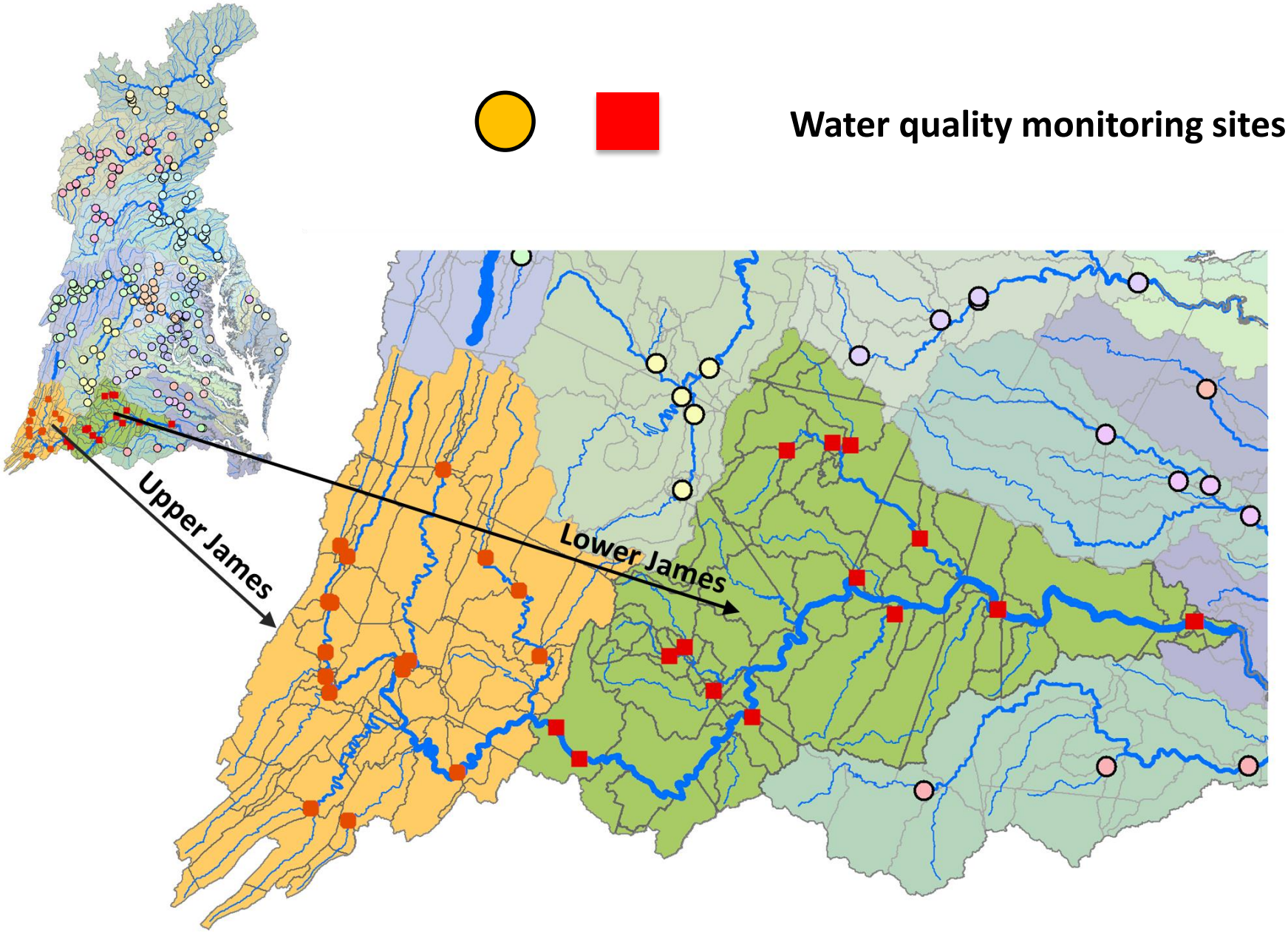
Wastewater Treatment Workgroup

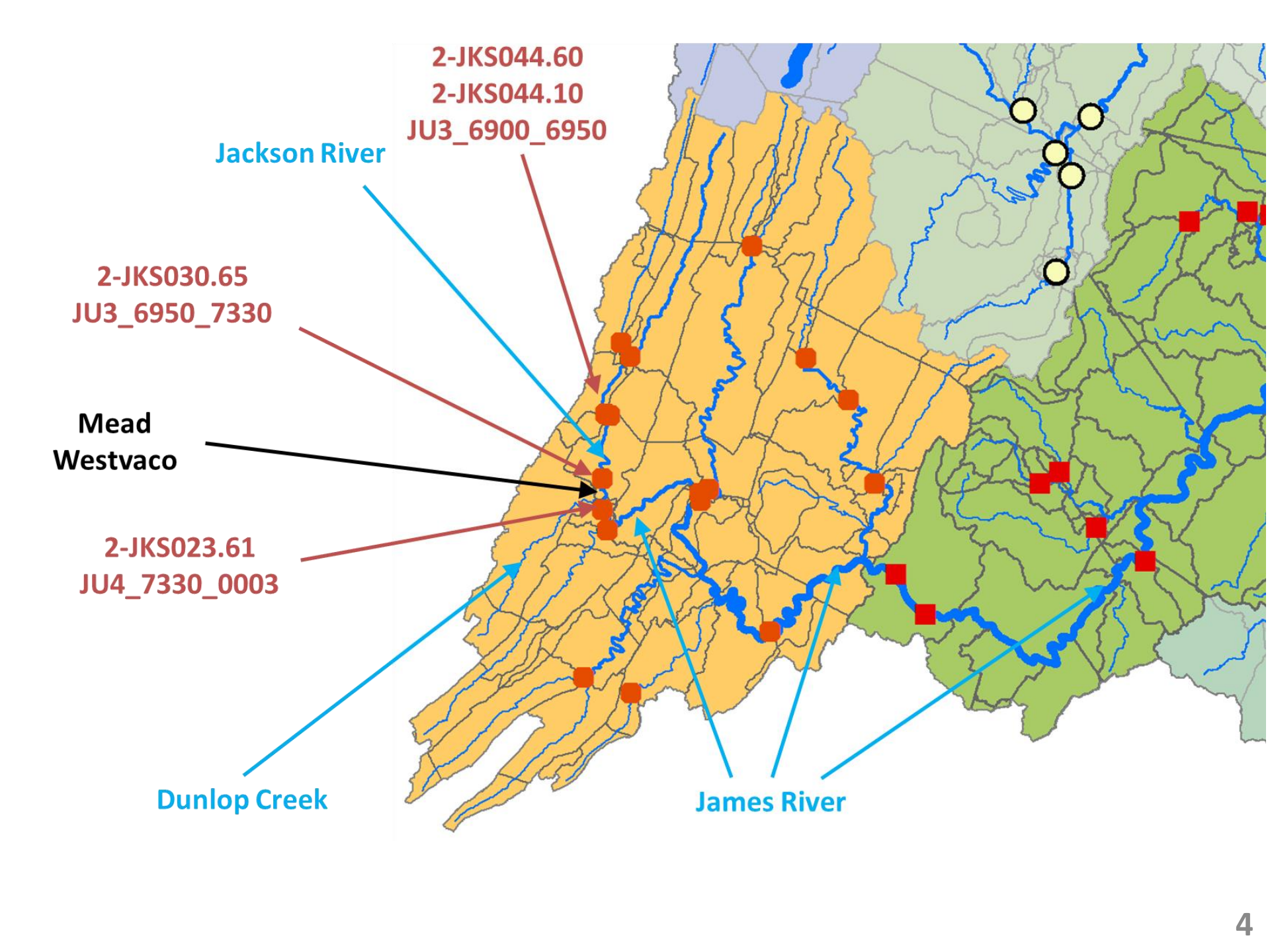
Gopal Bhatt

Penn State University

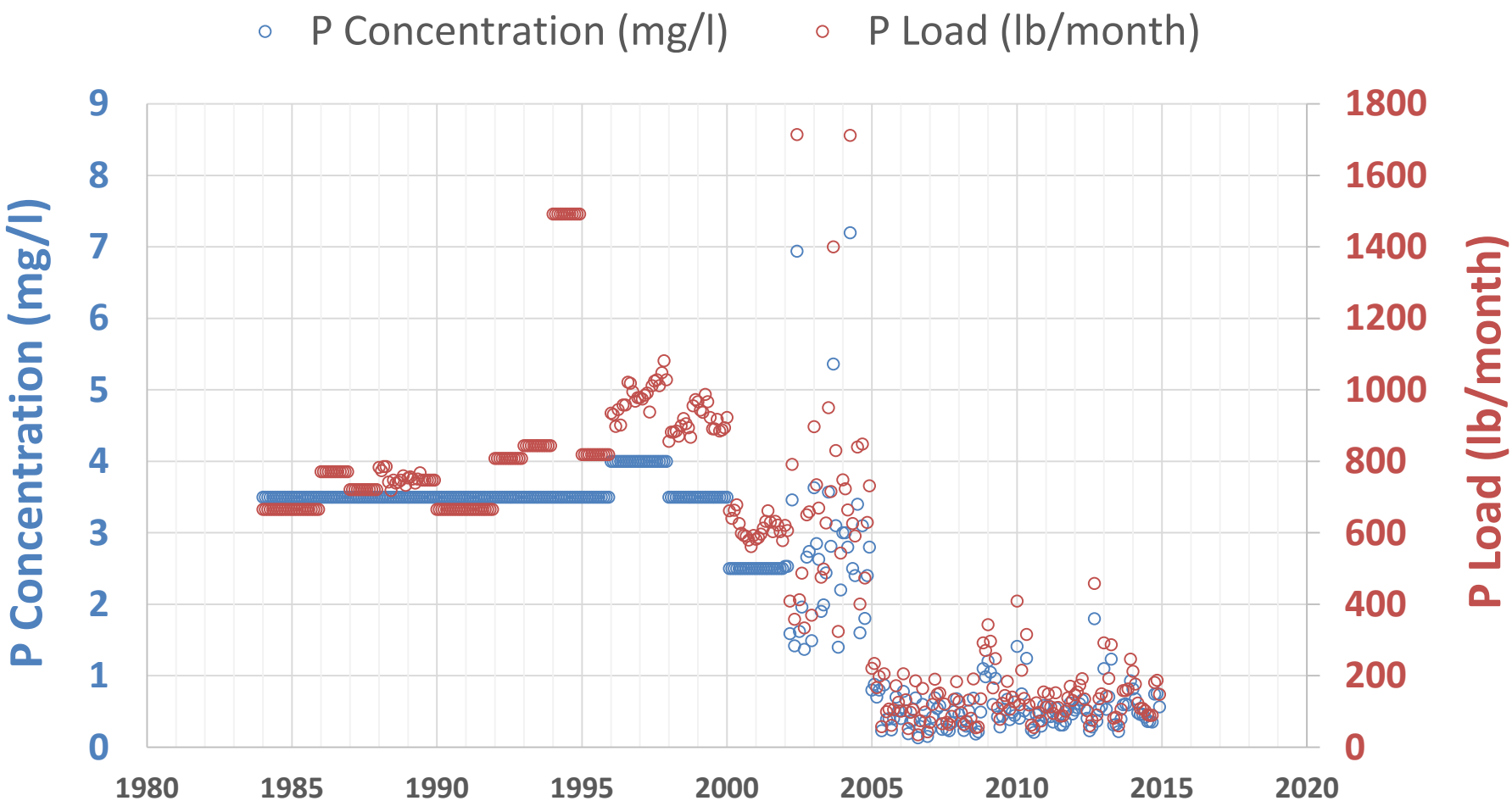
Presentation outline

1. Reported phosphorus loads
2. Weight of evidence approach
3. USGS-WRTDS tool
4. Phase 6 Beta 2 as a proof of concept
5. Review and approve

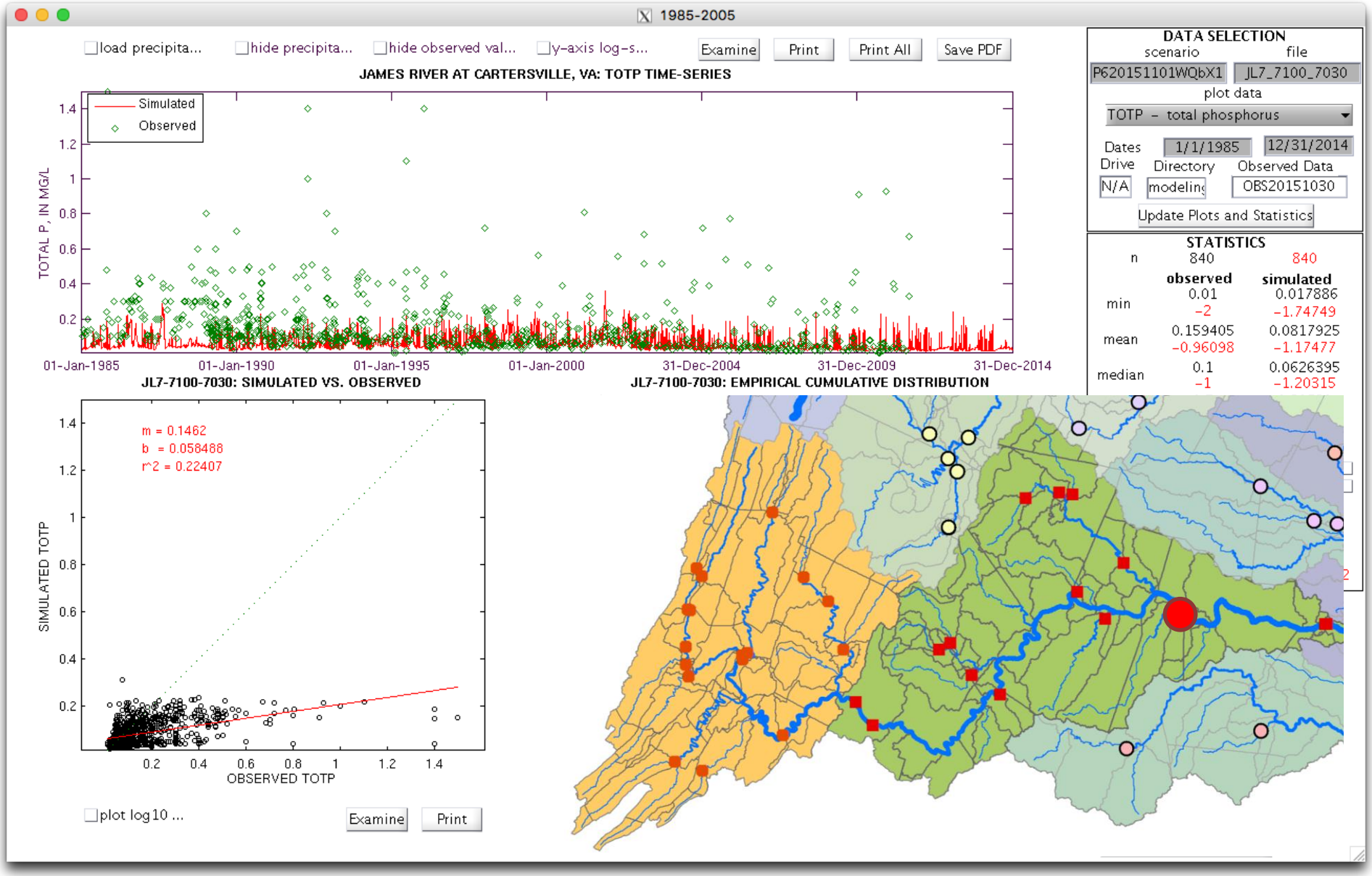

Water quality monitoring sites
Upper James
Lower James

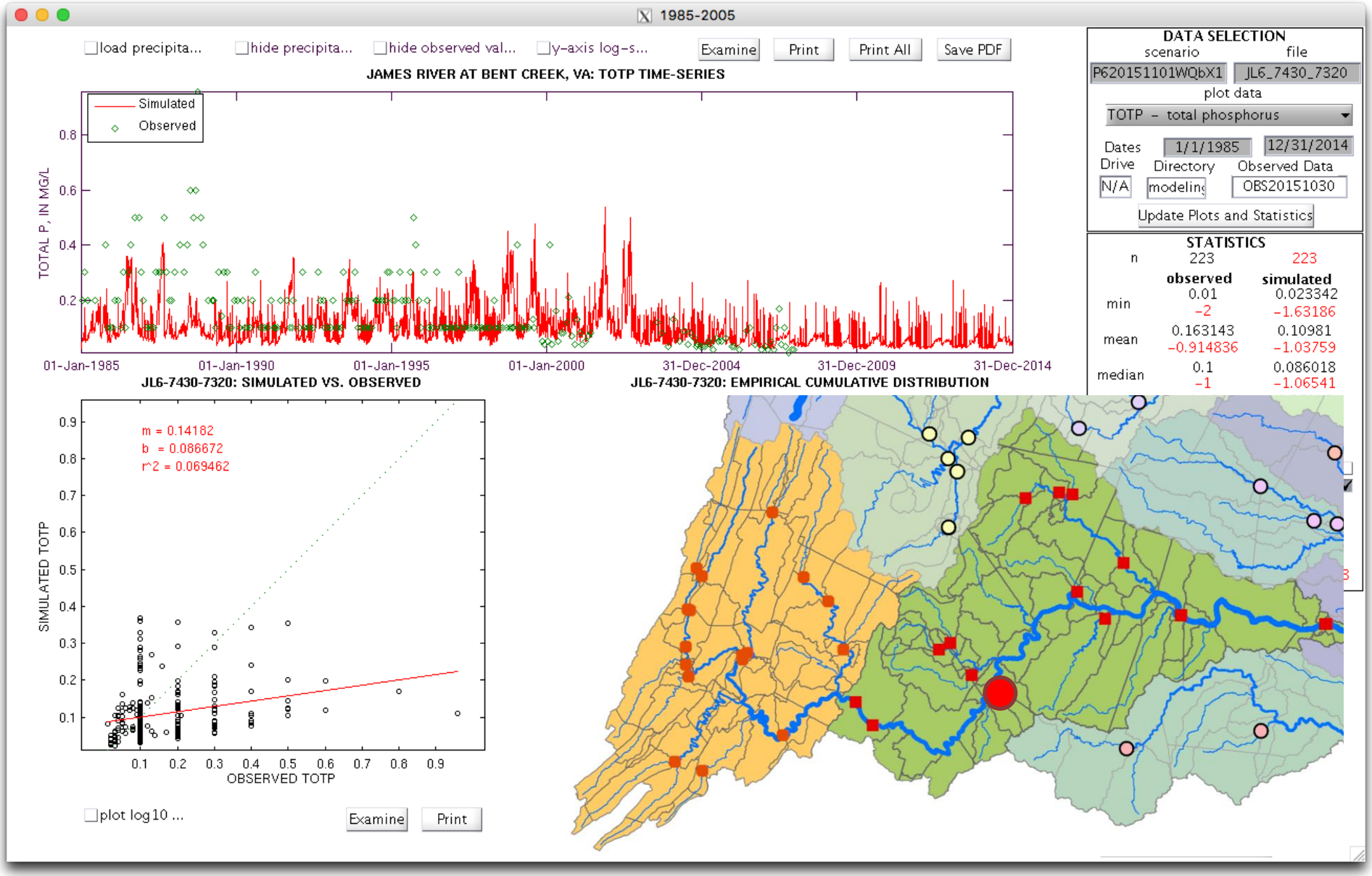

2-JKS044.60
2-JKS044.10
JU3_6900_6950
Jackson River
2-JKS030.65
JU3_6950_7330
Mead
Westvaco
2-JKS023.61
JU4_7330_0003
Dunlop Creek
James River

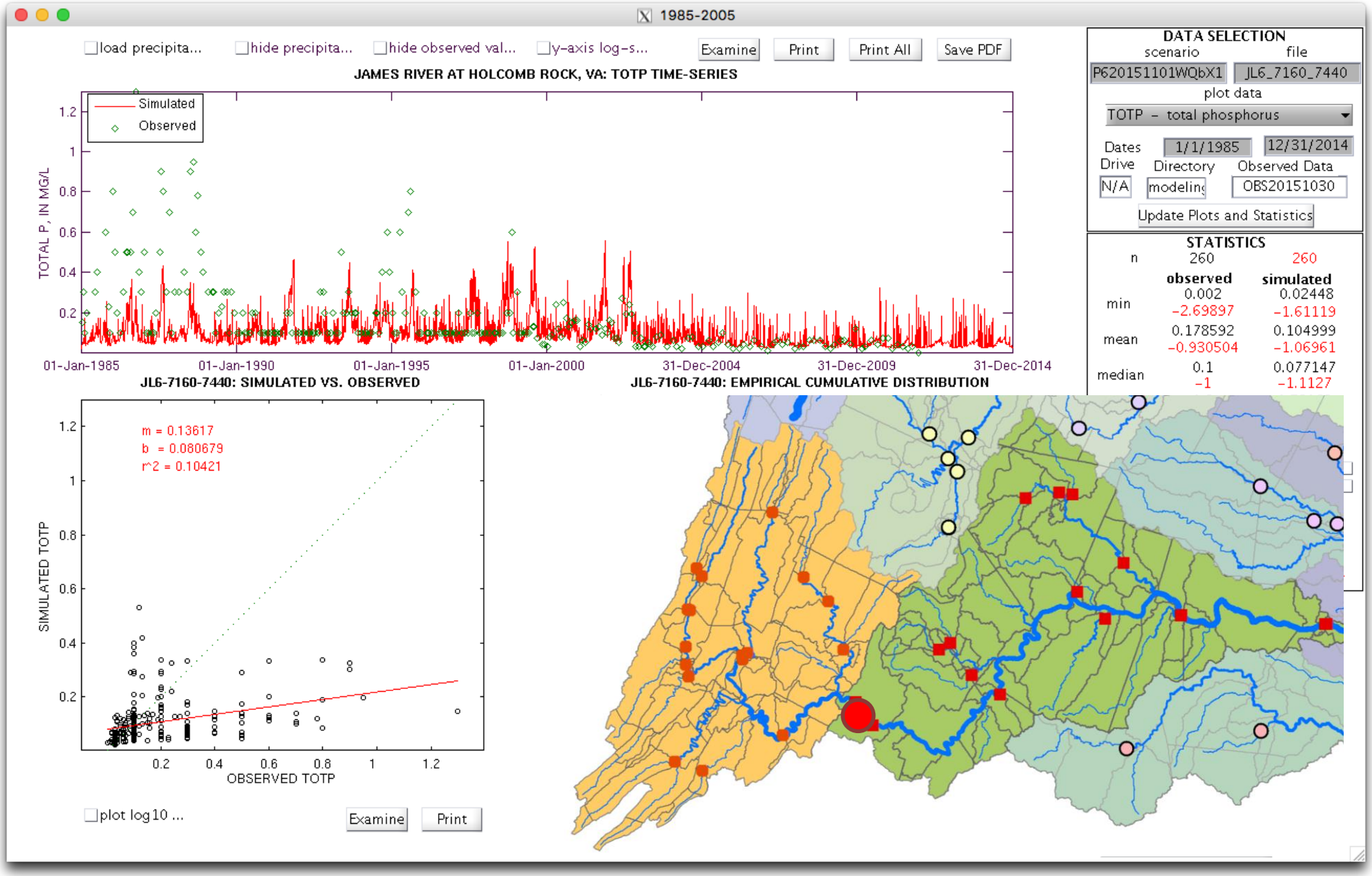
1. Input data for Mead Westvaco Industrial Facility

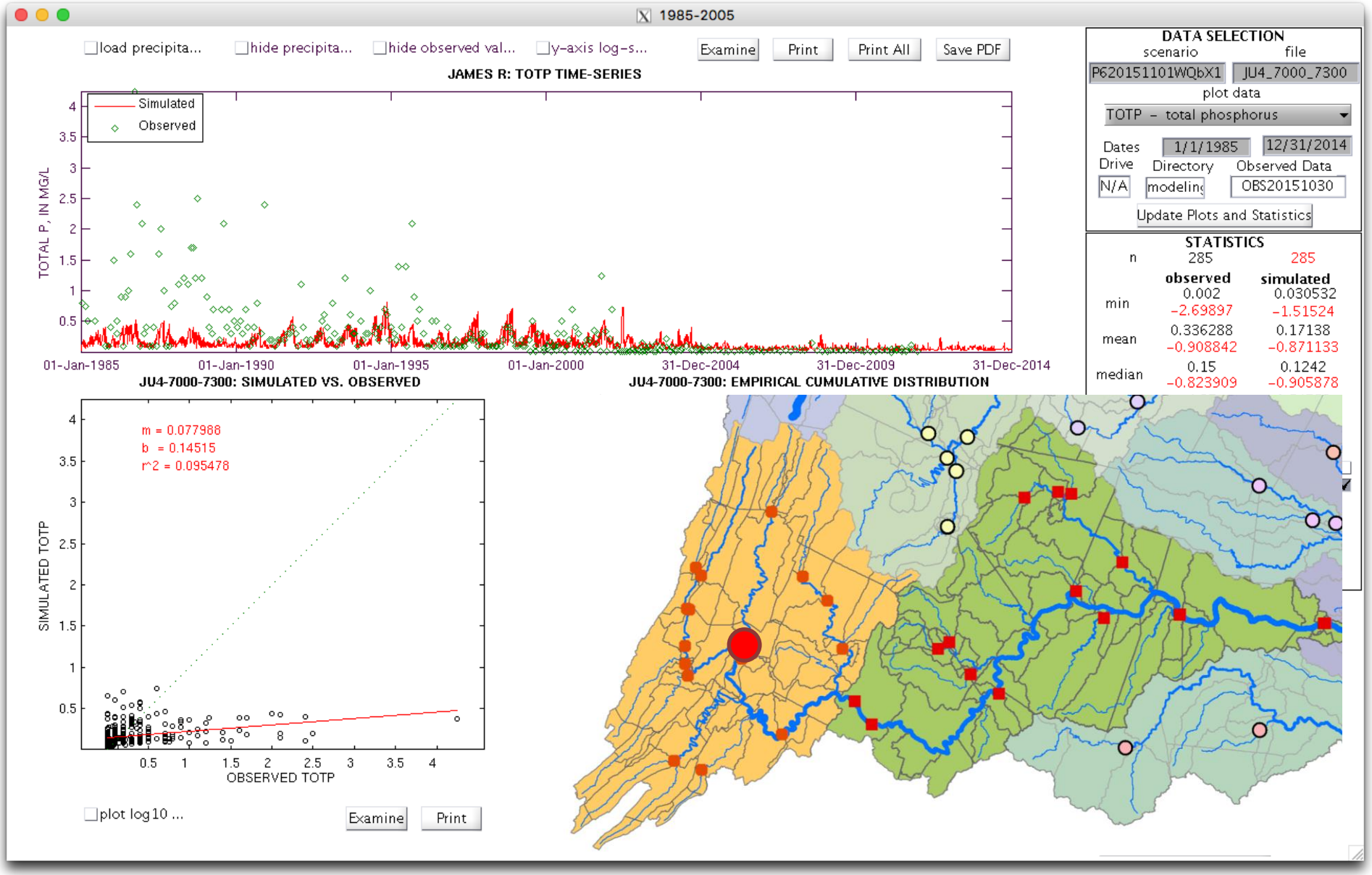


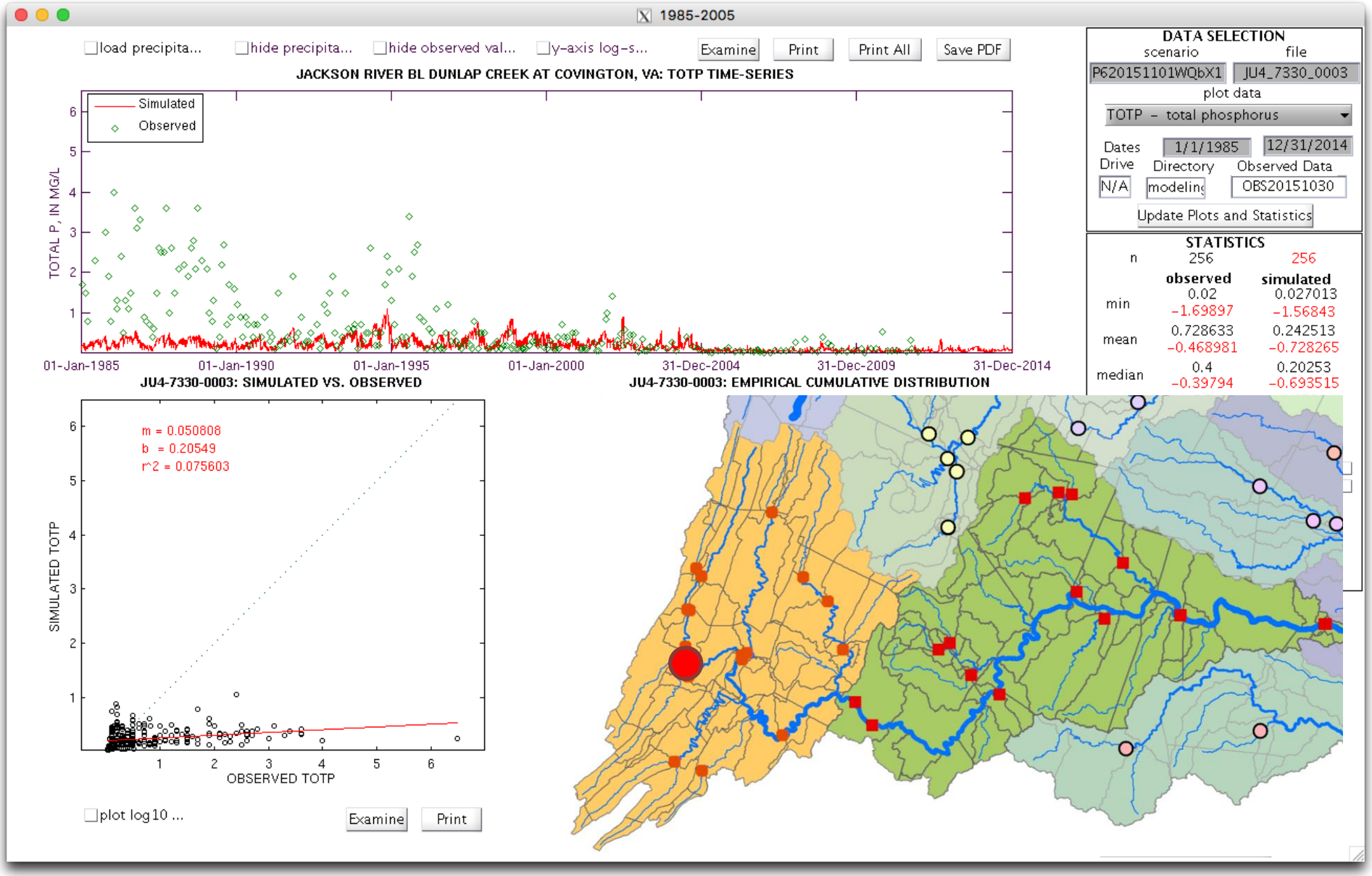
2. Weight of evidence

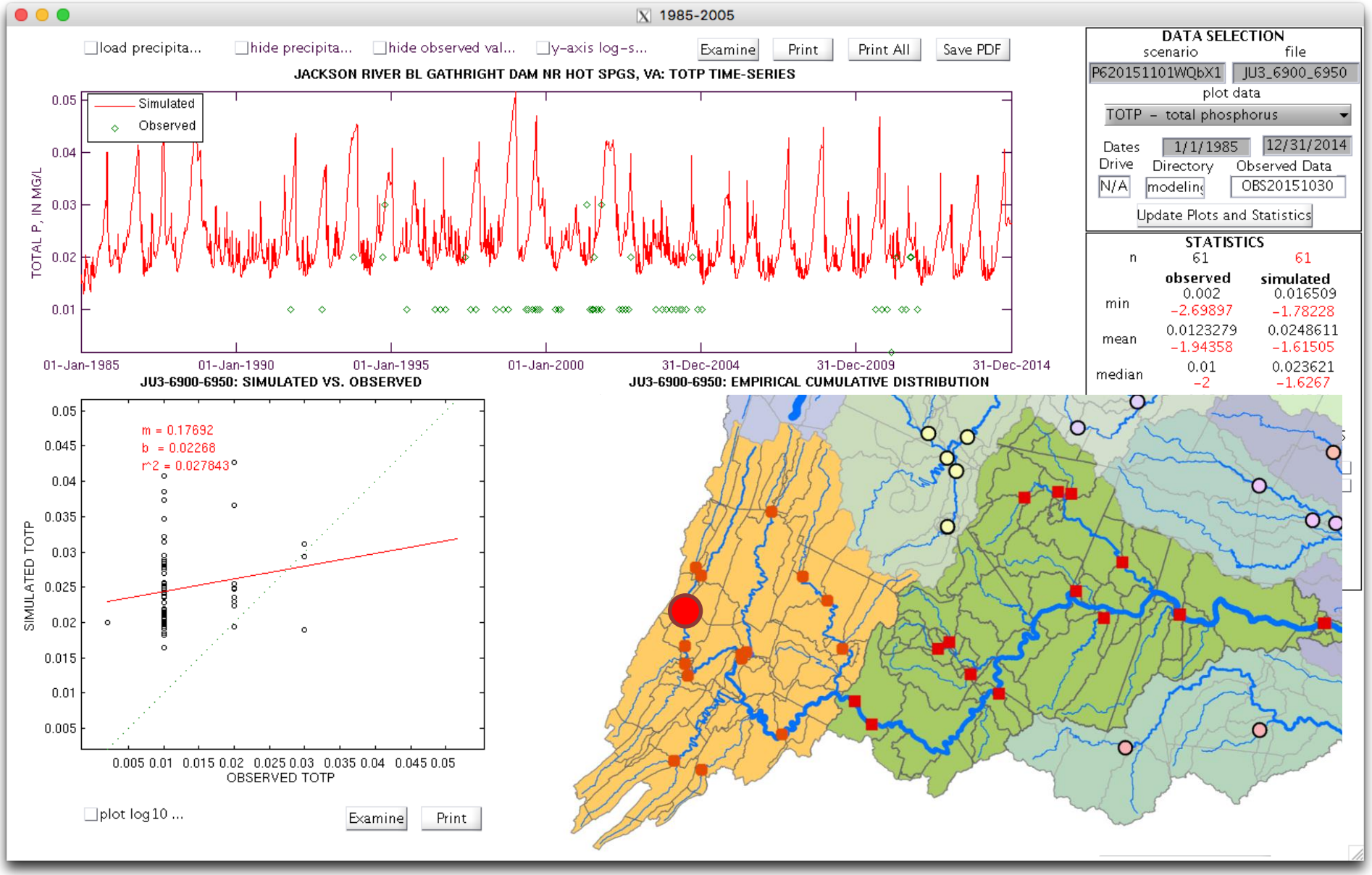



1985-2005
load precipita...
hide precipita...
hide observed val...
y-axis log-s...
Examine
Print
Print All
Save PDF
JAMES RIVER AT BENT CREEK, VA: TOTP TIME-SERIES
Simulated
Observed
TOTAL P, IN MG/L
0.8
0.6
0.4
0.2
01-Jan-1985
01-Jan-1990
01-Jan-1995
01-Jan-2000
31-Dec-2004
31-Dec-2009
31-Dec-2014
DATA SELECTION
scenario
file
P620151101WQbX1
JL6_7430_7320
plot data
TOTP - total phosphorus
Dates
1/1/1985
12/31/2014
Drive
Directory
Observed Data
N/A
modeling
OBS20151030
Update Plots and Statistics
STATISTICS
n
223
223
observed
simulated
min
0.01
-2
0.023342
-1.63186
mean
0.163143
-0.914836
0.10981
-1.03759
median
0.1
-1
0.086018
-1.06541
JL6-7430-7320: SIMULATED VS. OBSERVED
m = 0.14182
b = 0.086672
r^2 = 0.069462
SIMULATED TOTP
OBSERVED TOTP
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
plot log10 ...
Examine
Print
JL6-7430-7320: EMPIRICAL CUMULATIVE DISTRIBUTION

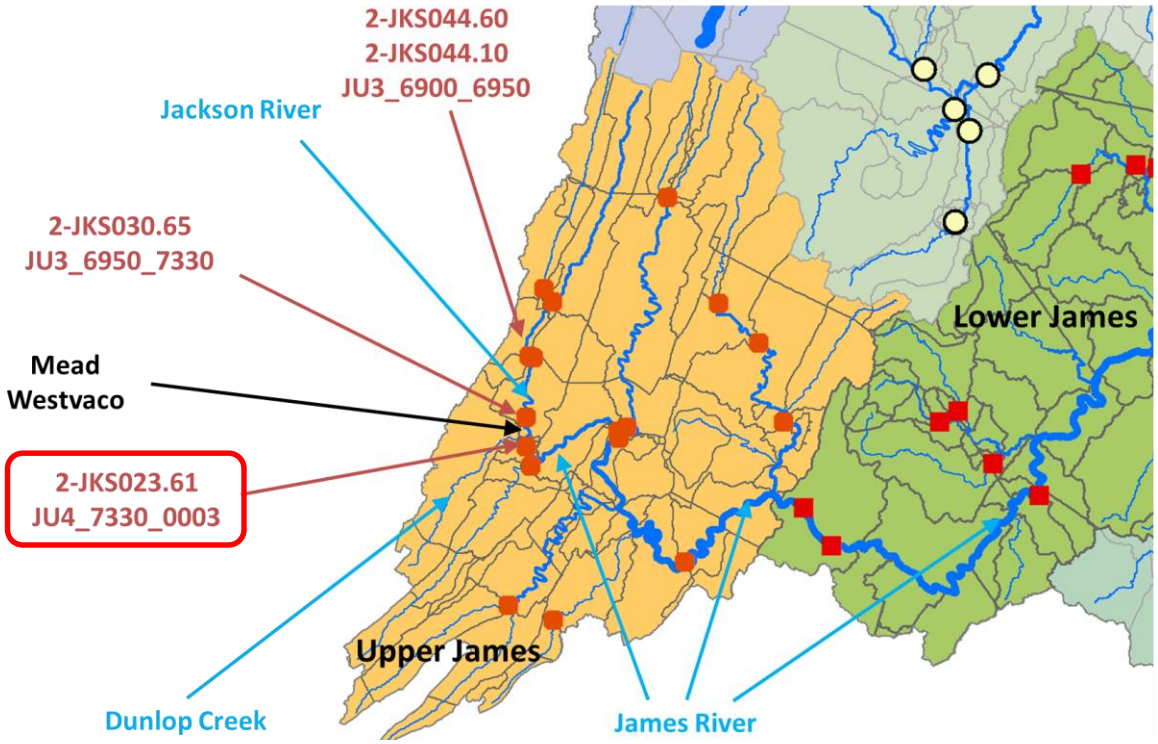

1985-2005
load precipita...
hide precipita...
hide observed val...
y-axis log-s...
Examine
Print
Print All
Save PDF
JAMES RIVER AT HOLCOMB ROCK, VA: TOTP TIME-SERIES
Simulated
Observed
TOTAL P, IN MG/L
01-Jan-1985
01-Jan-1990
01-Jan-1995
01-Jan-2000
31-Dec-2004
31-Dec-2009
31-Dec-2014
DATA SELECTION
scenario
file
P620151101WQbX1
JL6_7160_7440
plot data
TOTP - total phosphorus
Dates
1/1/1985
12/31/2014
Drive
Directory
Observed Data
N/A
modeling
OBS20151030
Update Plots and Statistics
STATISTICS
n
260
260
observed
simulated
min
0.002
0.02448
-2.69897
-1.61119
mean
0.178592
0.104999
-0.930504
-1.06961
median
0.1
0.077147
-1
-1.1127
JL6-7160-7440: SIMULATED VS. OBSERVED
m = 0.13617
b = 0.080679
r^2 = 0.10421
SIMULATED TOTP
OBSERVED TOTP
plot log10 ...
Examine
Print
JL6-7160-7440: EMPIRICAL CUMULATIVE DISTRIBUTION


1985-2005
load precipita...
hide precipita...
hide observed val...
y-axis log-s...
Examine
Print
Print All
Save PDF
JAMES R: TOTP TIME-SERIES
Simulated
Observed
TOTAL P, IN MG/L
01-Jan-1985
01-Jan-1990
01-Jan-1995
01-Jan-2000
31-Dec-2004
31-Dec-2009
31-Dec-2014
DATA SELECTION
scenario
file
P620151101WQbX1
JU4_7000_7300
plot data
TOTP - total phosphorus
Dates
1/1/1985
12/31/2014
Drive
Directory
Observed Data
N/A
modeling
OBS20151030
Update Plots and Statistics
STATISTICS
n
285
285
observed
simulated
min
0.002
0.030532
-2.69897
-1.51524
mean
0.336288
0.17138
-0.908842
-0.871133
median
0.15
0.1242
-0.823909
-0.905878
JU4-7000-7300: SIMULATED VS. OBSERVED
m = 0.077988
b = 0.14515
r^2 = 0.095478
SIMULATED TOTP
OBSERVED TOTP
plot log10 ...
Examine
Print
JU4-7000-7300: EMPIRICAL CUMULATIVE DISTRIBUTION

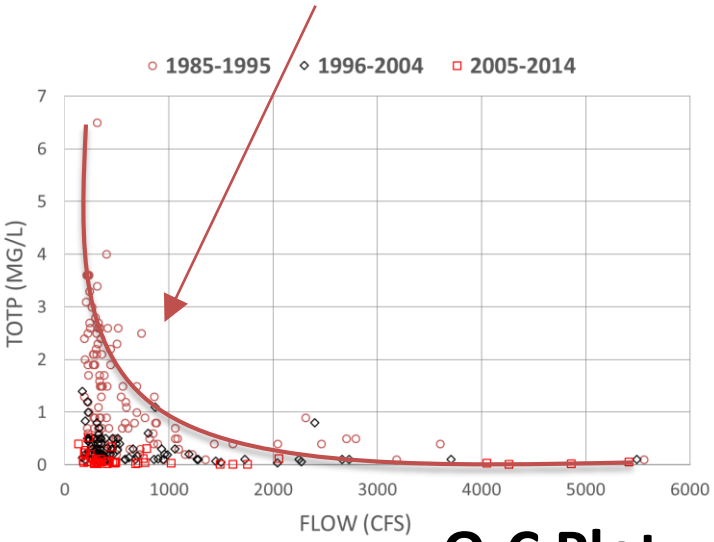

1985-2005
load precipita...
hide precipita...
hide observed val...
y-axis log-s...
Examine
Print
Print All
Save PDF
JACKSON RIVER BL DUNLAP CREEK AT COVINGTON, VA: TOTP TIME-SERIES
Simulated
Observed
TOTAL P, IN MG/L
01-Jan-1985
01-Jan-1990
01-Jan-1995
01-Jan-2000
31-Dec-2004
31-Dec-2009
31-Dec-2014
DATA SELECTION
scenario
file
P620151101WQbX1
JU4_7330_0003
plot data
TOTP - total phosphorus
Dates
1/1/1985
12/31/2014
Drive
Directory
Observed Data
N/A
modeling
OBS20151030
Update Plots and Statistics
STATISTICS
n
256
256
observed
simulated
min
0.02
-1.69897
0.027013
-1.56843
mean
0.728633
-0.468981
0.242513
-0.728265
median
0.4
-0.39794
0.20253
-0.693515
JU4-7330-0003: SIMULATED VS. OBSERVED
m = 0.050808
b = 0.20549
r^2 = 0.075603
SIMULATED TOTP
OBSERVED TOTP
plot log10 ...
Examine
Print
JU4-7330-0003: EMPIRICAL CUMULATIVE DISTRIBUTION


1985-2005
load precipita...
hide precipita...
hide observed val...
y-axis log-s...
Examine
Print
Print All
Save PDF
JACKSON RIVER BL GATHRIGHT DAM NR HOT SPGS, VA: TOTP TIME-SERIES
Simulated
Observed
TOTAL P, IN MG/L
0.05
0.04
0.03
0.02
0.01
01-Jan-1985
01-Jan-1990
01-Jan-1995
01-Jan-2000
31-Dec-2004
31-Dec-2009
31-Dec-2014
DATA SELECTION
scenario
file
P620151101WQbX1
JU3_6900_6950
plot data
TOTP - total phosphorus
Dates
1/1/1985
12/31/2014
Drive
Directory
Observed Data
N/A
modeling
OBS20151030
Update Plots and Statistics
STATISTICS
n
61
61
observed
simulated
min
0.002
-2.69897
0.016509
-1.78228
mean
0.0123279
-1.94358
0.0248611
-1.61505
median
0.01
-2
0.023621
-1.6267
JU3-6900-6950: SIMULATED VS. OBSERVED
m = 0.17692
b = 0.02268
r^2 = 0.027843
SIMULATED TOTP
OBSERVED TOTP
0.005 0.01 0.015 0.02 0.025 0.03 0.035 0.04 0.045 0.05
plot log10 ...
Examine
Print
JU3-6900-6950: EMPIRICAL CUMULATIVE DISTRIBUTION

Mead Westvaco Industrial Facility

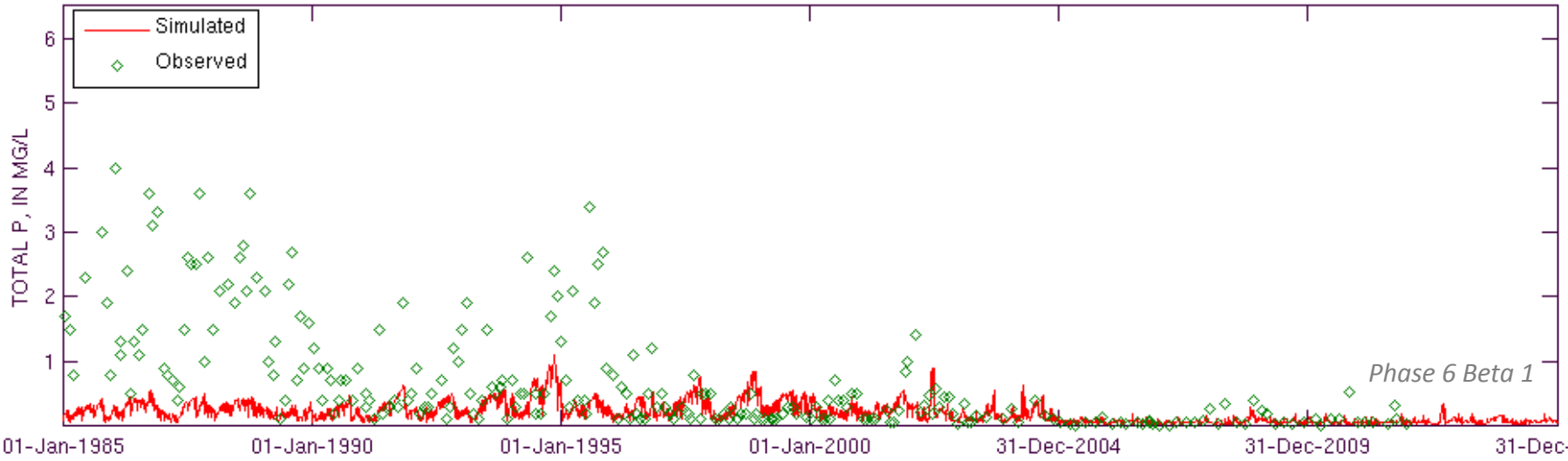


… suggests major loading is from a point source.



Q-C Plot

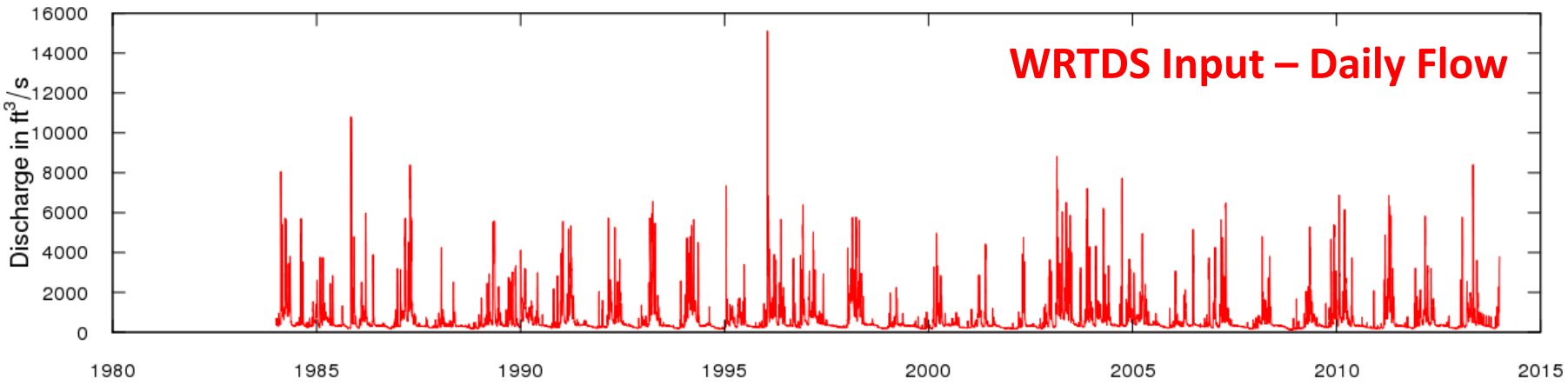
JACKSON RIVER BL DUNLAP CREEK AT COVINGTON, VA: TOTP TIME-SERIES

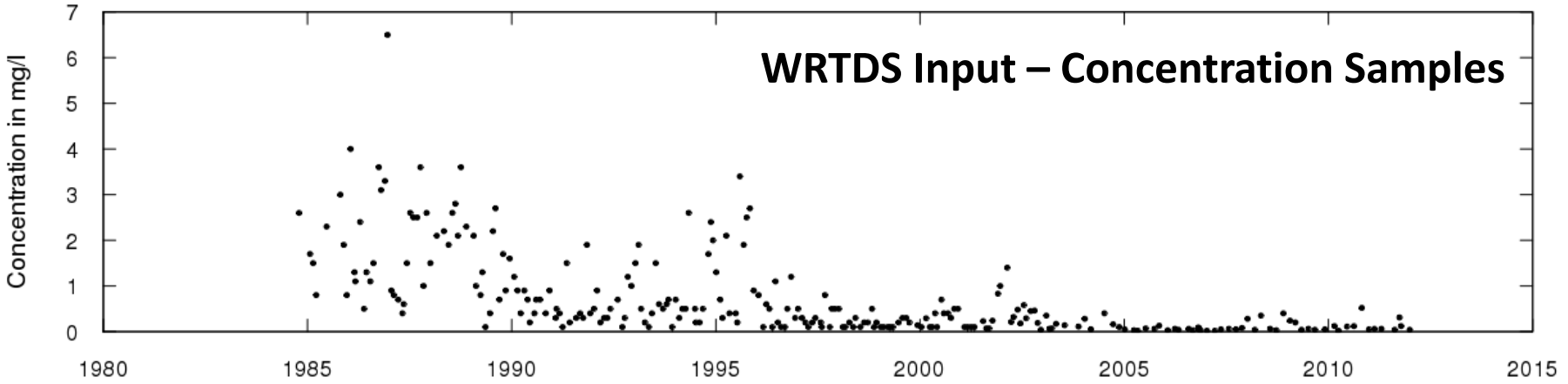


Phase 6 Beta 1

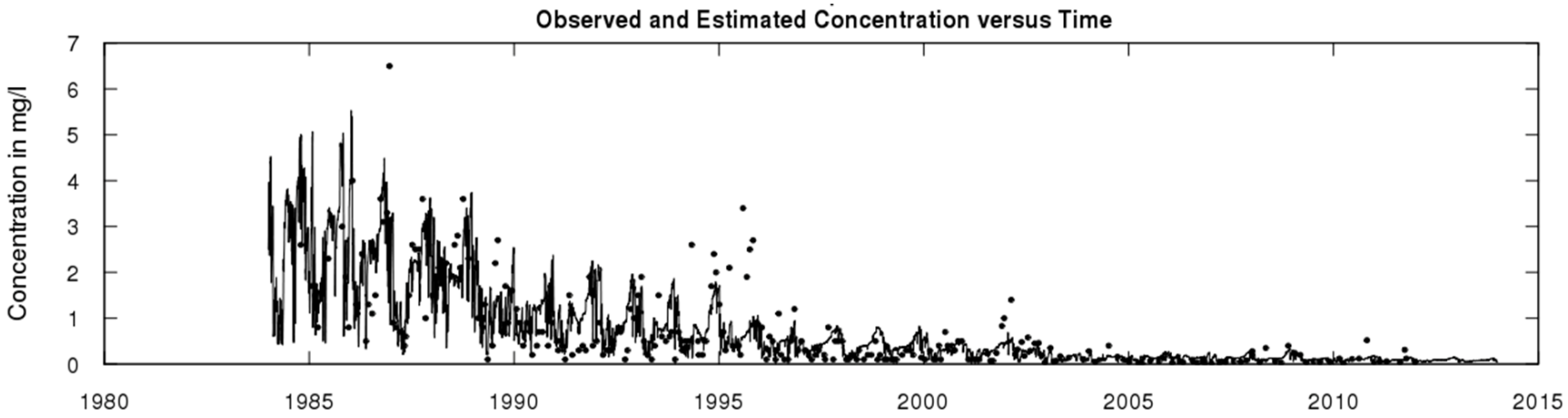
3. USGS-WRTDS (Hirsch et al., 2010; Hirsch and Di Cicco, 2014) is a statistical model especially designed to estimate long-term trends in loads and concentrations.

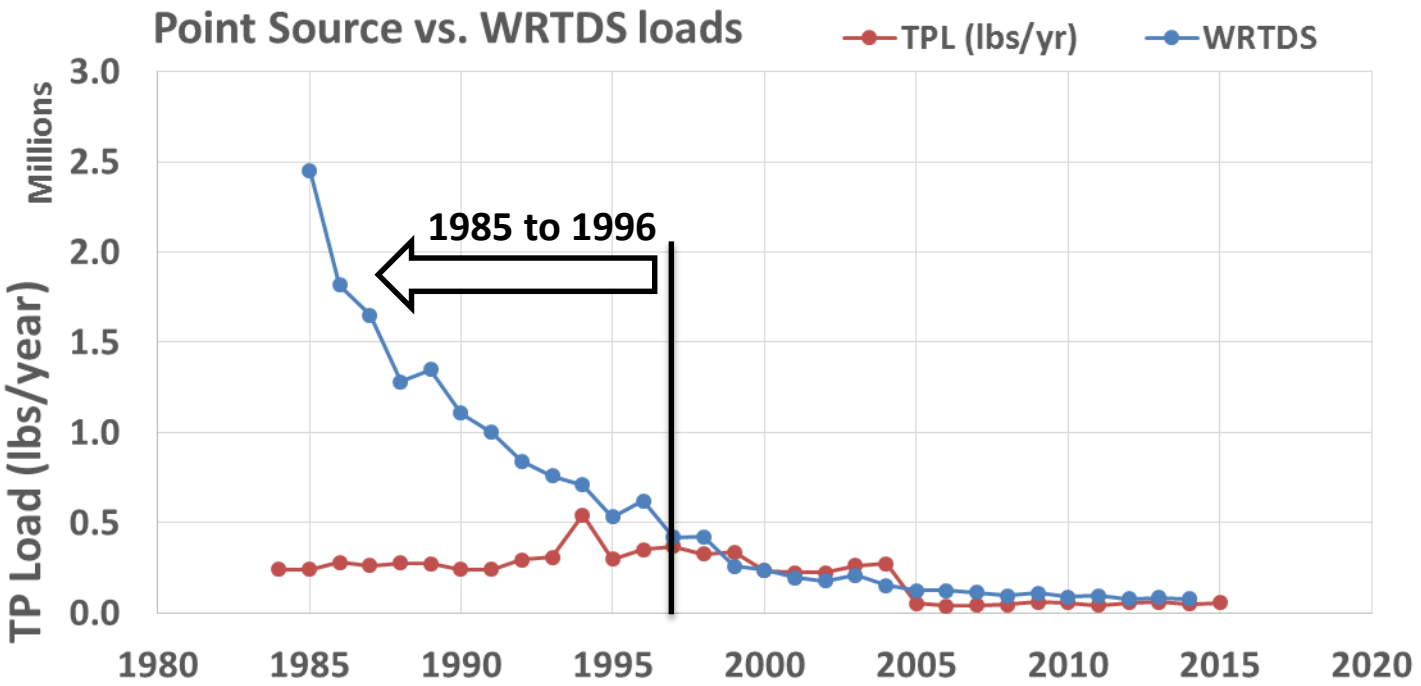
Jackson River below Dunlop Creek, Covington, VA





WRTDS estimates (a) daily concentration, (b) daily load

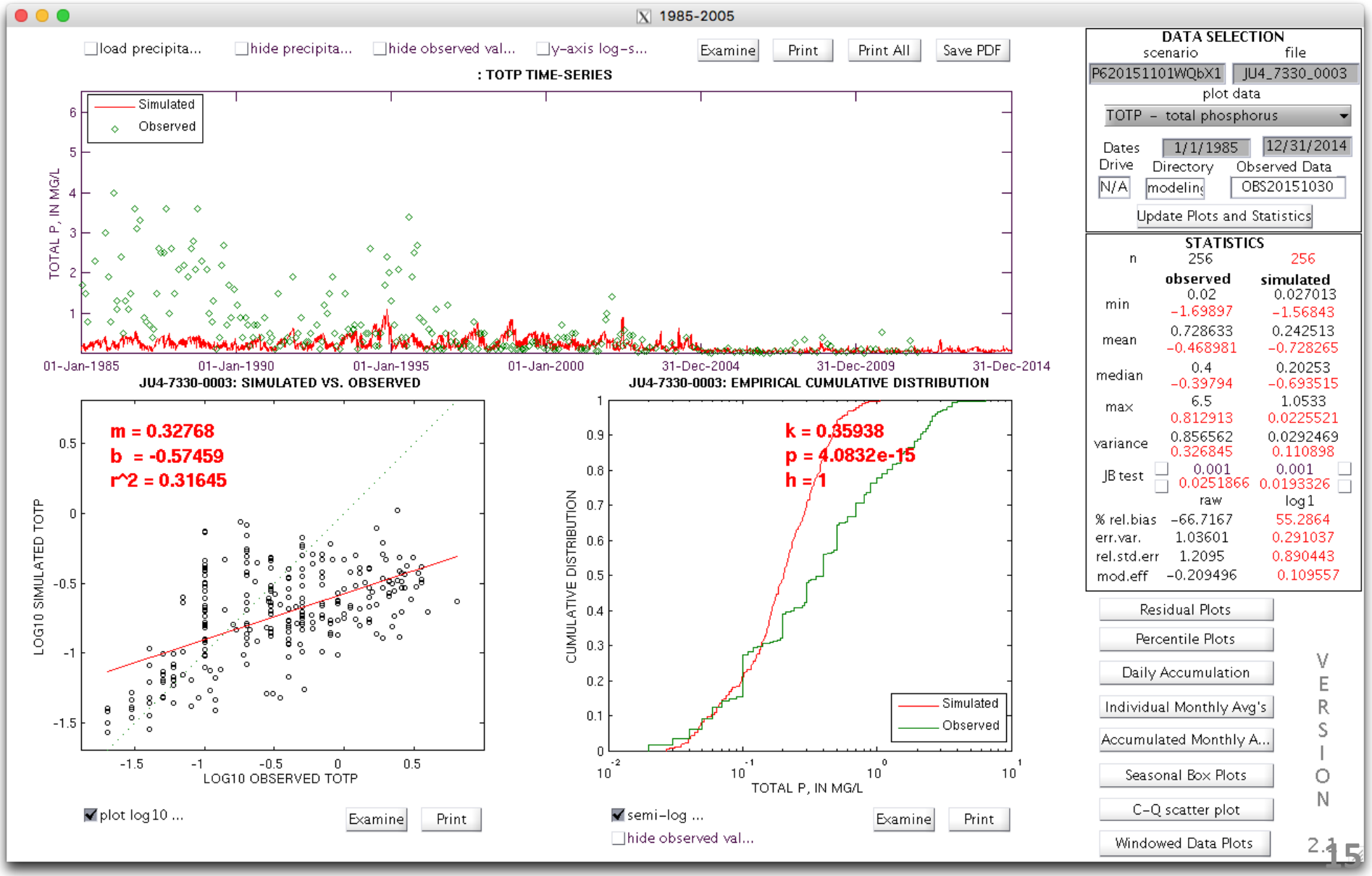




JACKSON RIVER BL DUNLAP CREEK AT COVINGTON, VA

PHASE 6 BETA 1

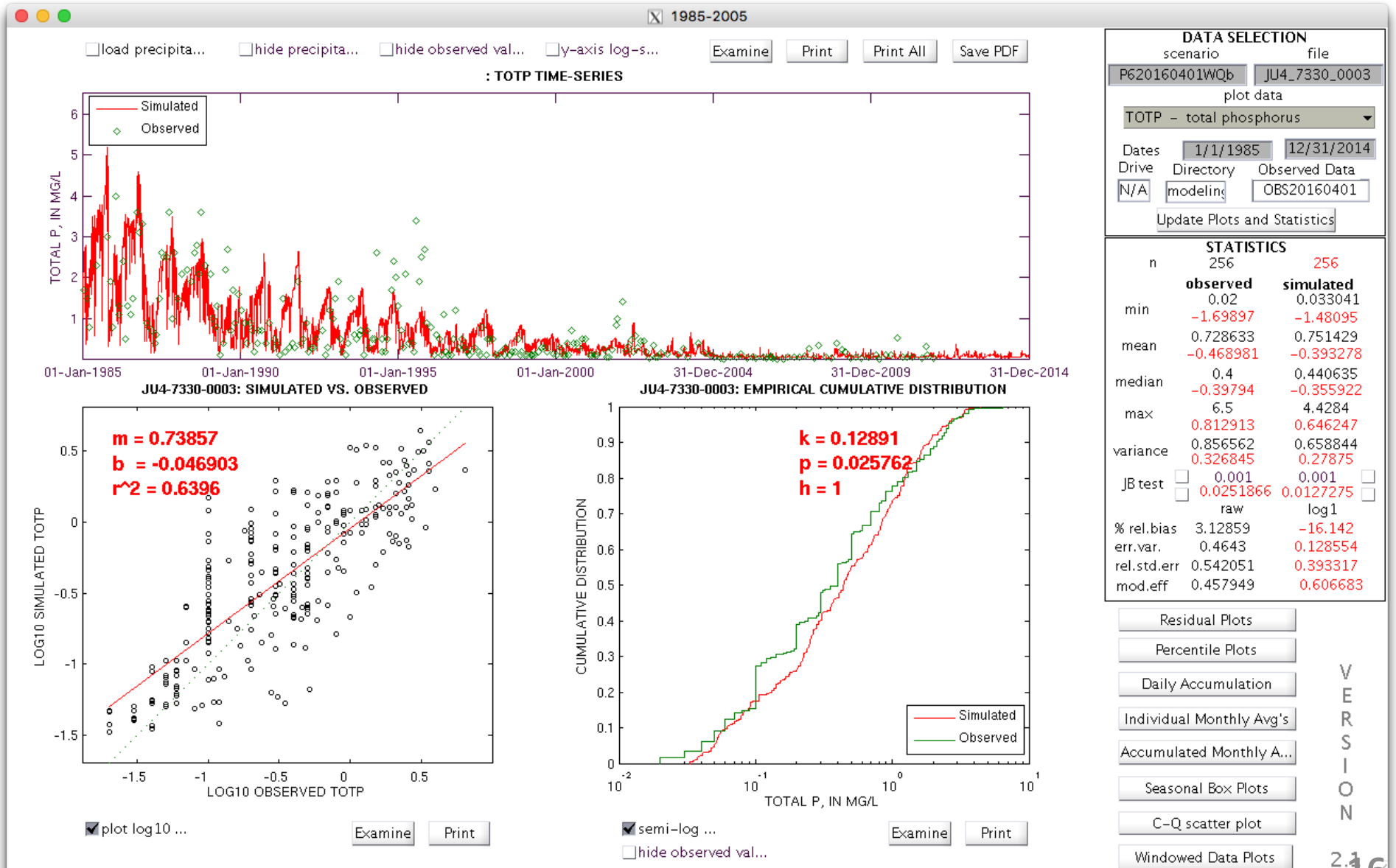
PHOSPHORUS



JACKSON RIVER BL DUNLAP CREEK AT COVINGTON, VA

PHASE 6 BETA 2

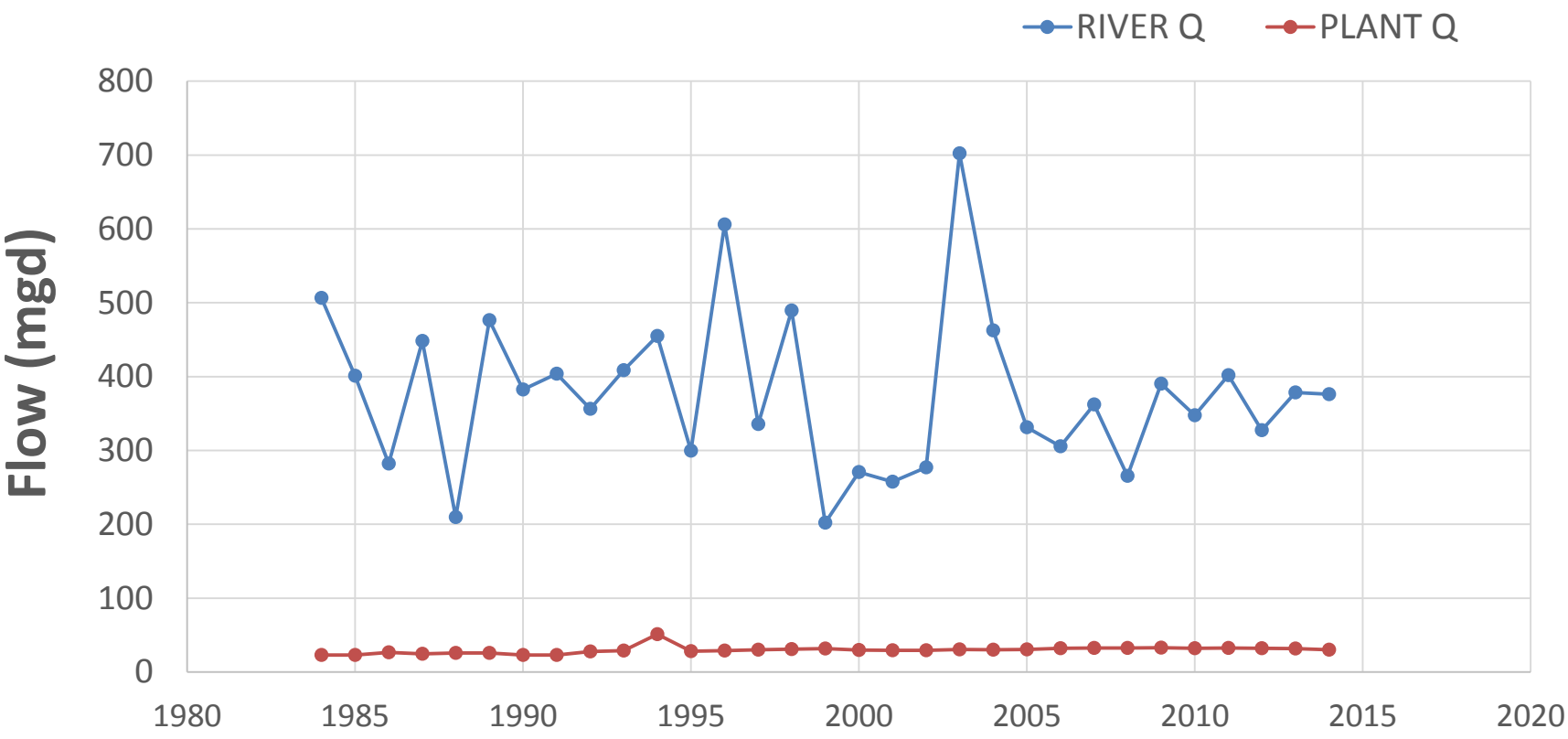
PHOSPHORUS



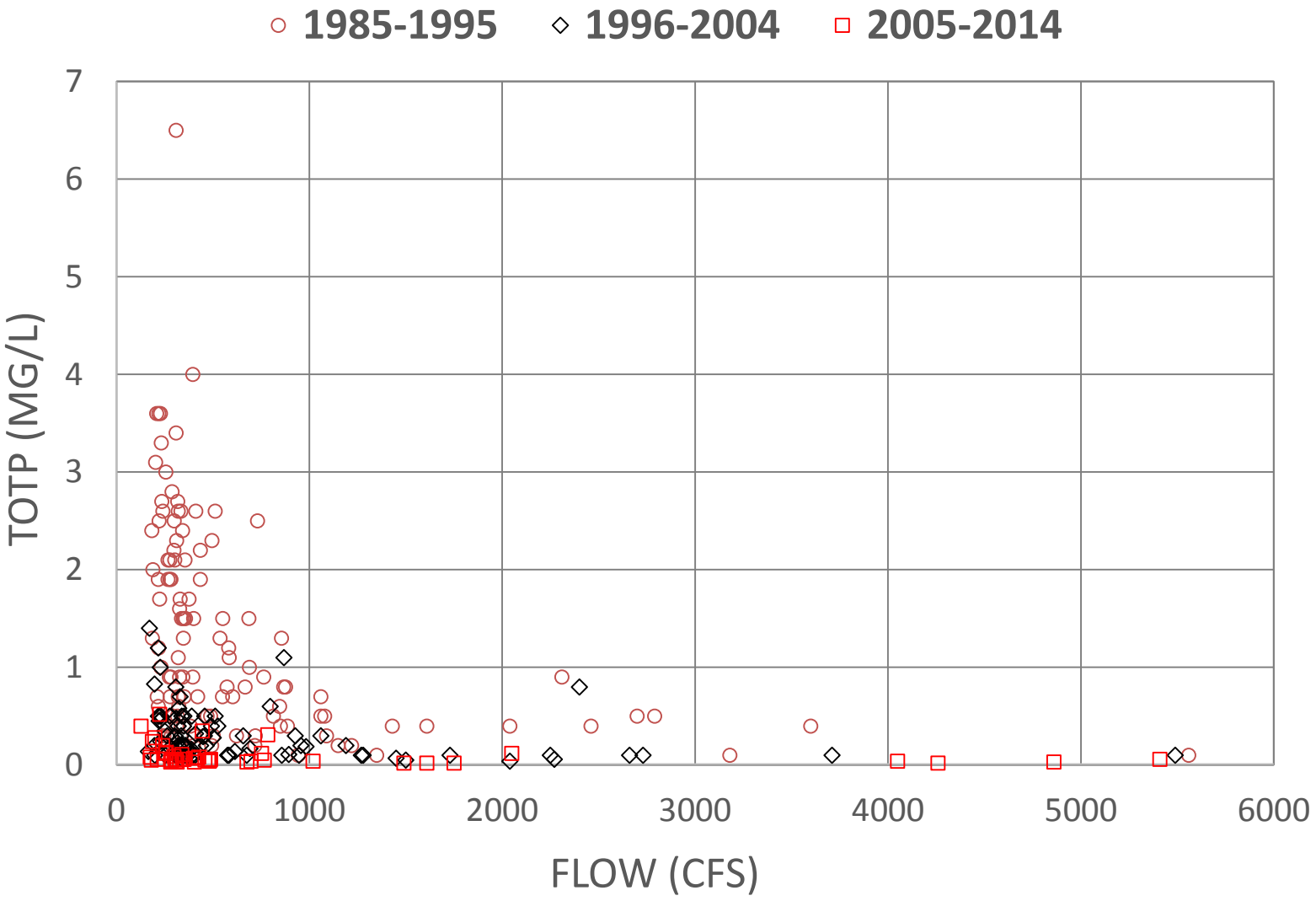
5. Review and approve …

1. Revise assumptions for the 1984 – 1996 period

2. The process for estimating load



River flow is approximately 13 times that of point source discharge.


1985-1995
1996-2004
2005-2014
TOTP (MG/L)
0
1
2
3
4
5
6
7
0
1000
2000
3000
4000
5000
6000
FLOW (CFS)