Update on Phase 5.3.2 Watershed Model Calibration

Water Quality Goal Implementation Team

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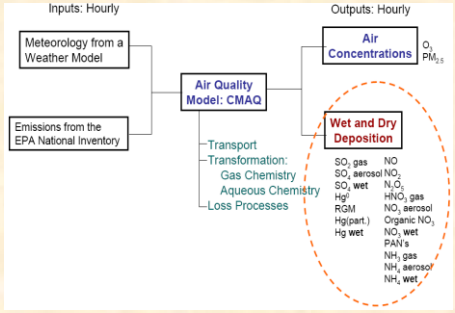
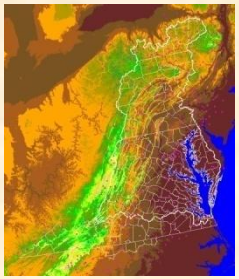
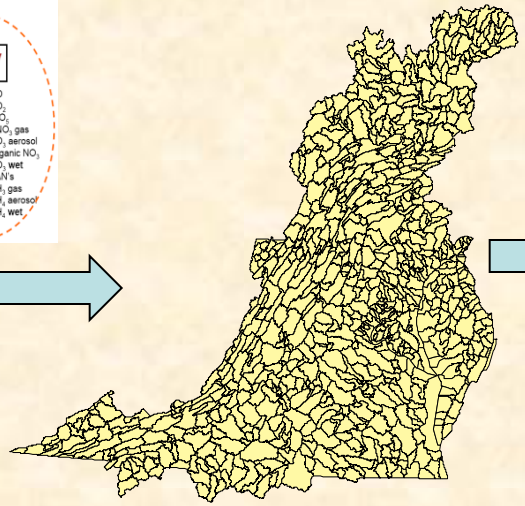
CBP Integrated Model Decision Support System

Airshed Model

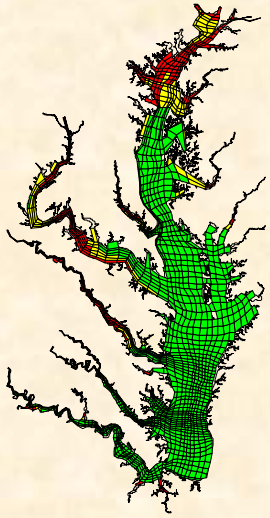




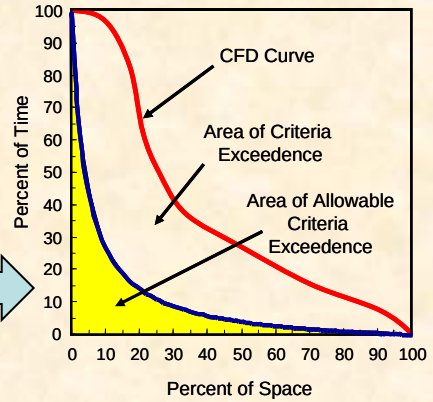
Watershed Model



Bay Model



Criteria Assessment Procedures



Effects

Allocations, Milestones, WIP Assessments

Changes Agreed to by AgWG/WQGIT/PSC

- Updated land use with more complete urban coverage
  - STAC reviewed and modifications incorporated
- Modified nutrient management
  - Increased non-NM application rates
  - Stop automatic transfer of manure
  - Dispose of excess manure in a sequence determined by the states

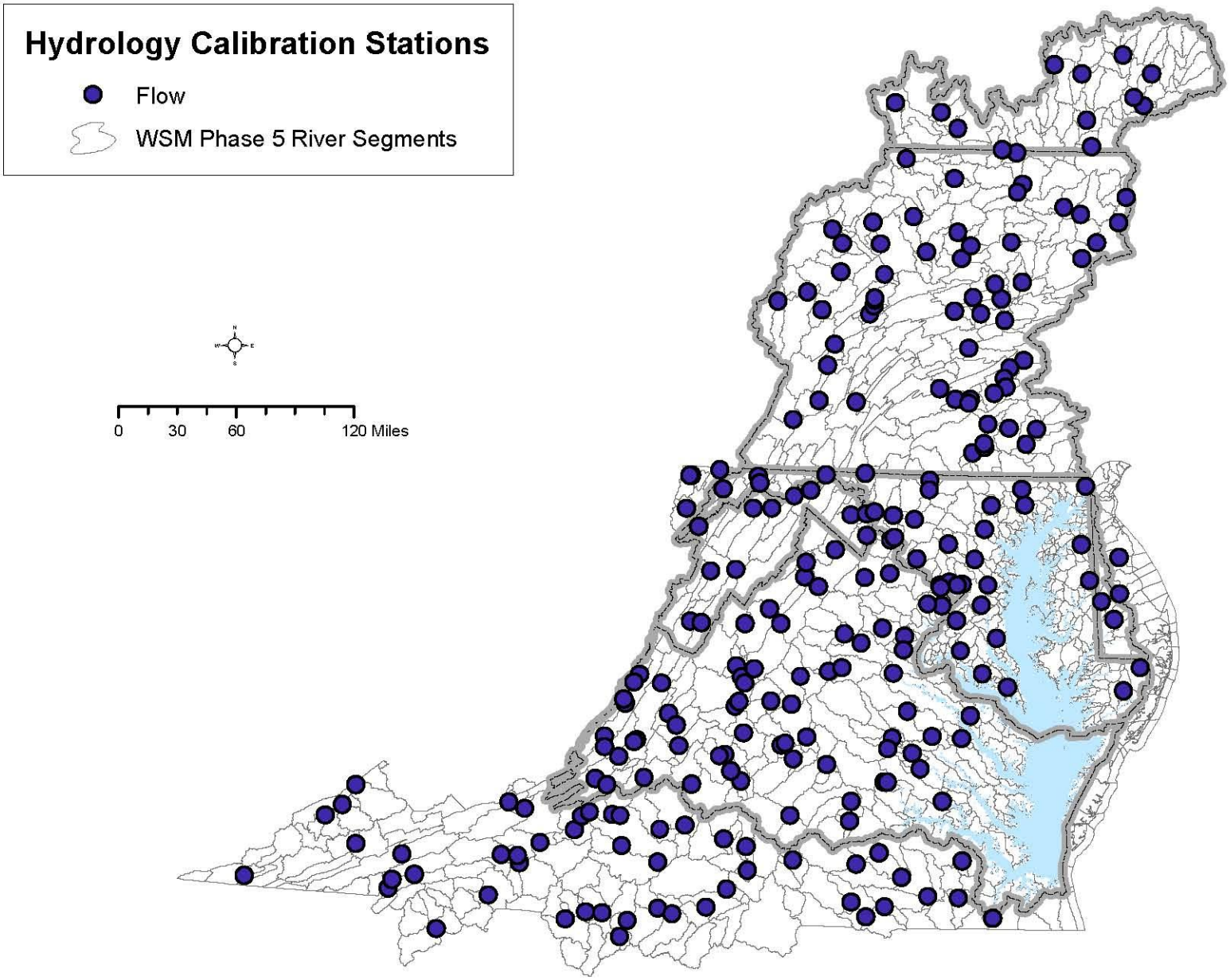
Changes Agreed to by AgWG/WQGIT/PSC

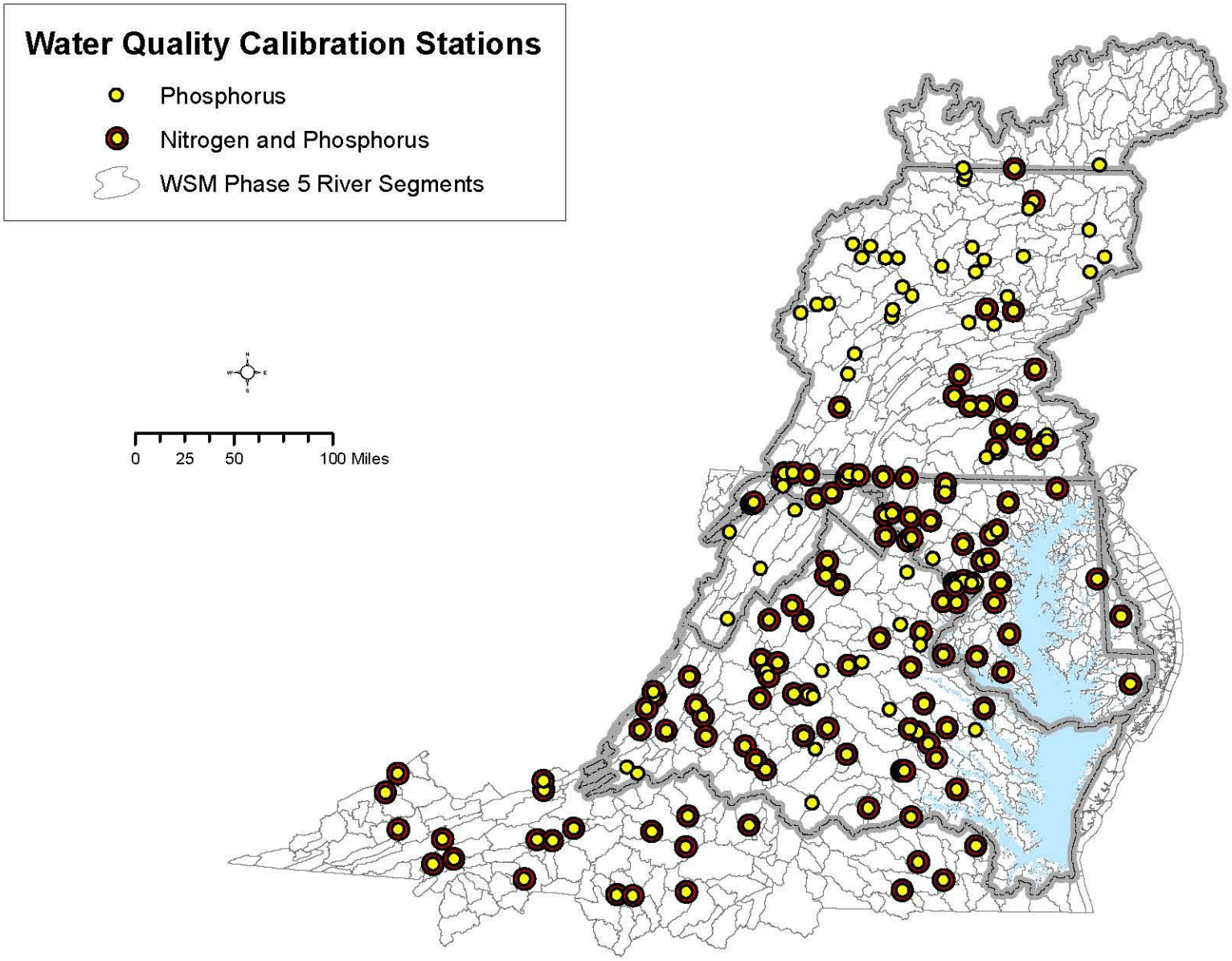
- Modified nutrient management (continued)
  - Count all manure phosphorus toward total
  - Refine nursery coverage
  - Double crop nutrient applications split
  - Update nutrient applications
  - Keep mass balance of manure with BMPs

Calibration Strategy

- Match observations in rivers
- Match properties and trends
  - Groundwater recession curve
  - Crop uptake of Nitrogen
- Match literature and other models
  - Reasonable rates of nutrient export
  - USGS estimator and sparrow models

• Calibration method, reviewed by Modeling Workgroup and STAC, is largely unchanged since 2008.

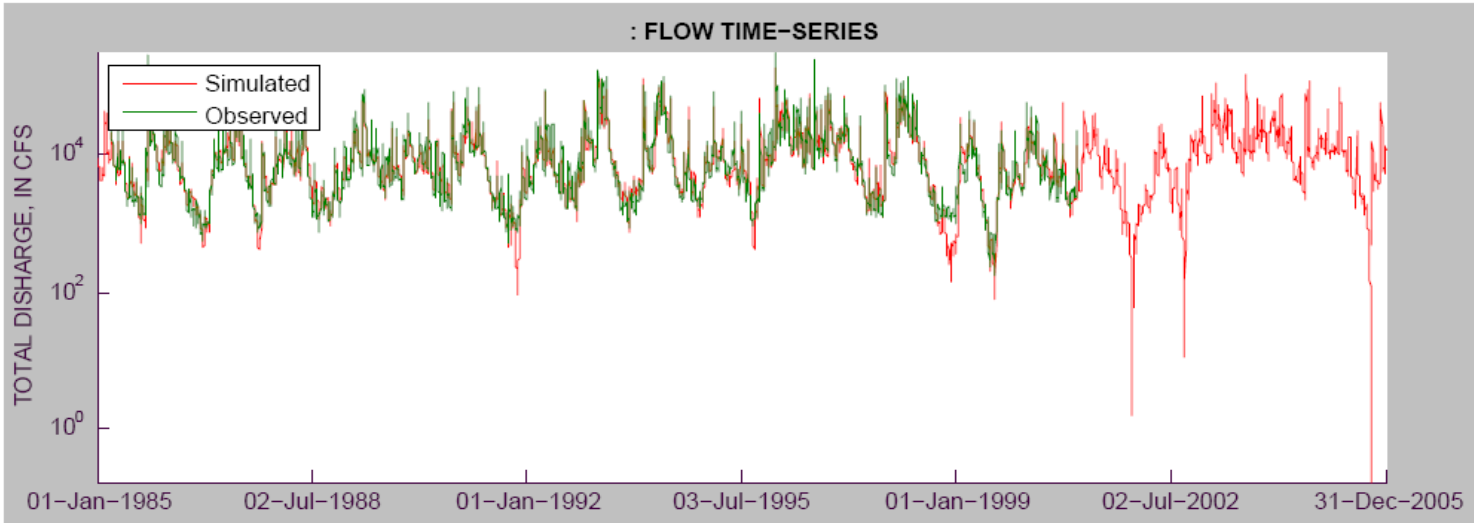

Hydrology Calibration Stations
Flow
WSM Phase 5 River Segments
0
30
60
120 Miles

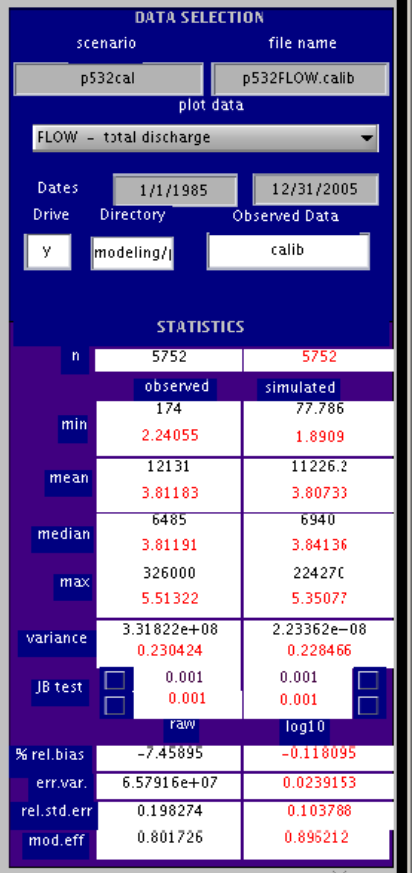

Water Quality Calibration Stations
Phosphorus
Nitrogen and Phosphorus
WSM Phase 5 River Segments
0
25
50
100 Miles

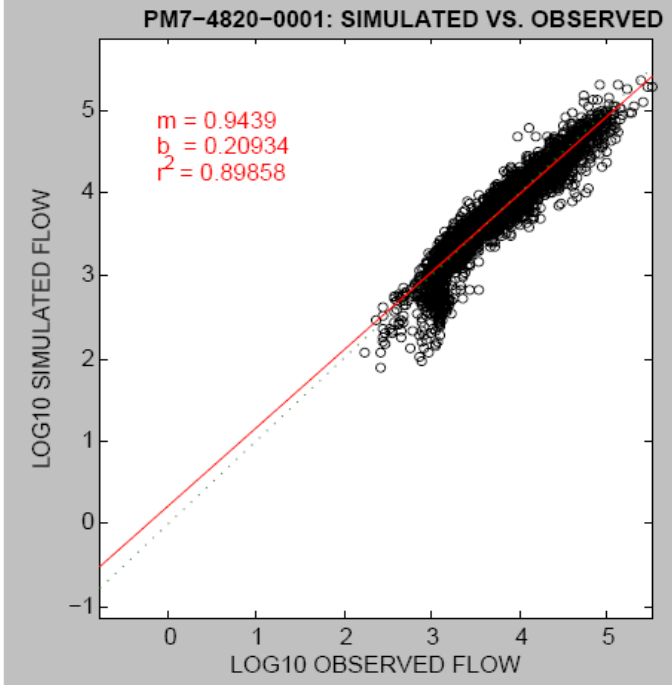
Calibration Plots

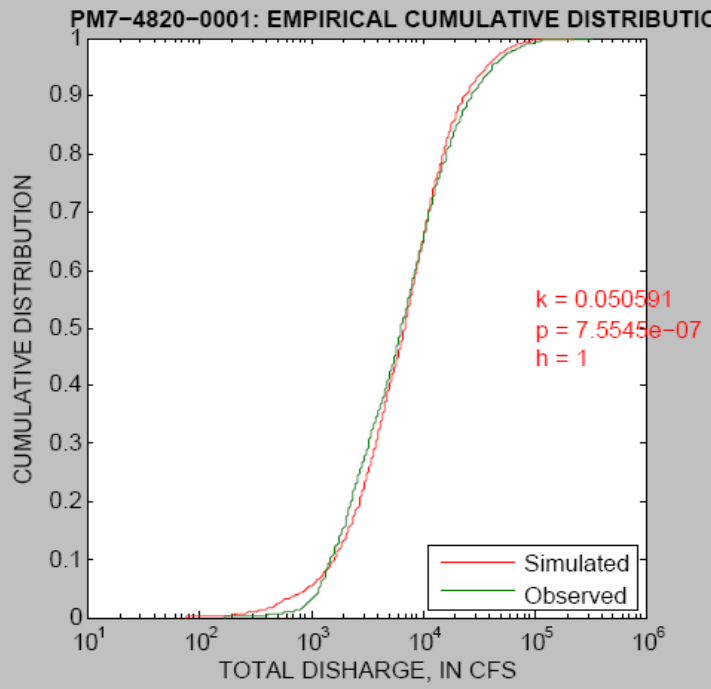
- Flow, TN, TP, TSS, Oxygen, Temperature, Chlorophyll, Nitrate, Ammonia, Phosphate
- 100 – 300 stations
- 5,151 total pages

https://archive.chesapeakebay.net/modeling/phase5/calibration_pdfs/p532_2011_05/

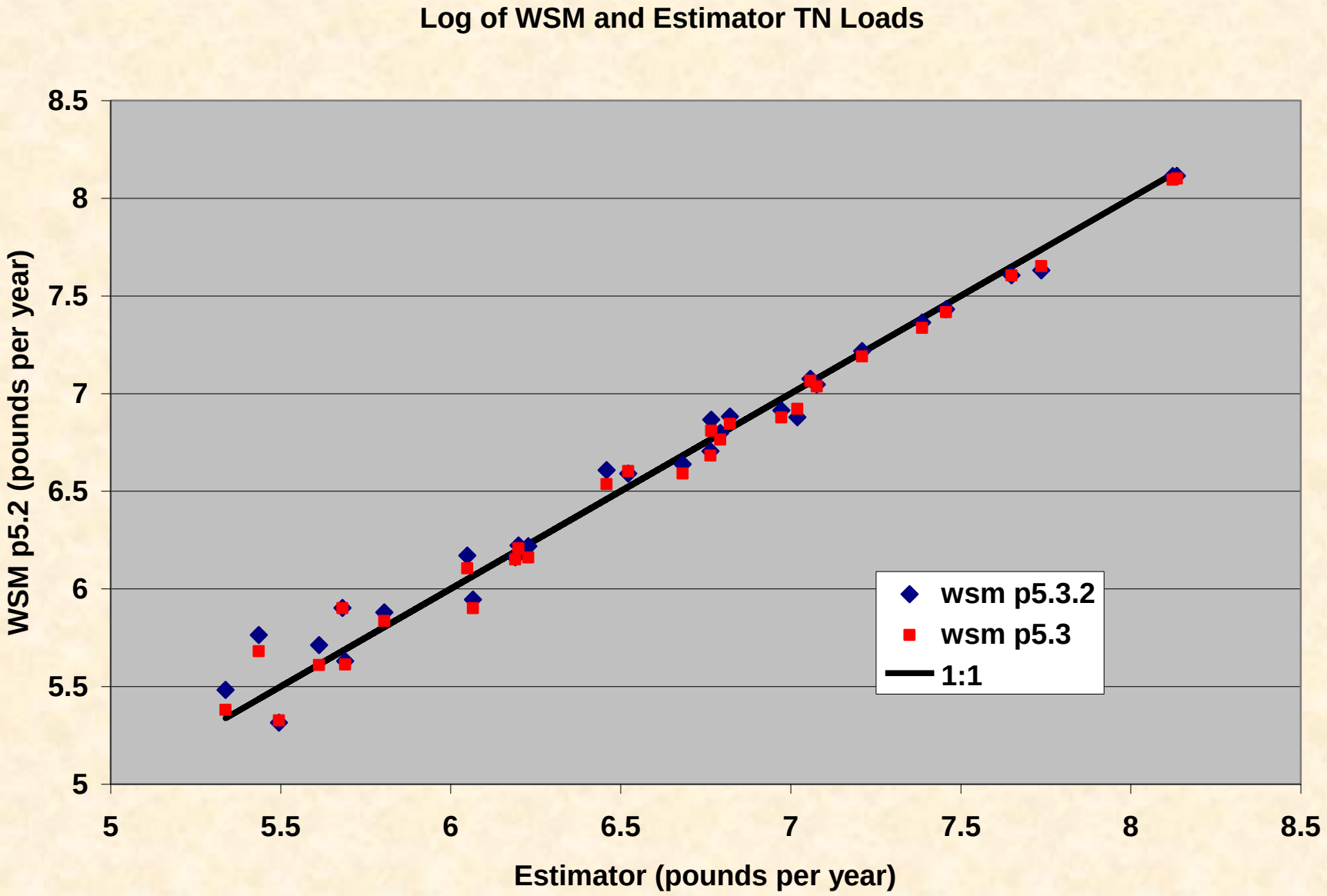

: FLOW TIME-SERIES
Simulated
Observed
TOTAL DISHARGE, IN CFS
10^4
10^2
10^0
01-Jan-1985
02-Jul-1988
01-Jan-1992
03-Jul-1995
01-Jan-1999
02-Jul-2002
31-Dec-2005

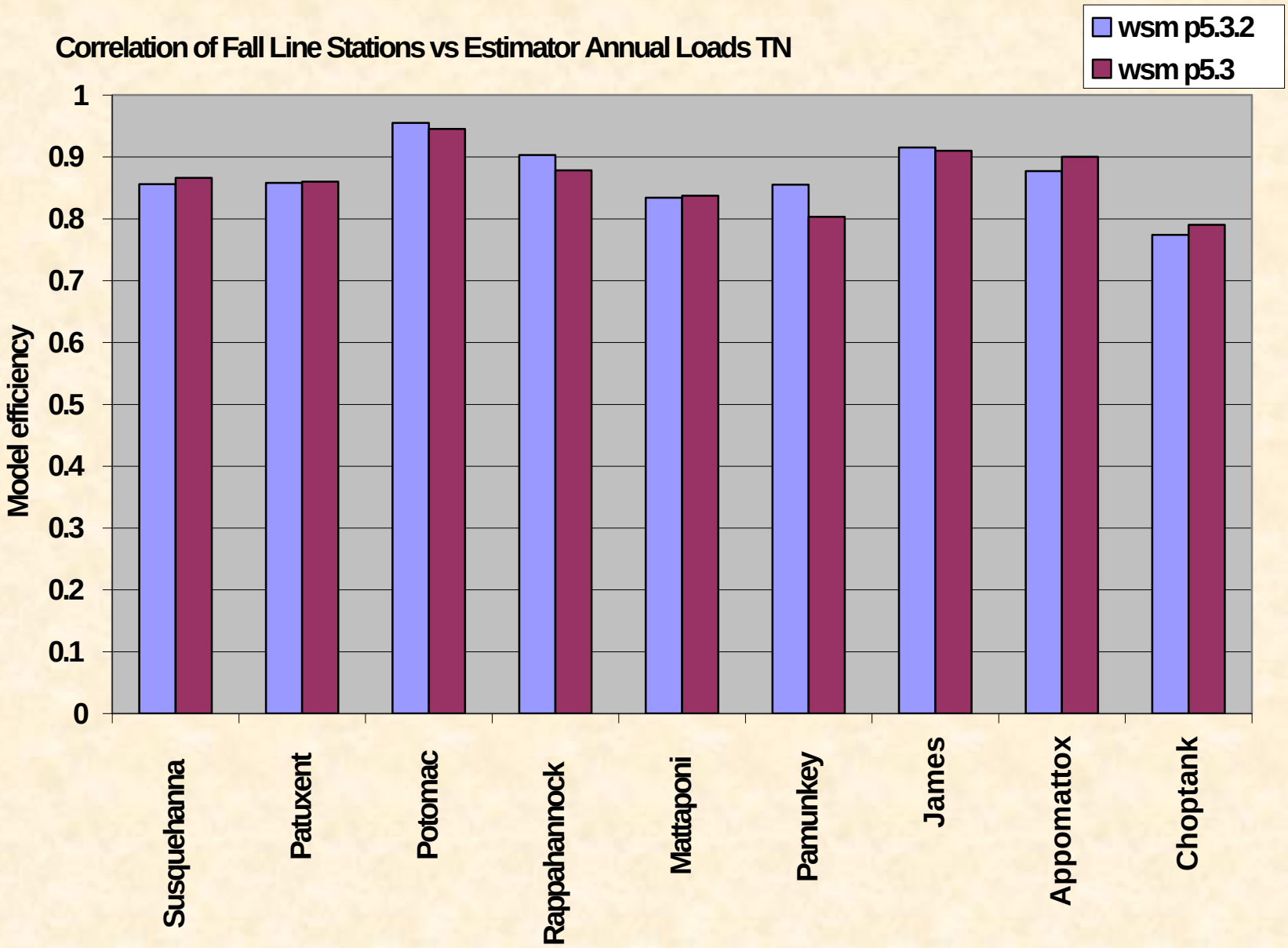

DATA SELECTION
scenario
file name
p532cal
p532FLOW.calib
plot data
FLOW - total discharge
Dates
1/1/1985
12/31/2005
Drive
Directory
Observed Data
y
modeling/
calib
STATISTICS
n
5752
5752
observed
simulated
min
174
2.24055
77.786
1.8909
mean
12131
3.81183
11226.2
3.80733
median
6485
3.81191
6940
3.84136
max
326000
5.51322
224270
5.35077
variance
3.31822e+08
0.230424
2.23362e-08
0.228466
JB test
0.001
0.001
0.001
0.001
raw
log10
% rel.bias
-7.45895
-0.118095
err.var.
6.57916e+07
0.0239153
rel.std.err
0.198274
0.103788
mod.eff
0.801726
0.896212


PM7-4820-0001: SIMULATED VS. OBSERVED
m = 0.9439
b = 0.20934
r^2 = 0.89858
LOG10 SIMULATED FLOW
LOG10 OBSERVED FLOW

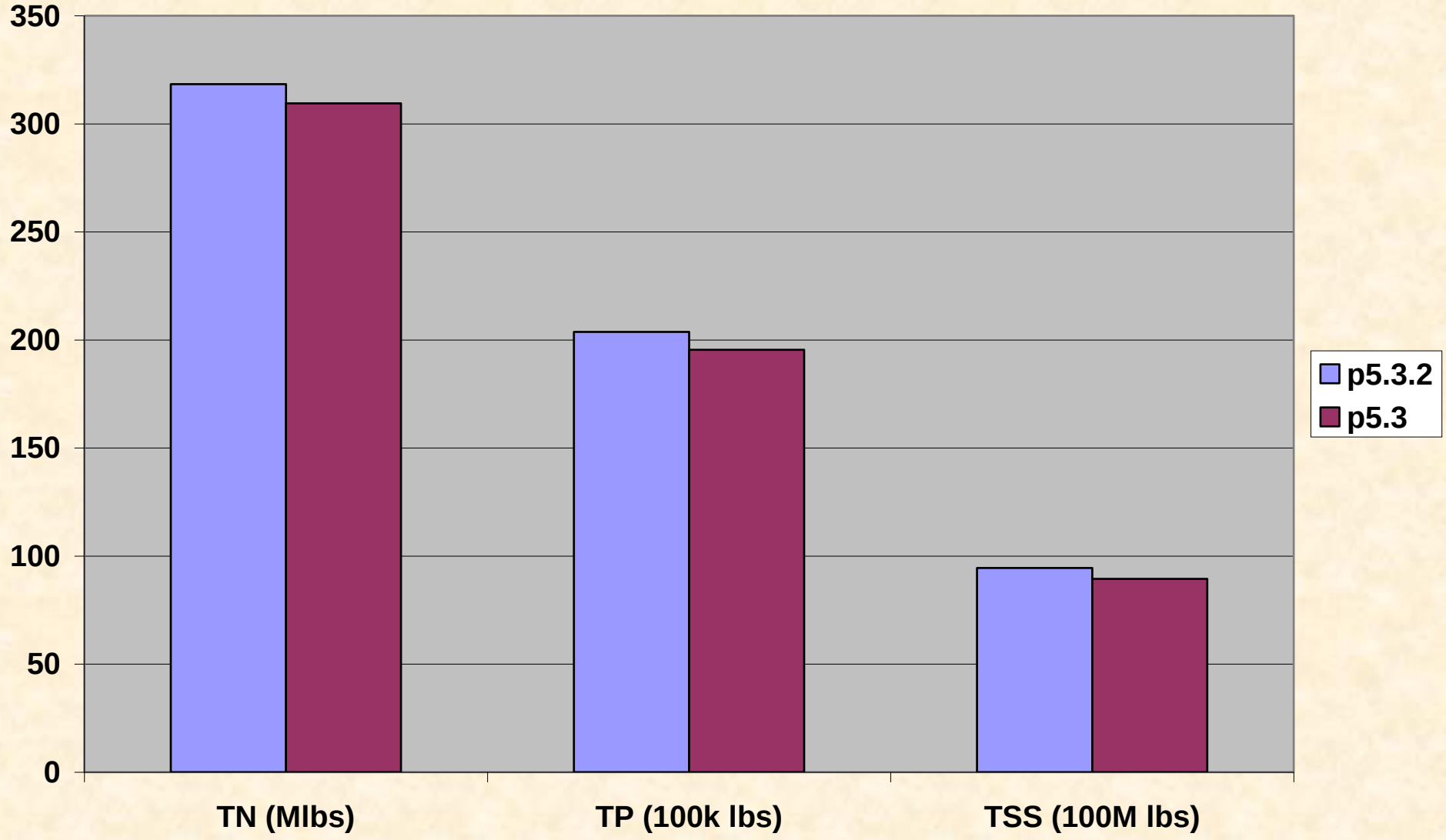

PM7-4820-0001: EMPIRICAL CUMULATIVE DISTRIBUTION
k = 0.050591
p = 7.5545e-07
h = 1
Simulated
Observed
CUMULATIVE DISTRIBUTION
TOTAL DISHARGE, IN CFS

VERSION 2.1

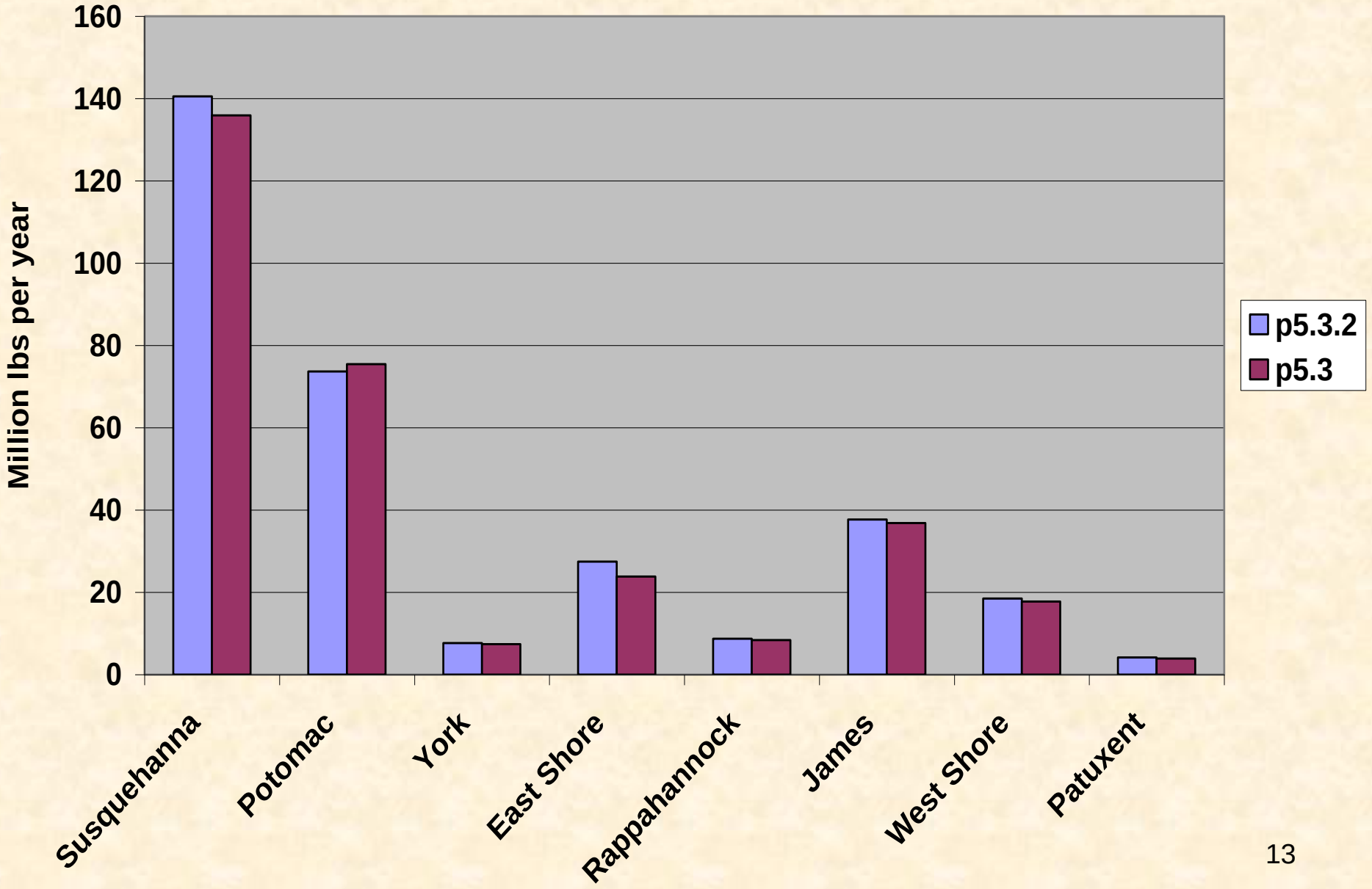

Log of WSM and Estimator TN Loads
WSM p5.2 (pounds per year)
Estimator (pounds per year)
8.5
8
7.5
7
6.5
6
5.5
5
5
5.5
6
6.5
7
7.5
8
8.5
wsm p5.3.2
wsm p5.3
1:1

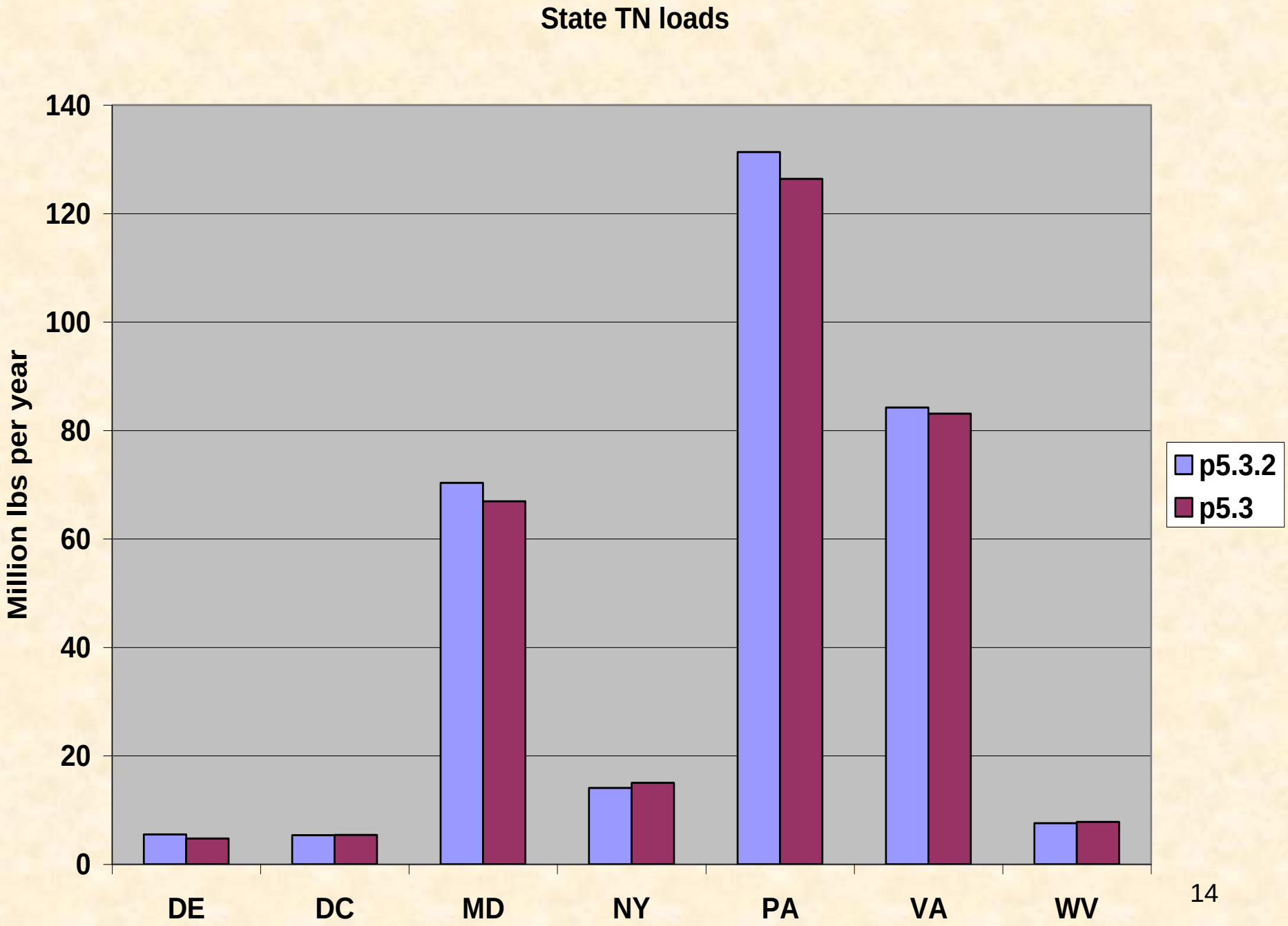

Correlation of Fall Line Stations vs Estimator Annual Loads TN
wsm p5.3.2
wsm p5.3
Model efficiency
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Susquehanna
Patuxent
Potomac
Rappahannock
Mattaponi
Pamunkey
James
Appomattox
Choptank

Total Watershed Loads

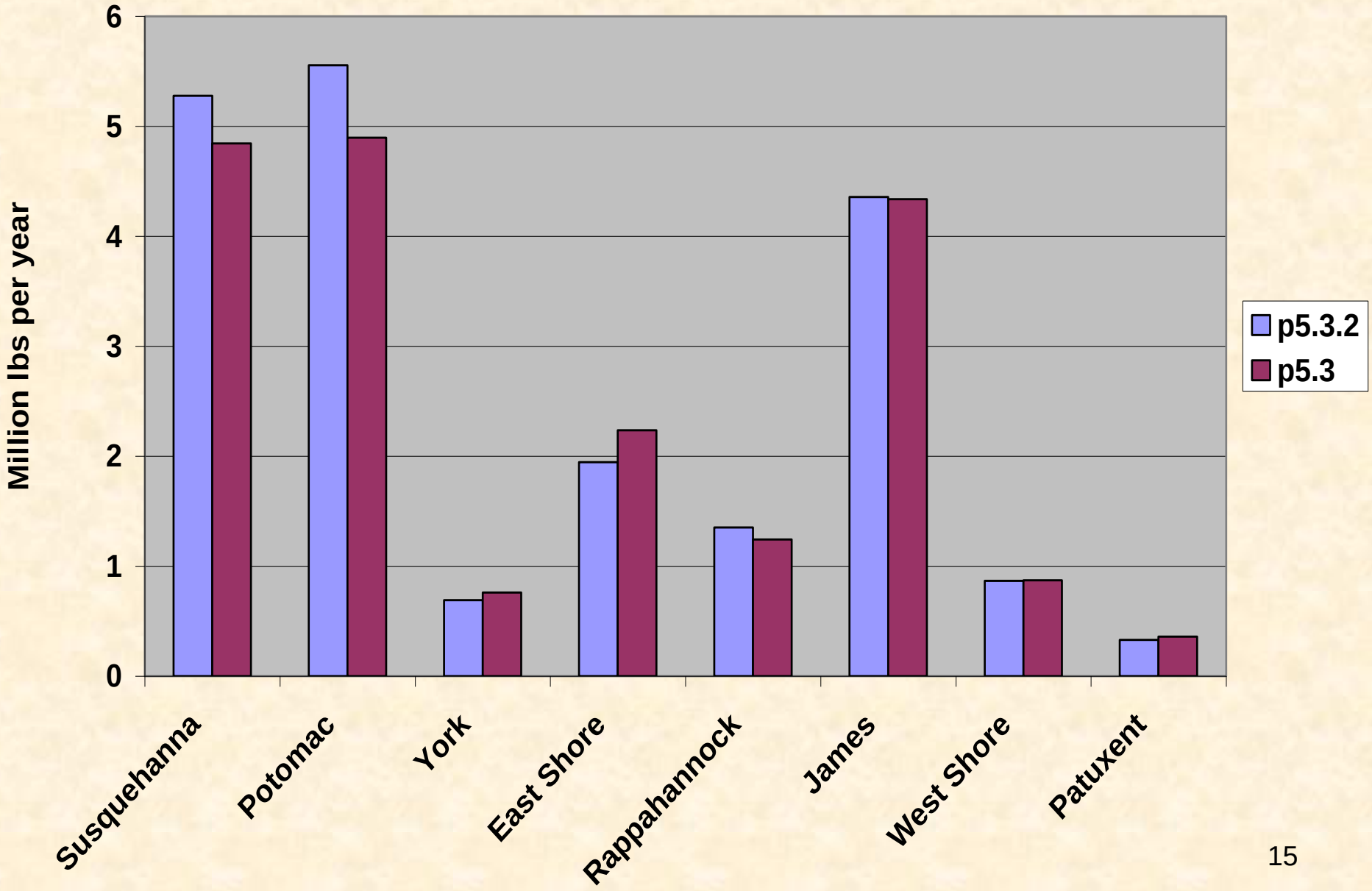


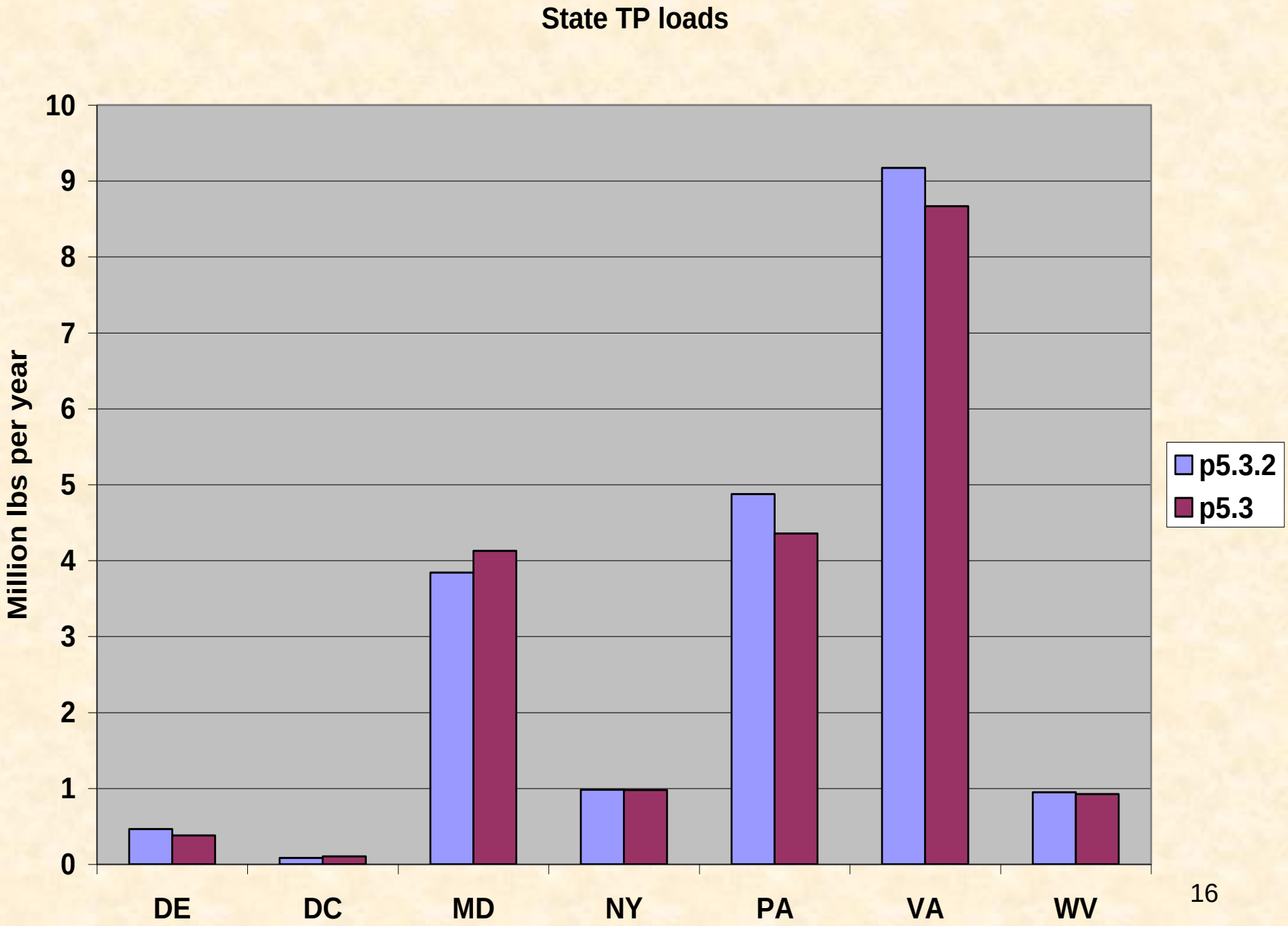
Basin TN loads



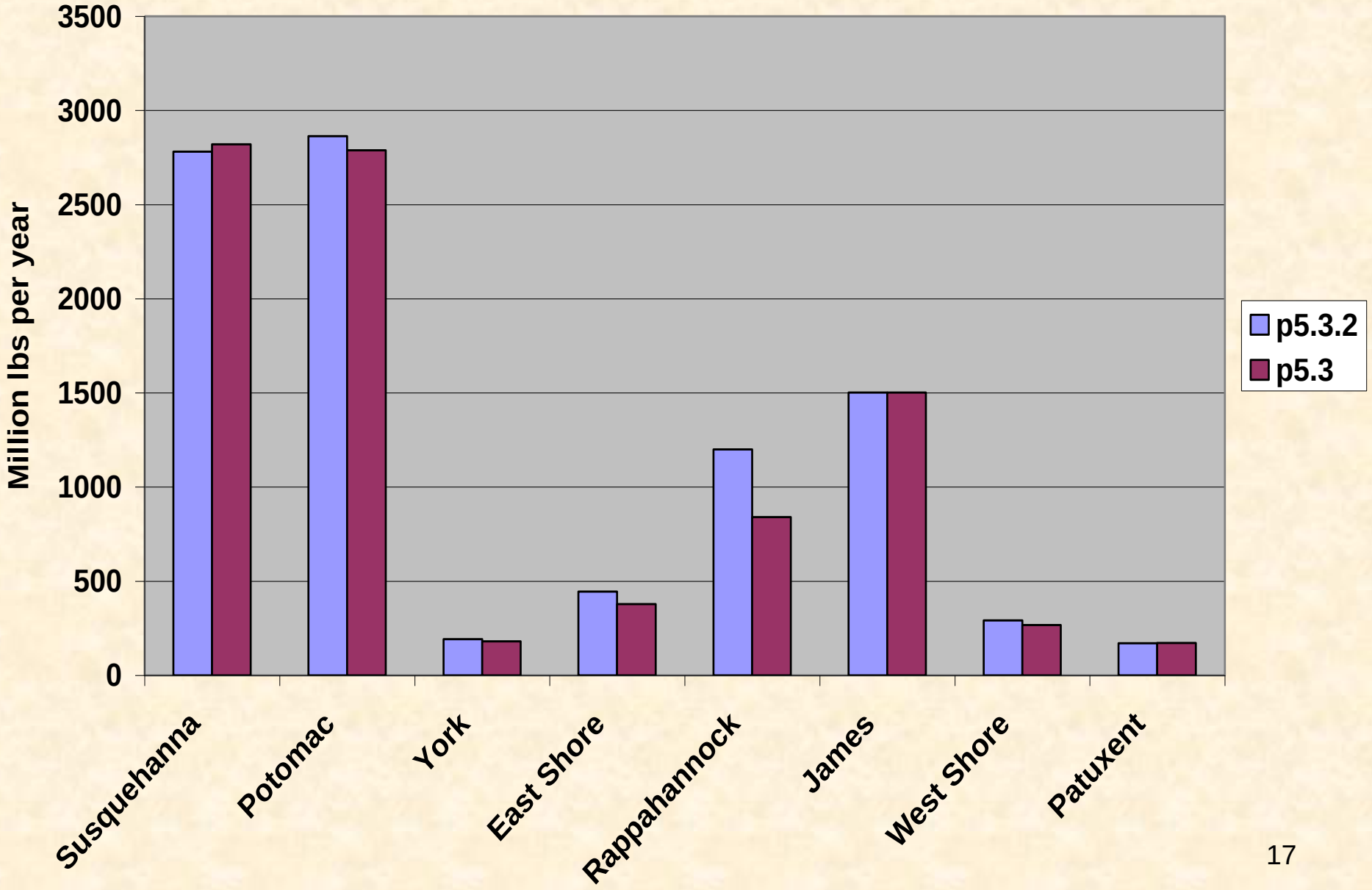

State TN loads
Million lbs per year
140
120
100
80
60
40
20
0
DE
DC
MD
NY
PA
VA
WV
p5.3.2
p5.3

Basin TP loads

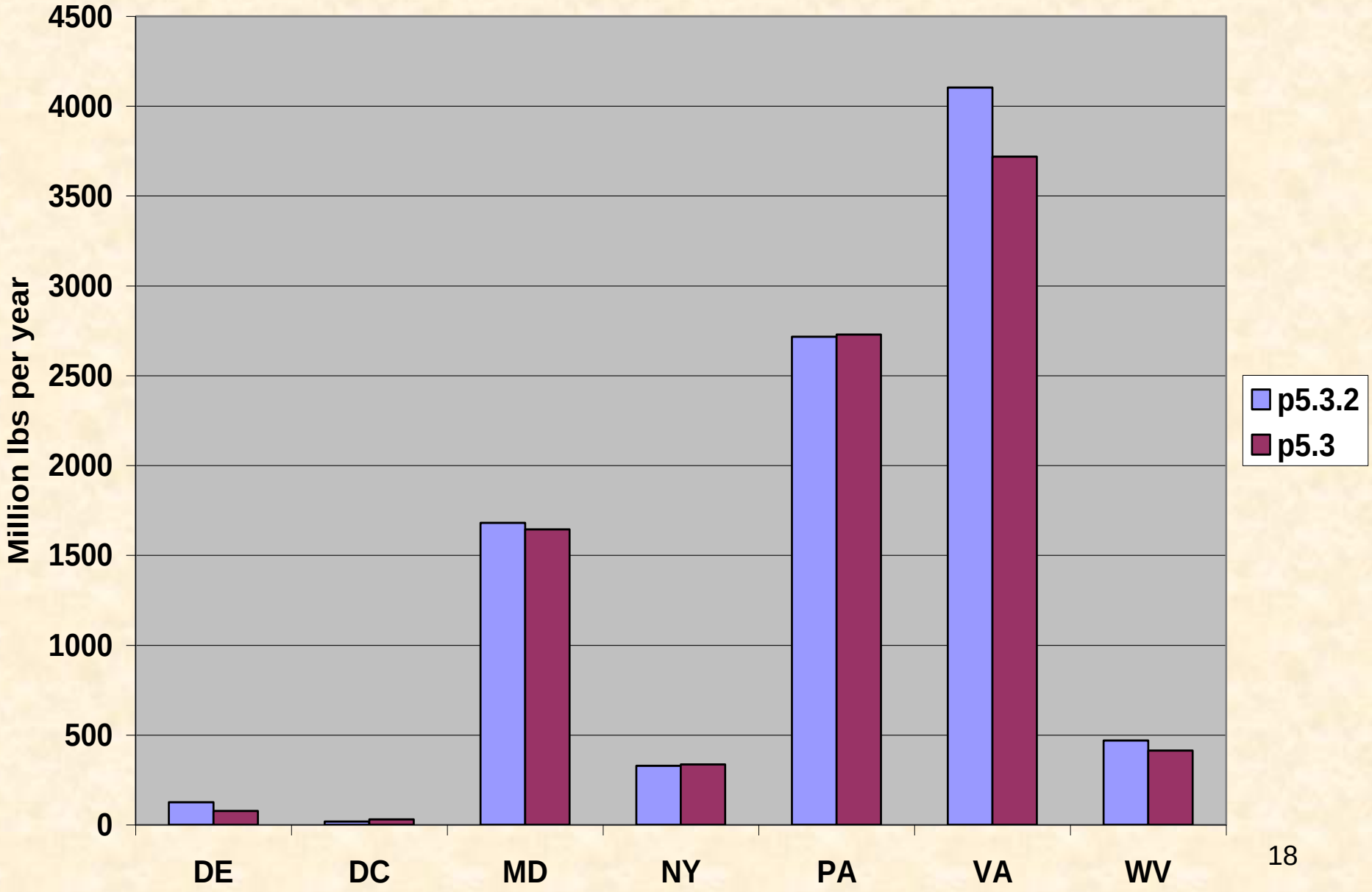



State TP loads
Million lbs per year
10
9
8
7
6
5
4
3
2
1
0
DE
DC
MD
NY
PA
VA
WV
p5.3.2
p5.3

Basin TSS loads



State TSS loads



Conclusions:

- Phase 5.3.2 inputs have improved with additional stakeholder input.
- Basin and State loads are relatively stable.
- We've seen improvements in many areas.
- To understand the implications of the new Phase 5.3.2 loads we need to complete the assessment through the WQSTM, particularly of the Phase 1 WIPs. This work is underway.