



Hydrologic Base Period and Critical Period Analysis: 1978-2025 Reference Period Update

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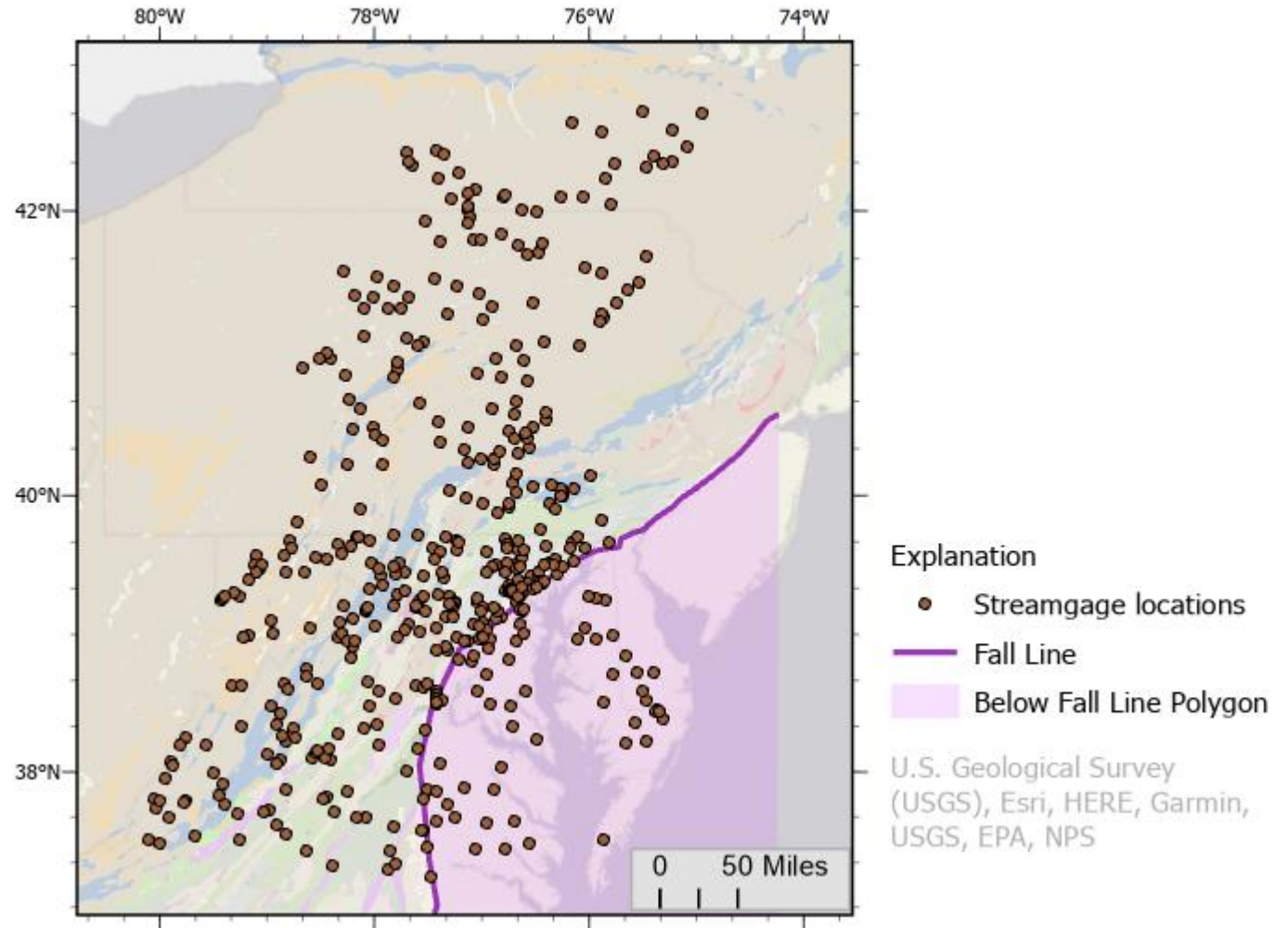
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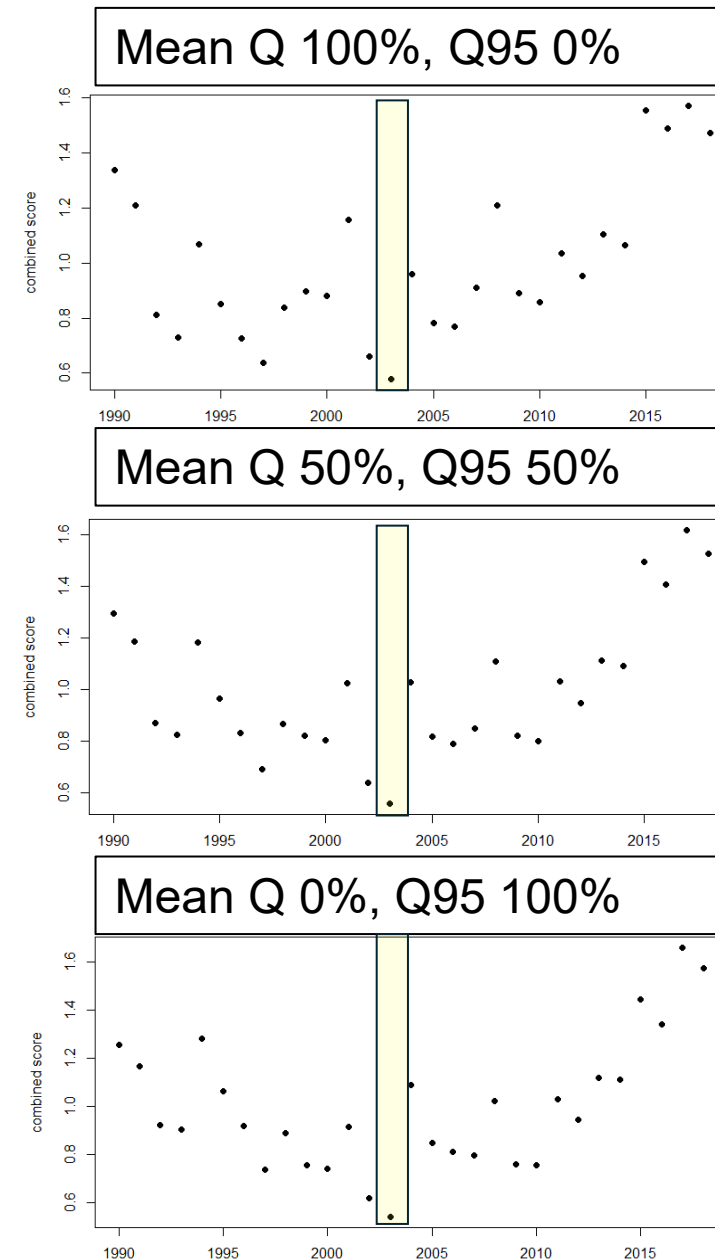
Reference period and scope

- Reference period locked at 1978-2025 (48 years), used consistently across MAPD, K-S, and critical period candidate selection
- Critical period calculation now uses full water year (all 12 months) instead of Oct-June only
- Tributary (non-RIM) stations filtered to below fall line only, using a hand-drawn polygon based on the published fall line boundary



Base period selection

- Ran three weighting scenarios varying the balance between mean flow and high flow (Q95): 100-0, 50-50, 0-100
- All three scenarios agreed on the same top-ranked base period: 1998-2007
- Result is robust to weighting choice, not an artifact of any single scoring assumption



Are recent decades a new regime?

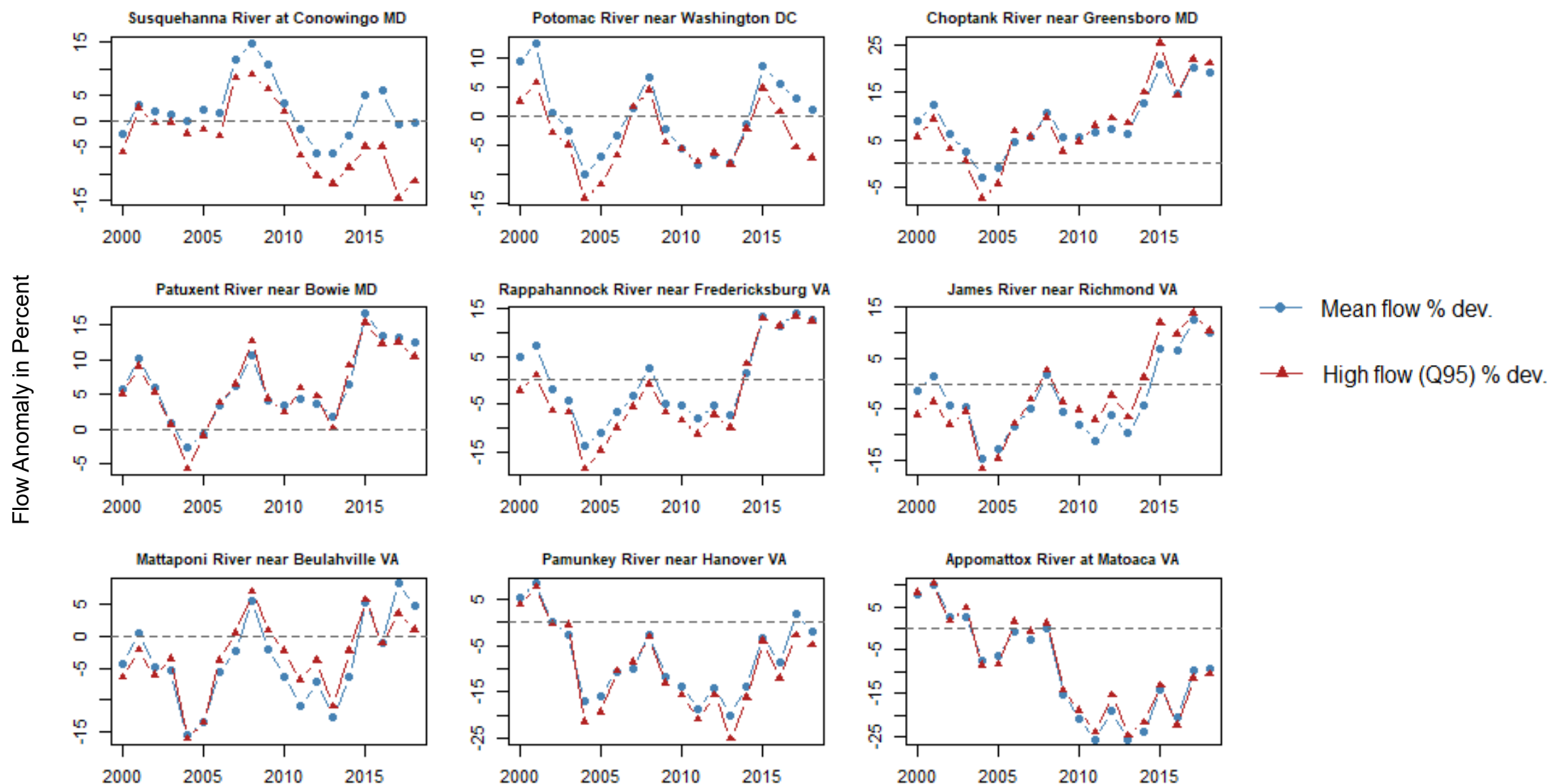
Ran multiple trend tests: Mann-Kendall, Sen's slope, Pettitt change-point test, at both composite and individual-station level, on mean flow and high flow

- No statistically significant trend or step change detected, at any station, under any test
- No evidence of a new hydrologic regime; recent variability reflects a complex, station-specific response rather than a uniform basin-wide shift
- Full nonstationarity analysis recommended as future work**

Trend test results

Station	Mean_Slope	Mean_p	Q95_Slope	Q95_p	Mean_Signif?	Q95_Signif?
Susquehanna River at Conowingo MD	37.91	0.783	-300.2	0.434	no	no
Potomac River near Washington DC	-50.24	0.333	-264.7	0.135	no	no
Choptank River near Greensboro MD	0.8	0.315	2.04	0.45	no	no
Patuxent River near Bowie MD	0.44	0.797	0.56	0.922	no	no
Rappahannock River near Fredericksburg VA	-2.92	0.638	-6.44	0.783	no	no
James River near Richmond VA	-13.82	0.625	-14.49	0.894	no	no
Mattaponi River near Beulahville VA	-2.09	0.419	-5.96	0.424	no	no
Pamunkey River near Hanover VA	-7.09	0.129	-24.01	0.138	no	no
Appomattox River at Matoaca VA	-9.81	0.066	-36.49	0.129	no	no

Ten-Year Window Flow Anomalies by Station: Mean and High Flow Relative to the Reference Period



Critical period result

- Within the 1998-2007 base period, one 3-year window meets the target return period criteria: 2004-2006 (return period approximately 12 years, within the target 10 plus or minus 2 window)
- This result is not a boundary artifact; it is well separated from the next-closest candidate windows
- Caveat: empirical Weibull return period estimation is sensitive to record length, particularly in the tails, where small differences in flow can produce large differences in estimated return period
- Future work: record extension and parametric distribution fitting (e.g., LP3) would provide a more stable estimate

Critical period candidate table

start	end	mid	window	mean_3yr_flow	near_target	return_p_weibull
1998	2000	1999	1998-2000	9446.2	FALSE	1.38
1999	2001	2000	1999-2001	7131.8	FALSE	1.02
2000	2002	2001	2000-2002	7382.6	FALSE	1.04
2001	2003	2002	2001-2003	9435.3	FALSE	1.34
2002	2004	2003	2002-2004	12940.7	FALSE	6.71
2003	2005	2004	2003-2005	15062.5	FALSE	47.00
2004	2006	2005	2004-2006	13767.3	TRUE	11.75
2005	2007	2006	2005-2007	11562.4	FALSE	3.36

Preliminary Results: 1998-2007 Base Period, 2004-2006 Critical Period

