# Appendix for Model 03100208

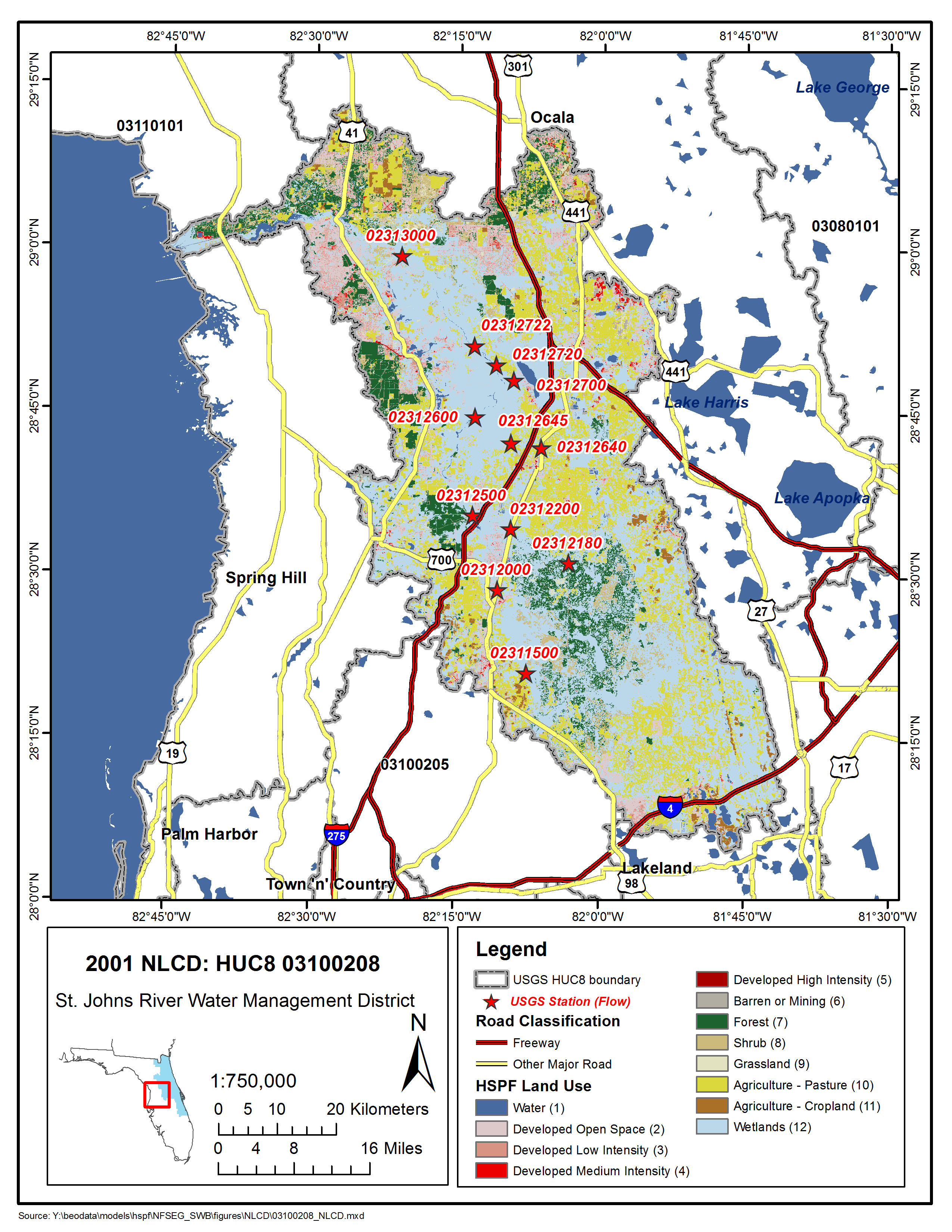


Figure 03100208-1: Land Cover from the National Land Cover Database.

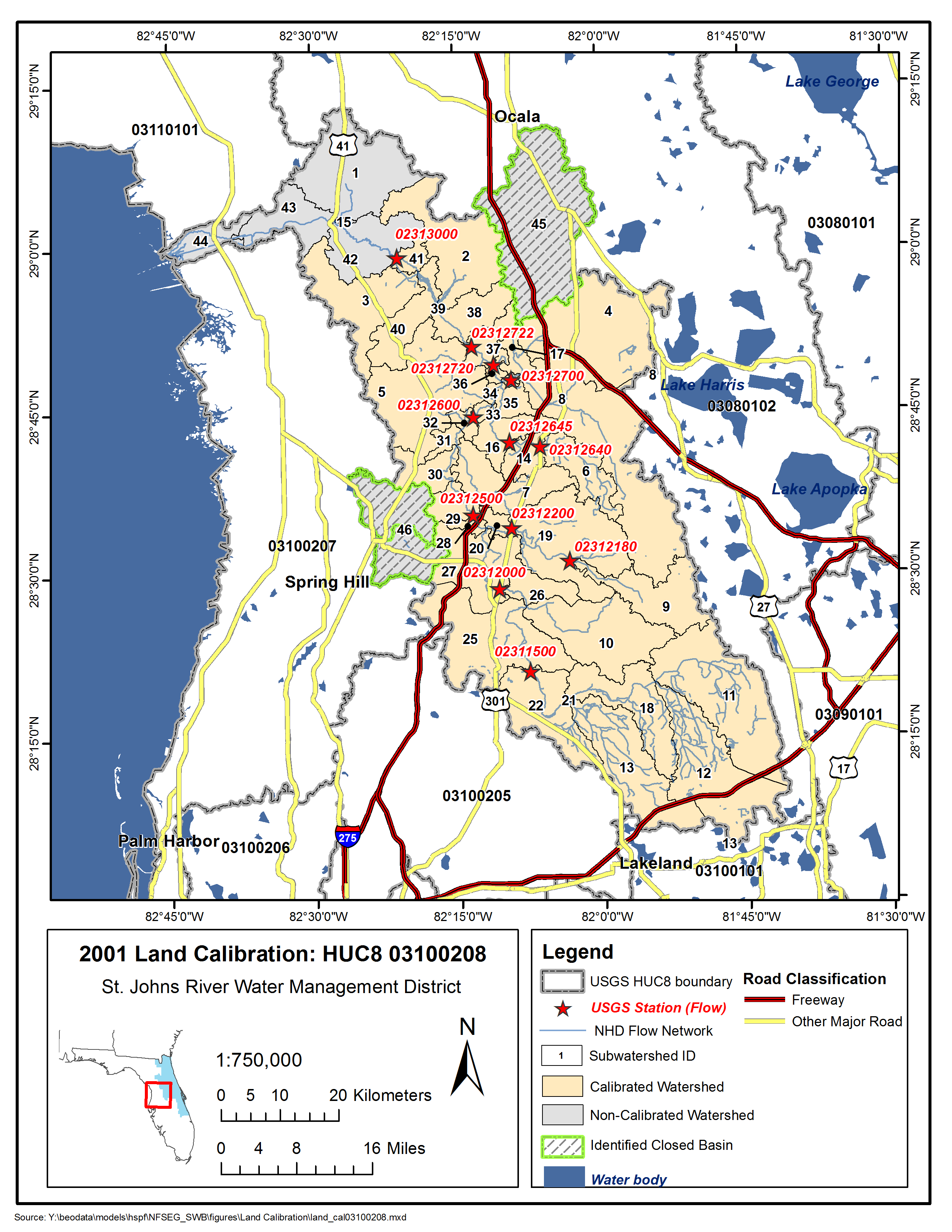


Figure 03100208-2: Calibrated sub-watersheds.

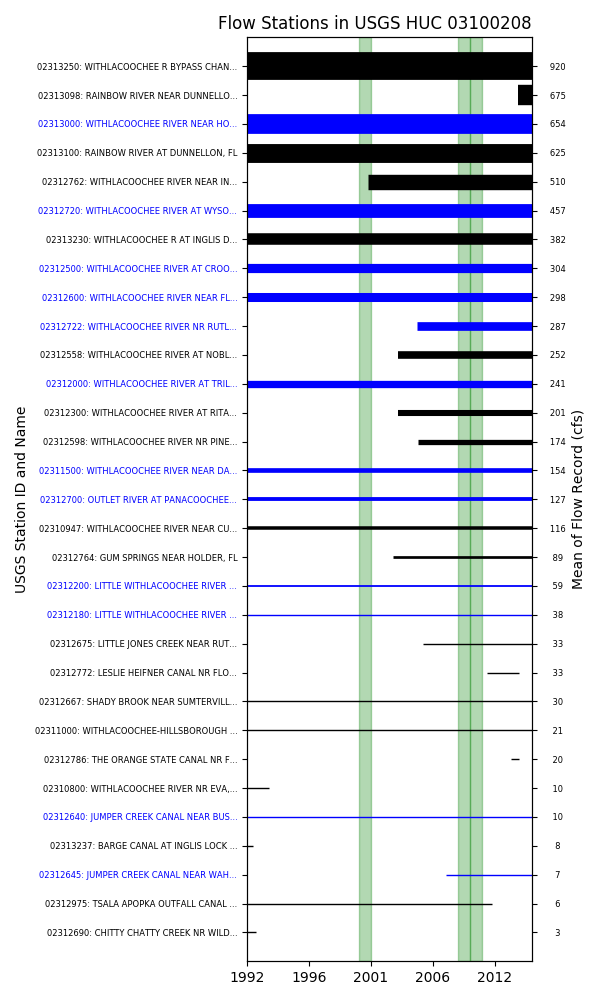


Figure 03100208-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 01, USGS Gauge 02313100

Table 03100208-1: Comparison Statistics Between HSPF Reach 01 and USGS Gauge 02313100.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 69.81 |
| Standard error | 207.52 |
| Relative bias | 0.11 |
| Relative standard error | 2.17 |
| Nash-Sutcliffe coefficient | -3.73 |
| Kling-Gupta coefficient | -0.27 |
| Coefficient of efficiency | -1.61 |
| Index of agreement | 0.23 |

Table 03100208-2: Hydrologic Indices Between USGS Gauge 02313100 and HSPF Reach 01.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02313100 | Simulated Reach 01 | Percent Difference |
| MA1: Mean, all daily flows | 622.03 | 691.70 | 11.20 |
| MA2: Median, all daily flows | 612.00 | 754.02 | 23.21 |
| MA3: CV, all daily flows | 8.09 | 5.37 | -33.64 |
| MA4: CV, log of all daily flows | 12.90 | 24.29 | 88.19 |
| MA5: Mean daily flow / median daily flow | 1.02 | 0.92 | -9.74 |
| MA9: (Q10 - Q90) / median daily flow | 0.38 | 0.64 | 70.34 |
| MA10: (Q20 - Q80) / median daily flow | 0.22 | 0.37 | 64.68 |
| MA11: (Q25 - Q75) / median daily flow | 0.18 | 0.23 | 27.57 |
| MA12: Mean monthly flow, January | 624.61 | 679.70 | 8.82 |
| MA13: Mean monthly flow, February | 588.76 | 656.20 | 11.46 |
| MA14: Mean monthly flow, March | 587.29 | 664.33 | 13.12 |
| MA15: Mean monthly flow, April | 582.02 | 656.96 | 12.88 |
| MA16: Mean monthly flow, May | 564.40 | 639.56 | 13.32 |
| MA17: Mean monthly flow, June | 559.42 | 637.64 | 13.98 |
| MA18: Mean monthly flow, July | 577.15 | 650.46 | 12.70 |
| MA19: Mean monthly flow, August | 598.58 | 674.35 | 12.66 |
| MA20: Mean monthly flow, September | 623.45 | 688.89 | 10.50 |
| MA21: Mean monthly flow, October | 633.57 | 691.54 | 9.15 |
| MA22: Mean monthly flow, November | 626.37 | 674.63 | 7.71 |
| MA23: Mean monthly flow, December | 614.58 | 671.62 | 9.28 |
| ML1: Mean minimum monthly flow, January | 613.88 | 667.49 | 8.73 |
| ML2: Mean minimum monthly flow, February | 598.87 | 667.80 | 11.51 |
| ML3: Mean minimum monthly flow, March | 598.26 | 673.97 | 12.65 |
| ML4: Mean minimum monthly flow, April | 593.13 | 670.98 | 13.13 |
| ML5: Mean minimum monthly flow, May | 576.26 | 655.56 | 13.76 |
| ML6: Mean minimum monthly flow, June | 572.61 | 652.58 | 13.97 |
| ML7: Mean minimum monthly flow, July | 586.65 | 662.96 | 13.01 |
| ML8: Mean minimum monthly flow, August | 606.83 | 681.90 | 12.37 |
| ML9: Mean minimum monthly flow, September | 634.91 | 694.62 | 9.40 |
| ML10: Mean minimum monthly flow, October | 643.61 | 702.48 | 9.15 |
| ML11: Mean minimum monthly flow, November | 641.83 | 692.43 | 7.88 |
| ML12: Mean minimum monthly flow, December | 627.52 | 684.37 | 9.06 |
| ML13: CV of minimum monthly flows | 15.13 | 26.58 | 75.72 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.90 | 0.91 | 1.76 |
| ML15: Mean minimum annual flow / mean annual flow | 0.88 | 0.91 | 2.49 |
| ML16: Median minimum annual flow / median annual flow | 0.90 | 0.94 | 4.39 |
| ML20: Ratio of baseflow volume to total flow volume | 1.00 | 0.99 | -0.37 |
| ML22: Mean annual minimum flow divided by catchment area | 5.51 | 6.33 | 14.87 |
| RA1: Mean of positive changes from one day to next (rise rate) | 2.52 | 13.39 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 100.66 | 199.56 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 1.84 | 3.39 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 69.81 | 300.54 |  |
| RA5: Ratio of days that are higher than previous day | 0.33 | 0.21 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.00 | 0.01 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.00 | 0.00 |  |
| RA8: Number of flow reversals from one day to the next | 85.29 | 94.50 |  |
| RA9: CV, number of flow reversals from one day to the next | 32.02 | 25.02 |  |

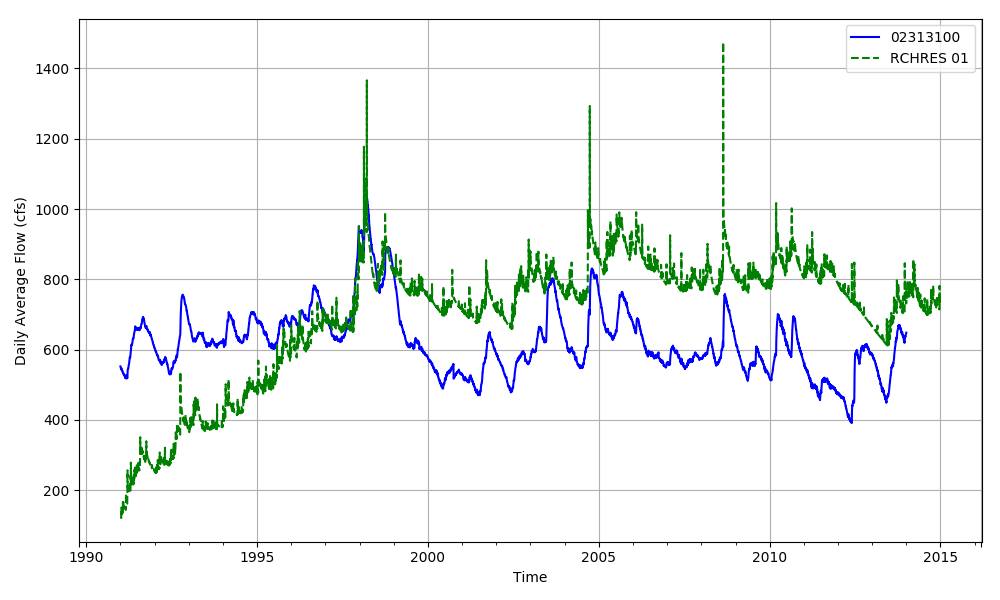


Figure 03100208-4: Daily flow for HSFP reach 01 and USGS station 02313100.

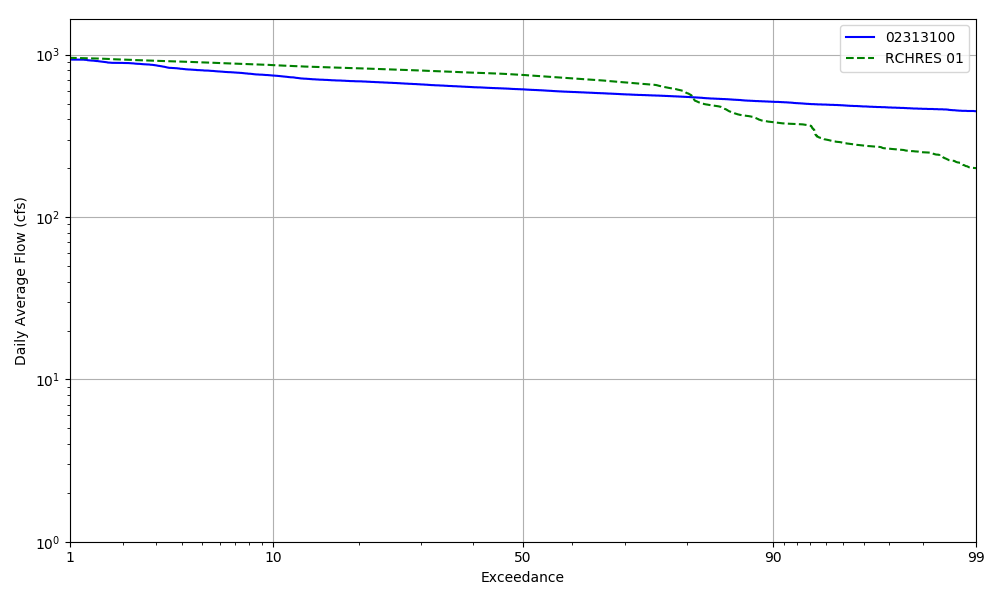


Figure 03100208-5: Daily exceedance for HSFP reach 01 and USGS station 02313100.

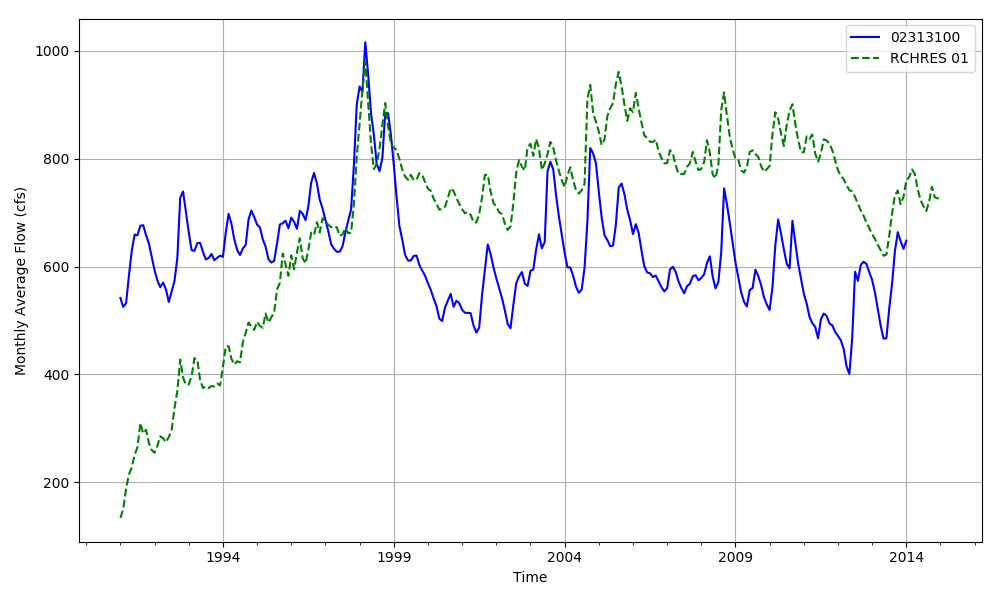


Figure 03100208-6: Monthly flow for HSFP reach 01 and USGS station 02313100.

## HSPF Reach 06, USGS Gauge 02312640

Table 03100208-3: Comparison Statistics Between HSPF Reach 06 and USGS Gauge 02312640.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -1.23 |
| Standard error | 12.83 |
| Relative bias | -0.11 |
| Relative standard error | 0.79 |
| Nash-Sutcliffe coefficient | 0.38 |
| Kling-Gupta coefficient | 0.58 |
| Coefficient of efficiency | 0.30 |
| Index of agreement | 0.62 |

Table 03100208-4: Hydrologic Indices Between USGS Gauge 02312640 and HSPF Reach 06.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312640 | Simulated Reach 06 | Percent Difference |
| MA1: Mean, all daily flows | 10.95 | 9.73 | -11.17 |
| MA2: Median, all daily flows | 3.60 | 4.42 | 22.90 |
| MA3: CV, all daily flows | 80.77 | 88.60 | 9.69 |
| MA4: CV, log of all daily flows | 128.59 | 121.12 | -5.81 |
| MA5: Mean daily flow / median daily flow | 3.04 | 2.20 | -27.72 |
| MA9: (Q10 - Q90) / median daily flow | 8.06 | 4.62 | -42.63 |
| MA10: (Q20 - Q80) / median daily flow | 4.80 | 3.10 | -35.45 |
| MA11: (Q25 - Q75) / median daily flow | 3.58 | 2.56 | -28.52 |
| MA12: Mean monthly flow, January | 10.76 | 9.16 | -14.92 |
| MA13: Mean monthly flow, February | 11.96 | 9.61 | -19.64 |
| MA14: Mean monthly flow, March | 13.17 | 10.49 | -20.37 |
| MA15: Mean monthly flow, April | 10.74 | 6.81 | -36.61 |
| MA16: Mean monthly flow, May | 6.15 | 3.36 | -45.37 |
| MA17: Mean monthly flow, June | 5.76 | 4.93 | -14.43 |
| MA18: Mean monthly flow, July | 10.15 | 9.87 | -2.76 |
| MA19: Mean monthly flow, August | 13.51 | 12.81 | -5.22 |
| MA20: Mean monthly flow, September | 14.20 | 14.70 | 3.56 |
| MA21: Mean monthly flow, October | 13.11 | 12.61 | -3.87 |
| MA22: Mean monthly flow, November | 8.07 | 8.88 | 10.02 |
| MA23: Mean monthly flow, December | 8.44 | 8.64 | 2.39 |
| ML1: Mean minimum monthly flow, January | 7.38 | 5.75 | -22.08 |
| ML2: Mean minimum monthly flow, February | 7.63 | 6.90 | -9.50 |
| ML3: Mean minimum monthly flow, March | 9.37 | 7.82 | -16.52 |
| ML4: Mean minimum monthly flow, April | 7.33 | 4.73 | -35.45 |
| ML5: Mean minimum monthly flow, May | 4.01 | 1.56 | -61.14 |
| ML6: Mean minimum monthly flow, June | 3.32 | 1.81 | -45.35 |
| ML7: Mean minimum monthly flow, July | 5.56 | 6.67 | 20.07 |
| ML8: Mean minimum monthly flow, August | 9.11 | 9.01 | -1.05 |
| ML9: Mean minimum monthly flow, September | 9.09 | 9.38 | 3.17 |
| ML10: Mean minimum monthly flow, October | 8.76 | 9.11 | 4.03 |
| ML11: Mean minimum monthly flow, November | 6.27 | 7.36 | 17.31 |
| ML12: Mean minimum monthly flow, December | 5.50 | 5.65 | 2.76 |
| ML13: CV of minimum monthly flows | 145.75 | 146.38 | 0.43 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.21 | 0.08 | -63.29 |
| ML15: Mean minimum annual flow / mean annual flow | 0.17 | 0.06 | -66.22 |
| ML16: Median minimum annual flow / median annual flow | 0.19 | 0.07 | -62.00 |
| ML20: Ratio of baseflow volume to total flow volume | 0.77 | 0.82 | 6.78 |
| ML22: Mean annual minimum flow divided by catchment area | 0.02 | 0.01 | -72.50 |
| RA1: Mean of positive changes from one day to next (rise rate) | 2.31 | 0.87 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 257.44 | 319.68 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 1.17 | 0.46 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 210.52 | 169.70 |  |
| RA5: Ratio of days that are higher than previous day | 0.22 | 0.34 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.09 | 0.08 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.06 | 0.05 |  |
| RA8: Number of flow reversals from one day to the next | 82.67 | 121.00 |  |
| RA9: CV, number of flow reversals from one day to the next | 40.80 | 32.39 |  |

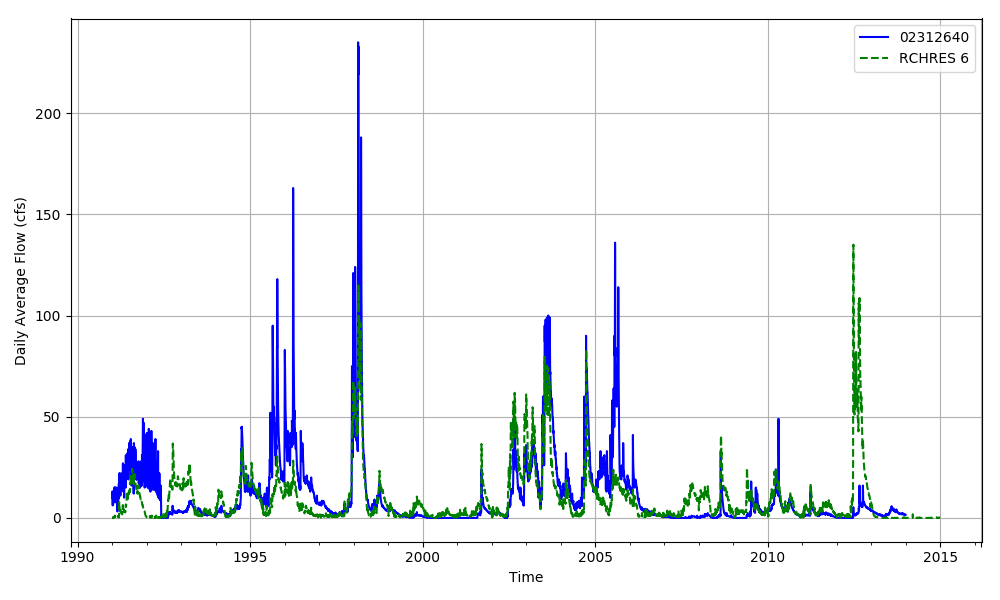


Figure 03100208-7: Daily flow for HSFP reach 06 and USGS station 02312640.

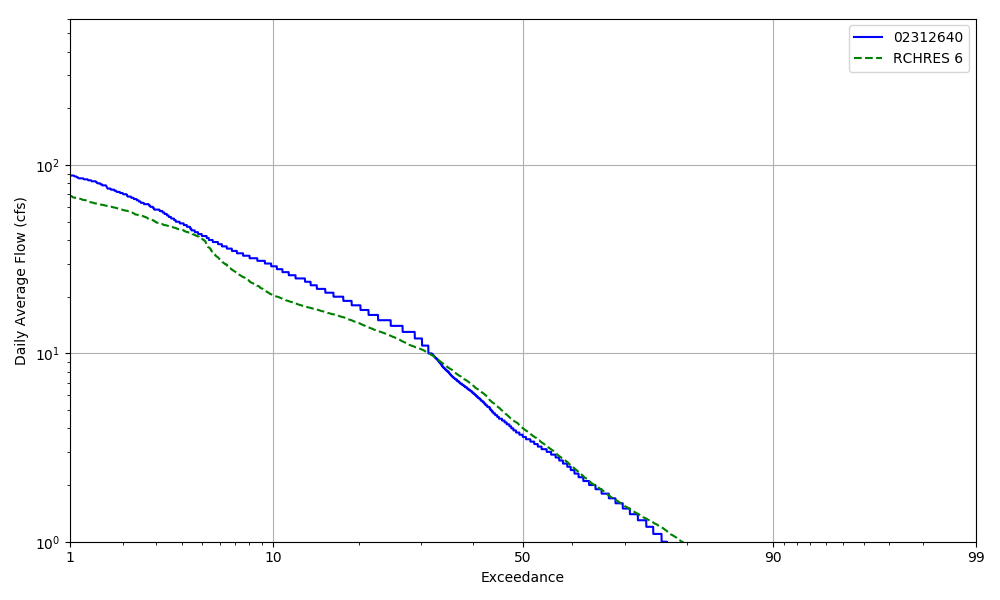


Figure 03100208-8: Daily exceedance for HSFP reach 06 and USGS station 02312640.

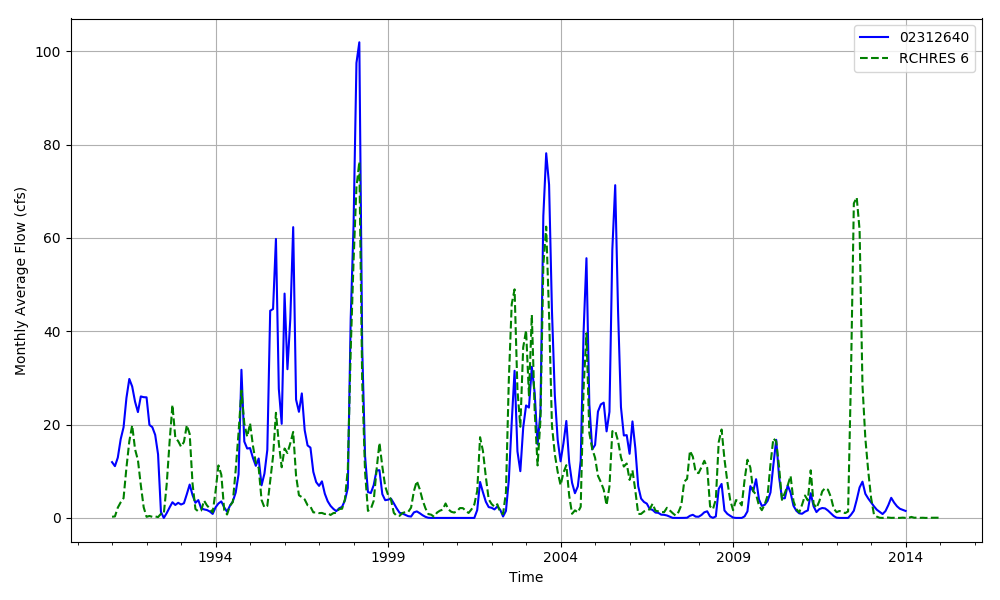


Figure 03100208-9: Monthly flow for HSFP reach 06 and USGS station 02312640.

## HSPF Reach 09, USGS Gauge 02312180

Table 03100208-5: Comparison Statistics Between HSPF Reach 09 and USGS Gauge 02312180.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -17.11 |
| Standard error | 65.93 |
| Relative bias | -0.44 |
| Relative standard error | 0.74 |
| Nash-Sutcliffe coefficient | 0.45 |
| Kling-Gupta coefficient | 0.29 |
| Coefficient of efficiency | 0.47 |
| Index of agreement | 0.68 |

Table 03100208-6: Hydrologic Indices Between USGS Gauge 02312180 and HSPF Reach 09.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312180 | Simulated Reach 09 | Percent Difference |
| MA1: Mean, all daily flows | 39.36 | 22.06 | -43.94 |
| MA2: Median, all daily flows | 0.30 | 1.01 | 235.08 |
| MA3: CV, all daily flows | 172.52 | 231.66 | 34.28 |
| MA4: CV, log of all daily flows | 230.75 | 185.71 | -19.52 |
| MA5: Mean daily flow / median daily flow | 131.19 | 21.95 | -83.27 |
| MA9: (Q10 - Q90) / median daily flow | 410.00 | 62.16 | -84.84 |
| MA10: (Q20 - Q80) / median daily flow | 123.33 | 27.67 | -77.56 |
| MA11: (Q25 - Q75) / median daily flow | 63.33 | 17.27 | -72.74 |
| MA12: Mean monthly flow, January | 33.75 | 19.39 | -42.57 |
| MA13: Mean monthly flow, February | 25.11 | 17.74 | -29.36 |
| MA14: Mean monthly flow, March | 36.59 | 19.53 | -46.61 |
| MA15: Mean monthly flow, April | 18.14 | 8.89 | -50.99 |
| MA16: Mean monthly flow, May | 3.75 | 2.80 | -25.16 |
| MA17: Mean monthly flow, June | 12.17 | 19.41 | 59.49 |
| MA18: Mean monthly flow, July | 49.53 | 23.92 | -51.70 |
| MA19: Mean monthly flow, August | 68.52 | 32.24 | -52.95 |
| MA20: Mean monthly flow, September | 87.59 | 51.58 | -41.11 |
| MA21: Mean monthly flow, October | 65.06 | 27.74 | -57.36 |
| MA22: Mean monthly flow, November | 18.40 | 10.24 | -44.34 |
| MA23: Mean monthly flow, December | 32.56 | 20.22 | -37.91 |
| ML1: Mean minimum monthly flow, January | 15.44 | 7.24 | -53.12 |
| ML2: Mean minimum monthly flow, February | 10.78 | 6.16 | -42.89 |
| ML3: Mean minimum monthly flow, March | 17.30 | 6.70 | -61.24 |
| ML4: Mean minimum monthly flow, April | 2.68 | 0.18 | -93.30 |
| ML5: Mean minimum monthly flow, May | 0.76 | 0.03 | -95.44 |
| ML6: Mean minimum monthly flow, June | 3.25 | 0.97 | -70.17 |
| ML7: Mean minimum monthly flow, July | 23.12 | 11.45 | -50.47 |
| ML8: Mean minimum monthly flow, August | 25.99 | 12.29 | -52.70 |
| ML9: Mean minimum monthly flow, September | 29.85 | 12.66 | -57.58 |
| ML10: Mean minimum monthly flow, October | 18.68 | 8.37 | -55.19 |
| ML11: Mean minimum monthly flow, November | 8.41 | 4.13 | -50.86 |
| ML12: Mean minimum monthly flow, December | 6.51 | 3.64 | -44.11 |
| ML13: CV of minimum monthly flows | 295.87 | 243.87 | -17.58 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.00 | 0.00 |  |
| ML15: Mean minimum annual flow / mean annual flow | 0.00 | 0.00 |  |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.00 |  |
| ML20: Ratio of baseflow volume to total flow volume | 0.59 | 0.44 | -26.33 |
| ML22: Mean annual minimum flow divided by catchment area | 0.00 | 0.00 |  |
| RA1: Mean of positive changes from one day to next (rise rate) | 15.62 | 16.10 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 232.28 | 632.41 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 5.63 | 6.66 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 206.84 | 868.04 |  |
| RA5: Ratio of days that are higher than previous day | 0.14 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.19 | 0.18 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.11 | 0.14 |  |
| RA8: Number of flow reversals from one day to the next | 33.75 | 92.12 |  |
| RA9: CV, number of flow reversals from one day to the next | 56.74 | 26.56 |  |

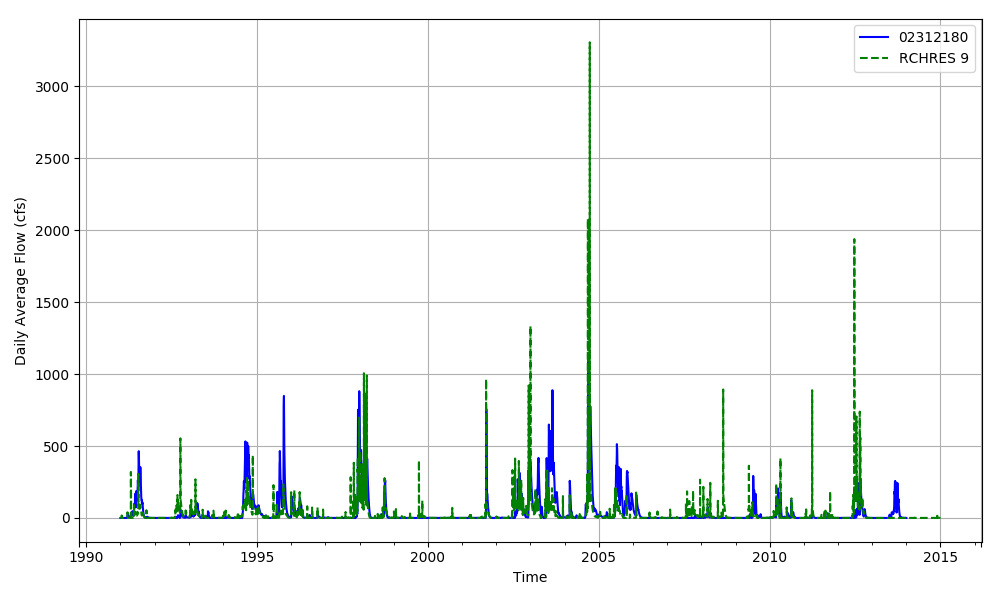


Figure 03100208-10: Daily flow for HSFP reach 09 and USGS station 02312180.

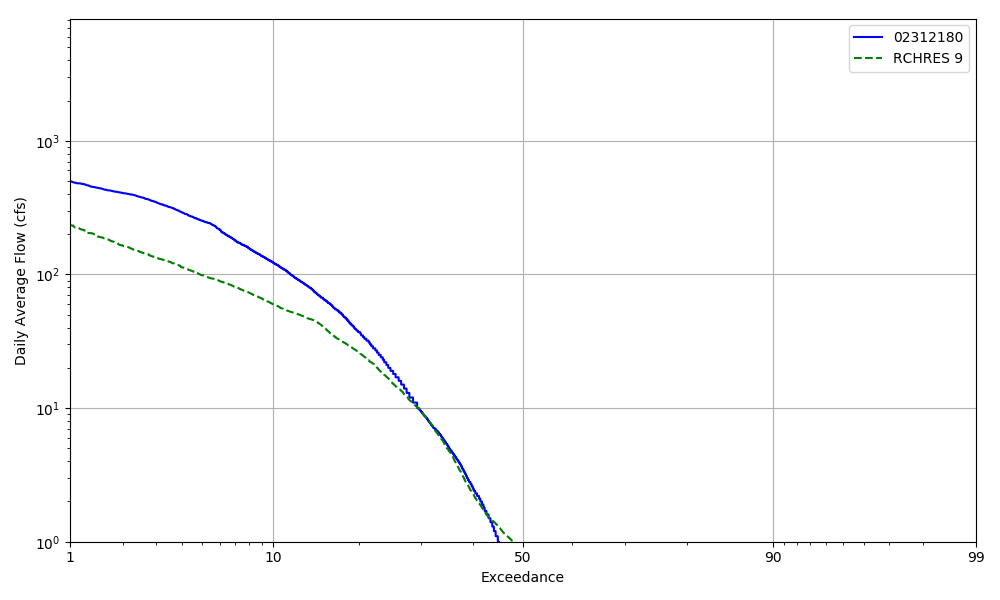


Figure 03100208-11: Daily exceedance for HSFP reach 09 and USGS station 02312180.

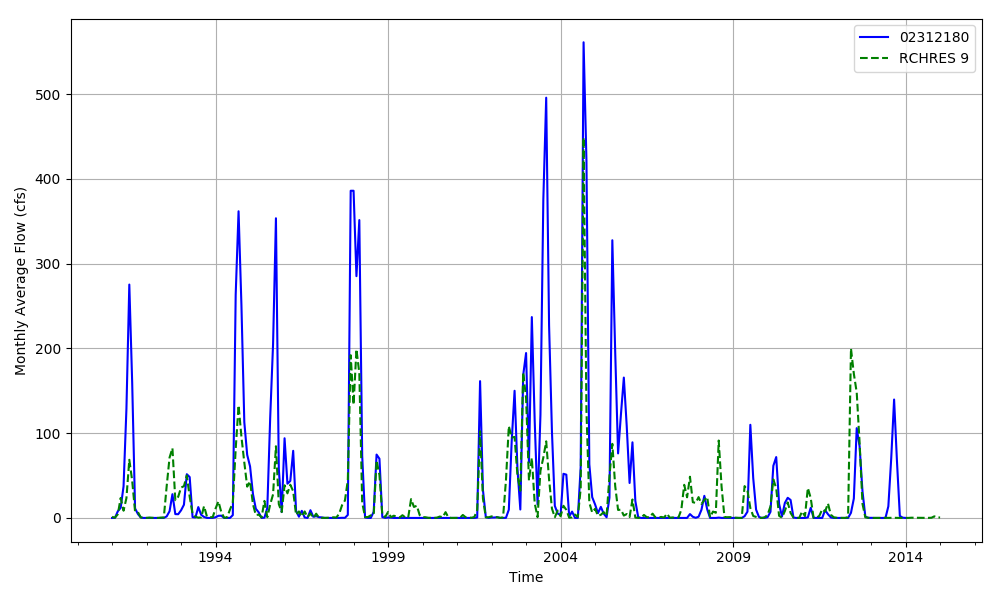


Figure 03100208-12: Monthly flow for HSFP reach 09 and USGS station 02312180.

## HSPF Reach 14, USGS Gauge 02312645

Table 03100208-7: Comparison Statistics Between HSPF Reach 14 and USGS Gauge 02312645.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 4.06 |
| Standard error | 17.48 |
| Relative bias | 0.46 |
| Relative standard error | 2.35 |
| Nash-Sutcliffe coefficient | -4.54 |
| Kling-Gupta coefficient | -0.72 |
| Coefficient of efficiency | -0.58 |
| Index of agreement | 0.45 |

Table 03100208-8: Hydrologic Indices Between USGS Gauge 02312645 and HSPF Reach 14.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312645 | Simulated Reach 14 | Percent Difference |
| MA1: Mean, all daily flows | 23.91 | 13.09 | -45.26 |
| MA2: Median, all daily flows | 24.00 | 8.85 | -63.14 |
| MA3: CV, all daily flows | 4.65 | 10.67 | 129.27 |
| MA4: CV, log of all daily flows | 33.50 | 84.72 | 152.87 |
| MA5: Mean daily flow / median daily flow | 1.00 | 1.48 | 48.50 |
| MA9: (Q10 - Q90) / median daily flow | 0.94 | 3.17 | 236.66 |
| MA10: (Q20 - Q80) / median daily flow | 0.63 | 2.72 | 329.97 |
| MA11: (Q25 - Q75) / median daily flow | 0.54 | 2.26 | 317.06 |
| MA12: Mean monthly flow, January | 1.71 | 0.12 | -93.26 |
| MA13: Mean monthly flow, February | 1.65 | 0.10 | -94.19 |
| MA14: Mean monthly flow, March | 2.24 | 0.62 | -72.39 |
| MA15: Mean monthly flow, April | 3.31 | 0.82 | -75.28 |
| MA16: Mean monthly flow, May | 2.77 | 0.93 | -66.51 |
| MA17: Mean monthly flow, June | 3.36 | 2.12 | -36.80 |
| MA18: Mean monthly flow, July | 4.12 | 3.14 | -23.78 |
| MA19: Mean monthly flow, August | 4.23 | 3.92 | -7.34 |
| MA20: Mean monthly flow, September | 3.42 | 2.85 | -16.80 |
| MA21: Mean monthly flow, October | 0.00 | 0.00 |  |
| MA22: Mean monthly flow, November | 0.00 | 0.00 |  |
| MA23: Mean monthly flow, December | 0.00 | 0.00 |  |
| ML1: Mean minimum monthly flow, January | 8.40 | 0.04 | -99.49 |
| ML2: Mean minimum monthly flow, February | 6.20 | 0.12 | -98.00 |
| ML3: Mean minimum monthly flow, March | 8.00 | 0.11 | -98.59 |
| ML4: Mean minimum monthly flow, April | 18.00 | 3.29 | -81.71 |
| ML5: Mean minimum monthly flow, May | 16.00 | 4.77 | -70.17 |
| ML6: Mean minimum monthly flow, June | 22.00 | 12.25 | -44.33 |
| ML7: Mean minimum monthly flow, July | 26.00 | 19.21 | -26.11 |
| ML8: Mean minimum monthly flow, August | 21.00 | 25.01 | 19.10 |
| ML9: Mean minimum monthly flow, September | 23.00 | 18.50 | -19.57 |
| ML10: Mean minimum monthly flow, October | 0.00 | 0.00 |  |
| ML11: Mean minimum monthly flow, November | 0.00 | 0.00 |  |
| ML12: Mean minimum monthly flow, December | 0.00 | 0.00 |  |
| ML13: CV of minimum monthly flows | 44.37 | 104.54 | 135.59 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.03 | 0.00 | -98.14 |
| ML15: Mean minimum annual flow / mean annual flow | 0.03 | 0.00 | -98.75 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.00 |  |
| ML20: Ratio of baseflow volume to total flow volume | 0.79 | 0.82 | 4.81 |
| ML22: Mean annual minimum flow divided by catchment area | 87500.01 | 87500.00 | -0.00 |
| RA1: Mean of positive changes from one day to next (rise rate) | 3.71 | 2.05 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 107.00 | 134.72 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 3.03 | 0.77 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 68.28 | 162.12 |  |
| RA5: Ratio of days that are higher than previous day | 0.40 | 0.30 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.12 | 0.12 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.12 | 0.06 |  |
| RA8: Number of flow reversals from one day to the next | 17.00 | 11.12 |  |
| RA9: CV, number of flow reversals from one day to the next | 282.84 | 282.84 |  |

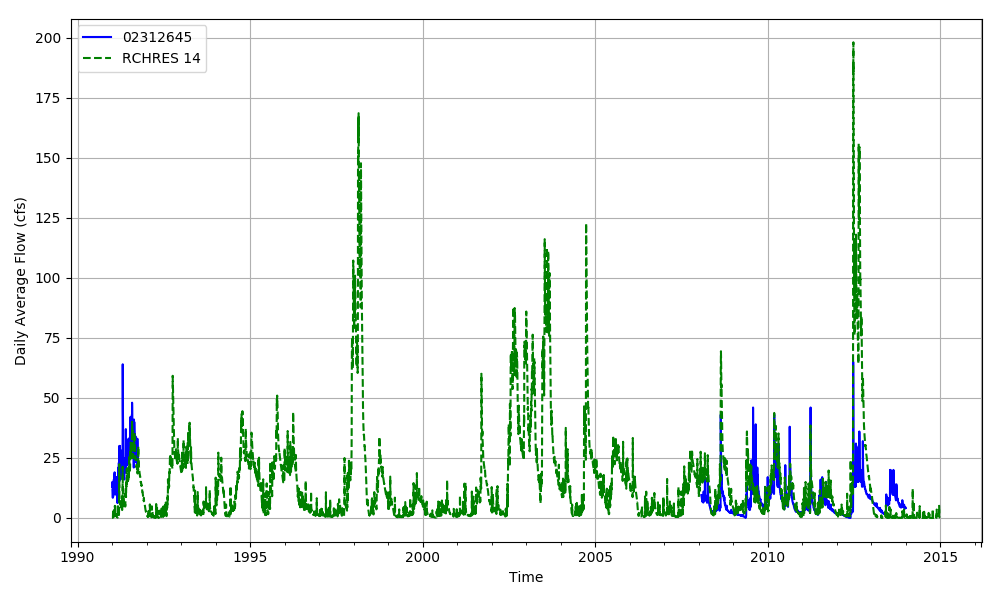


Figure 03100208-13: Daily flow for HSFP reach 14 and USGS station 02312645.

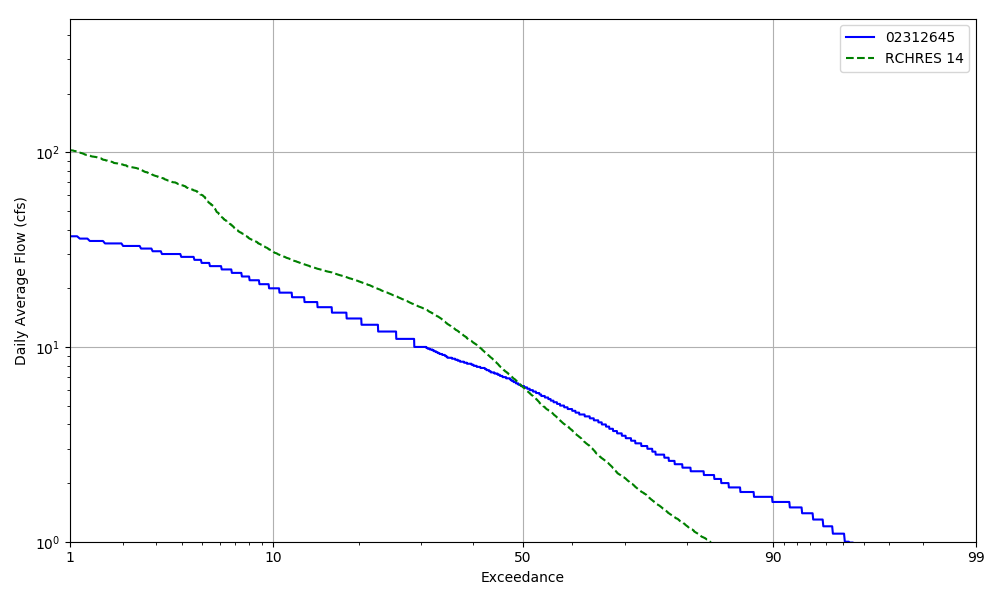


Figure 03100208-14: Daily exceedance for HSFP reach 14 and USGS station 02312645.

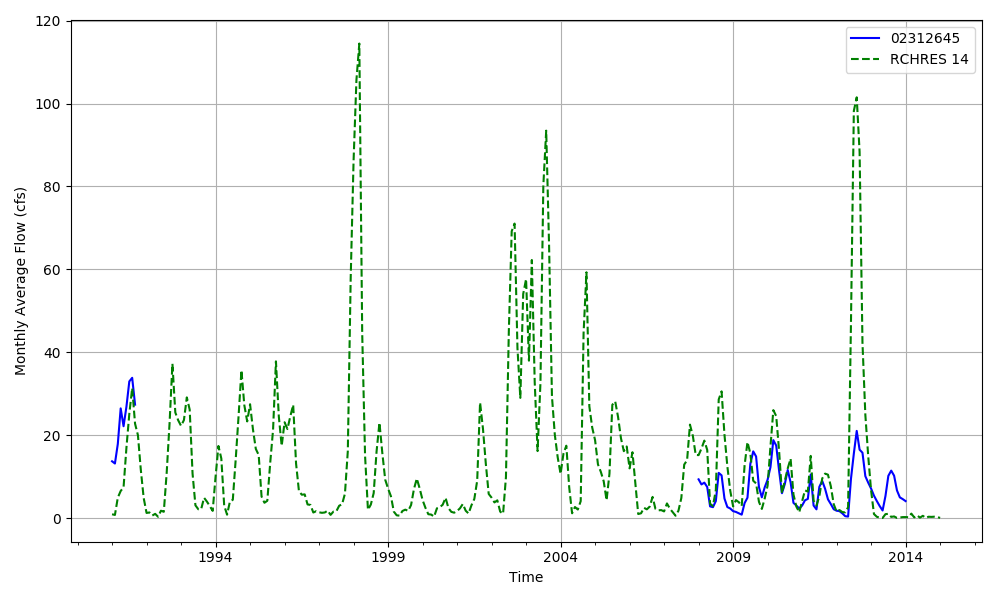


Figure 03100208-15: Monthly flow for HSFP reach 14 and USGS station 02312645.

## HSPF Reach 19, USGS Gauge 02312200

Table 03100208-9: Comparison Statistics Between HSPF Reach 19 and USGS Gauge 02312200.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -15.10 |
| Standard error | 77.75 |
| Relative bias | -0.25 |
| Relative standard error | 0.64 |
| Nash-Sutcliffe coefficient | 0.59 |
| Kling-Gupta coefficient | 0.52 |
| Coefficient of efficiency | 0.51 |
| Index of agreement | 0.72 |

Table 03100208-10: Hydrologic Indices Between USGS Gauge 02312200 and HSPF Reach 19.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312200 | Simulated Reach 19 | Percent Difference |
| MA1: Mean, all daily flows | 61.56 | 46.28 | -24.82 |
| MA2: Median, all daily flows | 6.90 | 12.52 | 81.51 |
| MA3: CV, all daily flows | 138.03 | 145.11 | 5.13 |
| MA4: CV, log of all daily flows | 193.46 | 150.02 | -22.46 |
| MA5: Mean daily flow / median daily flow | 8.92 | 3.70 | -58.58 |
| MA9: (Q10 - Q90) / median daily flow | 25.22 | 9.86 | -60.88 |
| MA10: (Q20 - Q80) / median daily flow | 10.99 | 5.01 | -54.40 |
| MA11: (Q25 - Q75) / median daily flow | 6.52 | 3.73 | -42.86 |
| MA12: Mean monthly flow, January | 63.39 | 43.21 | -31.84 |
| MA13: Mean monthly flow, February | 49.33 | 41.91 | -15.03 |
| MA14: Mean monthly flow, March | 62.46 | 45.03 | -27.91 |
| MA15: Mean monthly flow, April | 34.82 | 25.46 | -26.87 |
| MA16: Mean monthly flow, May | 9.17 | 9.84 | 7.32 |
| MA17: Mean monthly flow, June | 24.57 | 30.15 | 22.70 |
| MA18: Mean monthly flow, July | 69.42 | 49.68 | -28.44 |
| MA19: Mean monthly flow, August | 97.51 | 64.48 | -33.87 |
| MA20: Mean monthly flow, September | 120.94 | 90.15 | -25.45 |
| MA21: Mean monthly flow, October | 92.29 | 58.86 | -36.22 |
| MA22: Mean monthly flow, November | 31.21 | 31.64 | 1.37 |
| MA23: Mean monthly flow, December | 51.39 | 41.78 | -18.71 |
| ML1: Mean minimum monthly flow, January | 31.09 | 24.73 | -20.46 |
| ML2: Mean minimum monthly flow, February | 24.98 | 23.61 | -5.45 |
| ML3: Mean minimum monthly flow, March | 32.69 | 26.88 | -17.78 |
| ML4: Mean minimum monthly flow, April | 12.02 | 11.54 | -3.99 |
| ML5: Mean minimum monthly flow, May | 2.96 | 3.03 | 2.49 |
| ML6: Mean minimum monthly flow, June | 7.63 | 4.62 | -39.40 |
| ML7: Mean minimum monthly flow, July | 32.14 | 30.09 | -6.37 |
| ML8: Mean minimum monthly flow, August | 51.22 | 35.51 | -30.68 |
| ML9: Mean minimum monthly flow, September | 48.45 | 36.81 | -24.01 |
| ML10: Mean minimum monthly flow, October | 33.10 | 31.48 | -4.89 |
| ML11: Mean minimum monthly flow, November | 18.12 | 22.30 | 23.05 |
| ML12: Mean minimum monthly flow, December | 14.87 | 18.30 | 23.08 |
| ML13: CV of minimum monthly flows | 229.77 | 178.57 | -22.29 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.03 | 0.15 | 375.65 |
| ML15: Mean minimum annual flow / mean annual flow | 0.01 | 0.04 | 240.86 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.07 |  |
| ML20: Ratio of baseflow volume to total flow volume | 0.62 | 0.65 | 5.09 |
| ML22: Mean annual minimum flow divided by catchment area | 0.01 | 0.01 | 26.56 |
| RA1: Mean of positive changes from one day to next (rise rate) | 12.25 | 22.03 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 255.60 | 560.06 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 5.03 | 5.93 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 210.04 | 867.62 |  |
| RA5: Ratio of days that are higher than previous day | 0.22 | 0.21 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.13 | 0.14 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.08 | 0.05 |  |
| RA8: Number of flow reversals from one day to the next | 63.88 | 70.71 |  |
| RA9: CV, number of flow reversals from one day to the next | 32.80 | 26.47 |  |

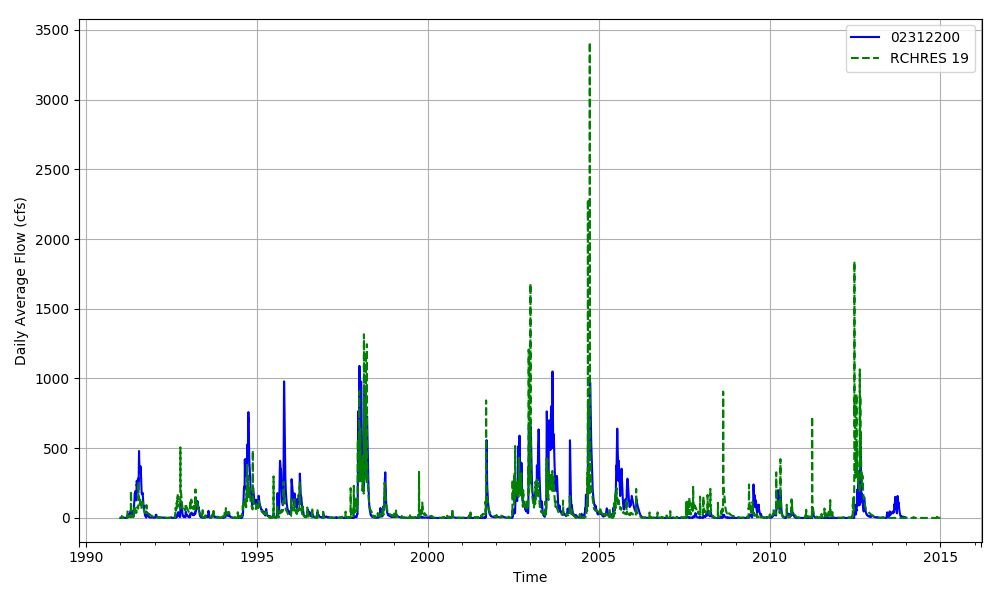


Figure 03100208-16: Daily flow for HSFP reach 19 and USGS station 02312200.

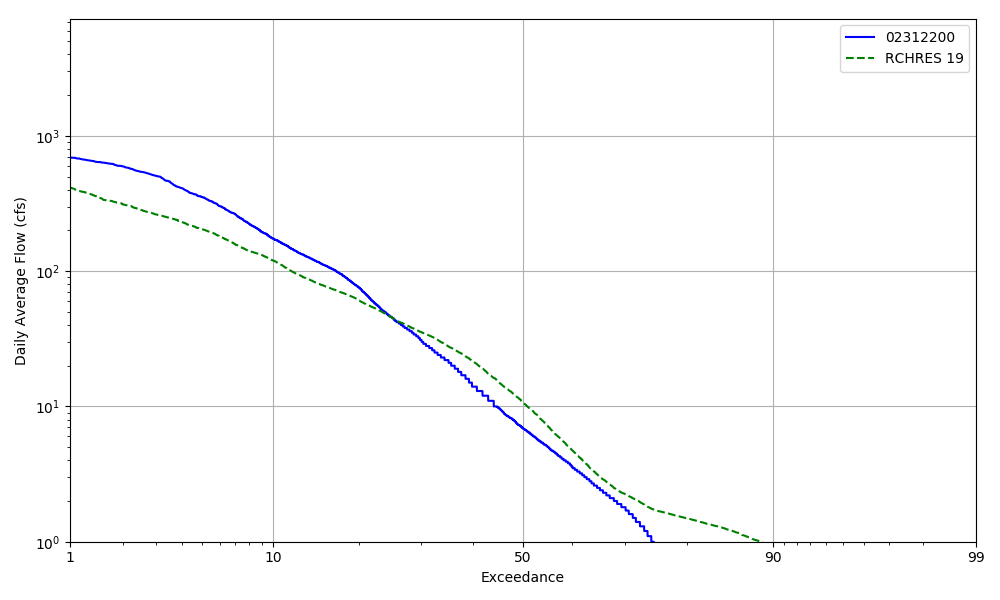


Figure 03100208-17: Daily exceedance for HSFP reach 19 and USGS station 02312200.

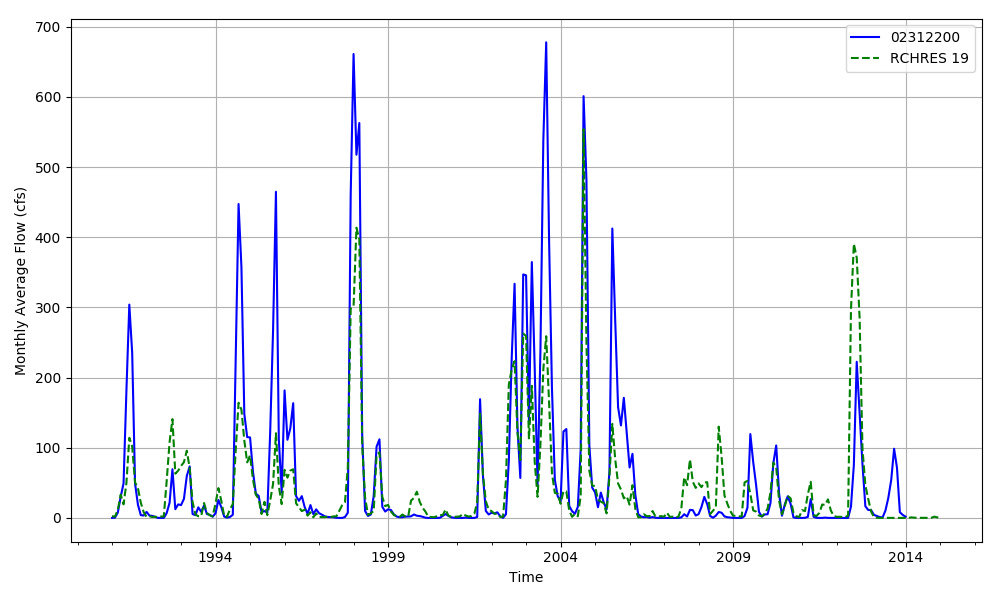


Figure 03100208-18: Monthly flow for HSFP reach 19 and USGS station 02312200.

## HSPF Reach 22, USGS Gauge 02311500

Table 03100208-11: Comparison Statistics Between HSPF Reach 22 and USGS Gauge 02311500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -3.63 |
| Standard error | 185.40 |
| Relative bias | -0.02 |
| Relative standard error | 0.66 |
| Nash-Sutcliffe coefficient | 0.57 |
| Kling-Gupta coefficient | 0.76 |
| Coefficient of efficiency | 0.49 |
| Index of agreement | 0.73 |

Table 03100208-12: Hydrologic Indices Between USGS Gauge 02311500 and HSPF Reach 22.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02311500 | Simulated Reach 22 | Percent Difference |
| MA1: Mean, all daily flows | 154.83 | 150.83 | -2.59 |
| MA2: Median, all daily flows | 19.00 | 38.72 | 103.81 |
| MA3: CV, all daily flows | 152.15 | 187.29 | 23.09 |
| MA4: CV, log of all daily flows | 176.34 | 144.17 | -18.24 |
| MA5: Mean daily flow / median daily flow | 8.15 | 3.89 | -52.20 |
| MA9: (Q10 - Q90) / median daily flow | 24.04 | 9.70 | -59.64 |
| MA10: (Q20 - Q80) / median daily flow | 10.96 | 5.35 | -51.20 |
| MA11: (Q25 - Q75) / median daily flow | 7.47 | 3.92 | -47.53 |
| MA12: Mean monthly flow, January | 151.05 | 147.60 | -2.28 |
| MA13: Mean monthly flow, February | 109.43 | 128.50 | 17.43 |
| MA14: Mean monthly flow, March | 135.43 | 129.95 | -4.05 |
| MA15: Mean monthly flow, April | 94.13 | 68.19 | -27.56 |
| MA16: Mean monthly flow, May | 16.99 | 25.32 | 49.02 |
| MA17: Mean monthly flow, June | 57.24 | 108.00 | 88.67 |
| MA18: Mean monthly flow, July | 192.07 | 148.46 | -22.70 |
| MA19: Mean monthly flow, August | 252.05 | 200.50 | -20.45 |
| MA20: Mean monthly flow, September | 329.93 | 329.08 | -0.26 |
| MA21: Mean monthly flow, October | 221.26 | 201.92 | -8.74 |
| MA22: Mean monthly flow, November | 71.18 | 101.65 | 42.80 |
| MA23: Mean monthly flow, December | 145.95 | 145.62 | -0.23 |
| ML1: Mean minimum monthly flow, January | 58.63 | 70.16 | 19.65 |
| ML2: Mean minimum monthly flow, February | 63.99 | 64.43 | 0.68 |
| ML3: Mean minimum monthly flow, March | 86.23 | 62.64 | -27.35 |
| ML4: Mean minimum monthly flow, April | 20.41 | 18.83 | -7.74 |
| ML5: Mean minimum monthly flow, May | 3.50 | 6.37 | 82.19 |
| ML6: Mean minimum monthly flow, June | 18.71 | 12.76 | -31.84 |
| ML7: Mean minimum monthly flow, July | 73.52 | 66.29 | -9.83 |
| ML8: Mean minimum monthly flow, August | 106.85 | 83.28 | -22.06 |
| ML9: Mean minimum monthly flow, September | 127.67 | 111.98 | -12.29 |
| ML10: Mean minimum monthly flow, October | 66.86 | 89.30 | 33.57 |
| ML11: Mean minimum monthly flow, November | 35.44 | 53.65 | 51.39 |
| ML12: Mean minimum monthly flow, December | 27.84 | 51.63 | 85.46 |
| ML13: CV of minimum monthly flows | 211.70 | 188.42 | -10.99 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.04 | 0.05 | 21.84 |
| ML15: Mean minimum annual flow / mean annual flow | 0.01 | 0.02 | 55.10 |
| ML16: Median minimum annual flow / median annual flow | 0.00 | 0.03 |  |
| ML20: Ratio of baseflow volume to total flow volume | 0.62 | 0.53 | -14.34 |
| ML22: Mean annual minimum flow divided by catchment area | 0.02 | 0.02 | 0.80 |
| RA1: Mean of positive changes from one day to next (rise rate) | 27.43 | 121.94 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 231.66 | 511.65 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 12.55 | 35.59 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 216.80 | 850.23 |  |
| RA5: Ratio of days that are higher than previous day | 0.25 | 0.23 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.10 | 0.18 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.07 | 0.07 |  |
| RA8: Number of flow reversals from one day to the next | 41.83 | 63.50 |  |
| RA9: CV, number of flow reversals from one day to the next | 35.40 | 21.28 |  |

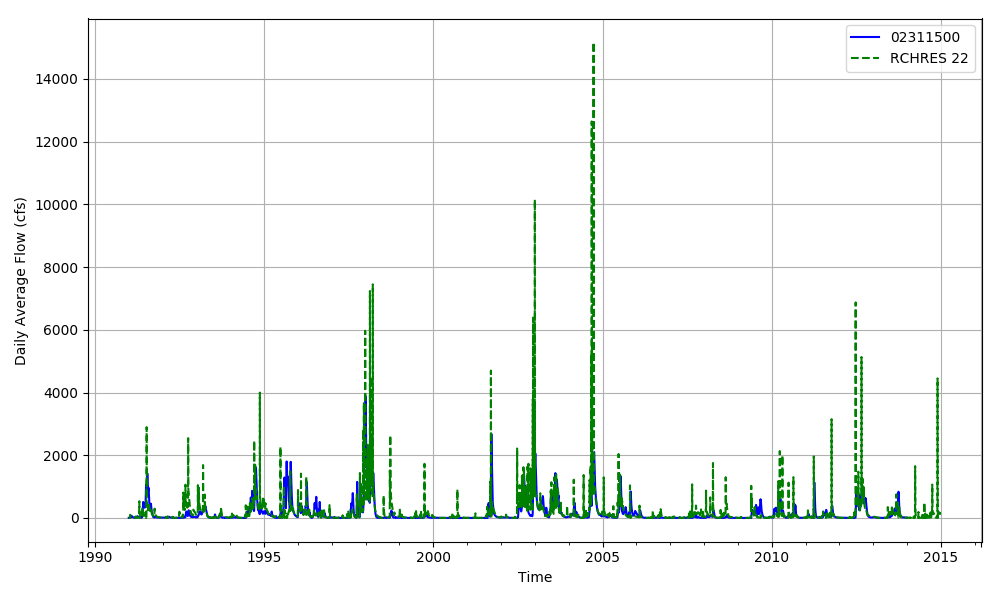


Figure 03100208-19: Daily flow for HSFP reach 22 and USGS station 02311500.

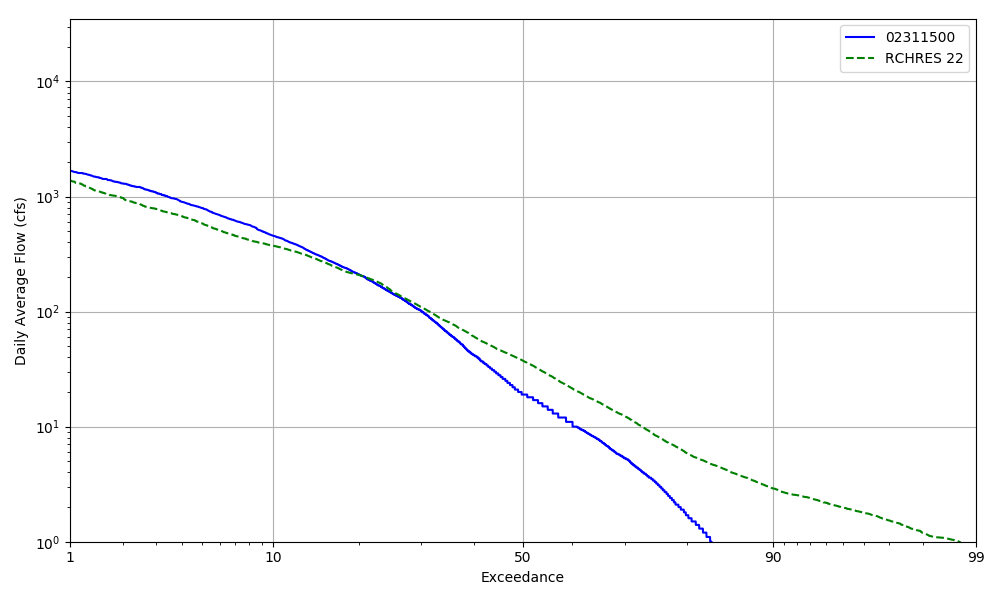


Figure 03100208-20: Daily exceedance for HSFP reach 22 and USGS station 02311500.

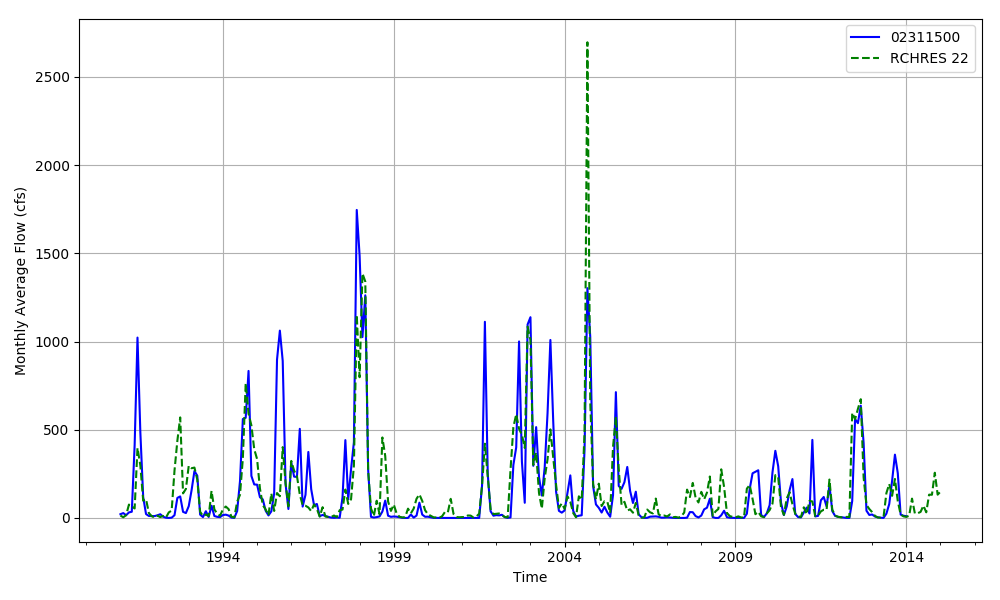


Figure 03100208-21: Monthly flow for HSFP reach 22 and USGS station 02311500.

## HSPF Reach 23, USGS Gauge 02312700

Table 03100208-13: Comparison Statistics Between HSPF Reach 23 and USGS Gauge 02312700.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -13.15 |
| Standard error | 79.62 |
| Relative bias | -0.10 |
| Relative standard error | 0.74 |
| Nash-Sutcliffe coefficient | 0.45 |
| Kling-Gupta coefficient | 0.70 |
| Coefficient of efficiency | 0.32 |
| Index of agreement | 0.66 |

Table 03100208-14: Hydrologic Indices Between USGS Gauge 02312700 and HSPF Reach 23.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312700 | Simulated Reach 23 | Percent Difference |
| MA1: Mean, all daily flows | 127.37 | 113.79 | -10.66 |
| MA2: Median, all daily flows | 96.00 | 78.38 | -18.35 |
| MA3: CV, all daily flows | 51.05 | 62.53 | 22.50 |
| MA4: CV, log of all daily flows | 69.46 | 78.22 | 12.61 |
| MA5: Mean daily flow / median daily flow | 1.33 | 1.45 | 9.41 |
| MA9: (Q10 - Q90) / median daily flow | 2.29 | 2.37 | 3.55 |
| MA10: (Q20 - Q80) / median daily flow | 1.51 | 1.46 | -3.46 |
| MA11: (Q25 - Q75) / median daily flow | 1.20 | 1.18 | -1.82 |
| MA12: Mean monthly flow, January | 135.26 | 111.82 | -17.33 |
| MA13: Mean monthly flow, February | 137.68 | 110.22 | -19.95 |
| MA14: Mean monthly flow, March | 140.87 | 117.83 | -16.35 |
| MA15: Mean monthly flow, April | 118.75 | 88.22 | -25.71 |
| MA16: Mean monthly flow, May | 86.46 | 61.01 | -29.44 |
| MA17: Mean monthly flow, June | 85.75 | 74.31 | -13.34 |
| MA18: Mean monthly flow, July | 103.21 | 111.05 | 7.60 |
| MA19: Mean monthly flow, August | 128.11 | 134.59 | 5.05 |
| MA20: Mean monthly flow, September | 145.91 | 150.25 | 2.98 |
| MA21: Mean monthly flow, October | 157.39 | 138.10 | -12.26 |
| MA22: Mean monthly flow, November | 120.61 | 106.20 | -11.95 |
| MA23: Mean monthly flow, December | 104.30 | 106.51 | 2.12 |
| ML1: Mean minimum monthly flow, January | 97.96 | 88.38 | -9.77 |
| ML2: Mean minimum monthly flow, February | 119.04 | 87.53 | -26.47 |
| ML3: Mean minimum monthly flow, March | 118.37 | 92.90 | -21.52 |
| ML4: Mean minimum monthly flow, April | 90.17 | 69.83 | -22.56 |
| ML5: Mean minimum monthly flow, May | 69.65 | 43.81 | -37.10 |
| ML6: Mean minimum monthly flow, June | 61.79 | 47.41 | -23.27 |
| ML7: Mean minimum monthly flow, July | 79.04 | 83.47 | 5.60 |
| ML8: Mean minimum monthly flow, August | 95.71 | 101.65 | 6.20 |
| ML9: Mean minimum monthly flow, September | 106.74 | 104.65 | -1.96 |
| ML10: Mean minimum monthly flow, October | 130.72 | 106.87 | -18.25 |
| ML11: Mean minimum monthly flow, November | 94.37 | 94.00 | -0.40 |
| ML12: Mean minimum monthly flow, December | 90.00 | 82.60 | -8.22 |
| ML13: CV of minimum monthly flows | 93.10 | 85.74 | -7.90 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.30 | 0.49 | 65.04 |
| ML15: Mean minimum annual flow / mean annual flow | 0.28 | 0.40 | 42.73 |
| ML16: Median minimum annual flow / median annual flow | 0.29 | 0.50 | 71.91 |
| ML20: Ratio of baseflow volume to total flow volume | 0.90 | 0.86 | -5.01 |
| ML22: Mean annual minimum flow divided by catchment area | 0.37 | 0.37 | -0.45 |
| RA1: Mean of positive changes from one day to next (rise rate) | 6.60 | 12.96 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 167.49 | 275.99 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 4.45 | 4.29 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 137.98 | 199.77 |  |
| RA5: Ratio of days that are higher than previous day | 0.34 | 0.25 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.04 | 0.06 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.02 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 92.83 | 78.71 |  |
| RA9: CV, number of flow reversals from one day to the next | 39.80 | 23.68 |  |

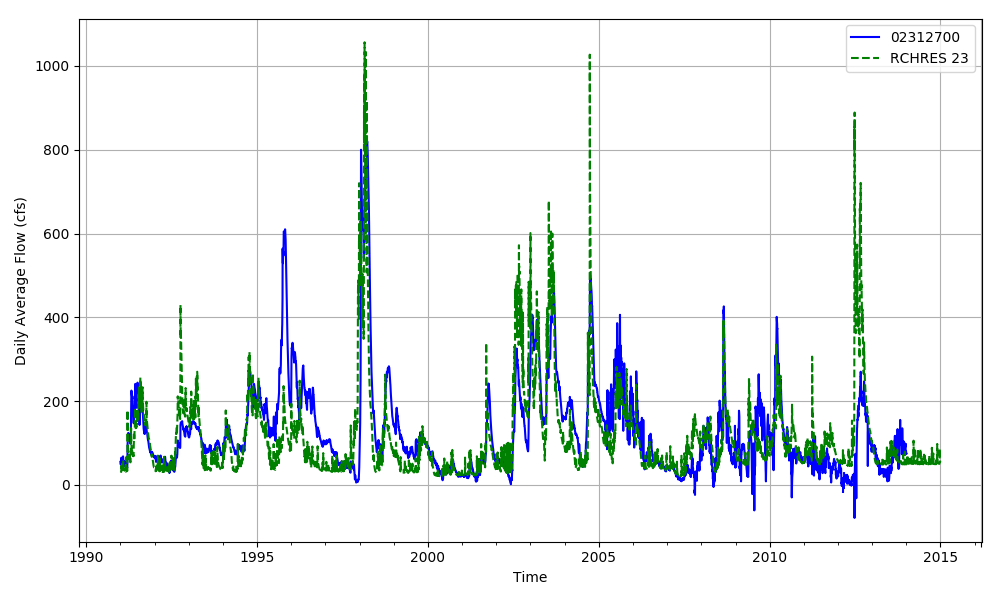


Figure 03100208-22: Daily flow for HSFP reach 23 and USGS station 02312700.

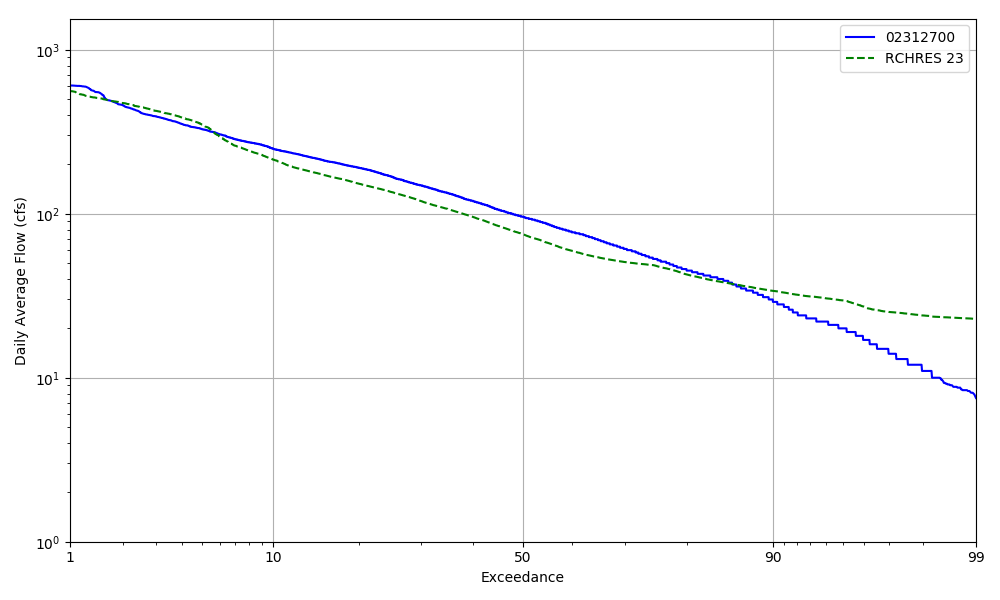


Figure 03100208-23: Daily exceedance for HSFP reach 23 and USGS station 02312700.

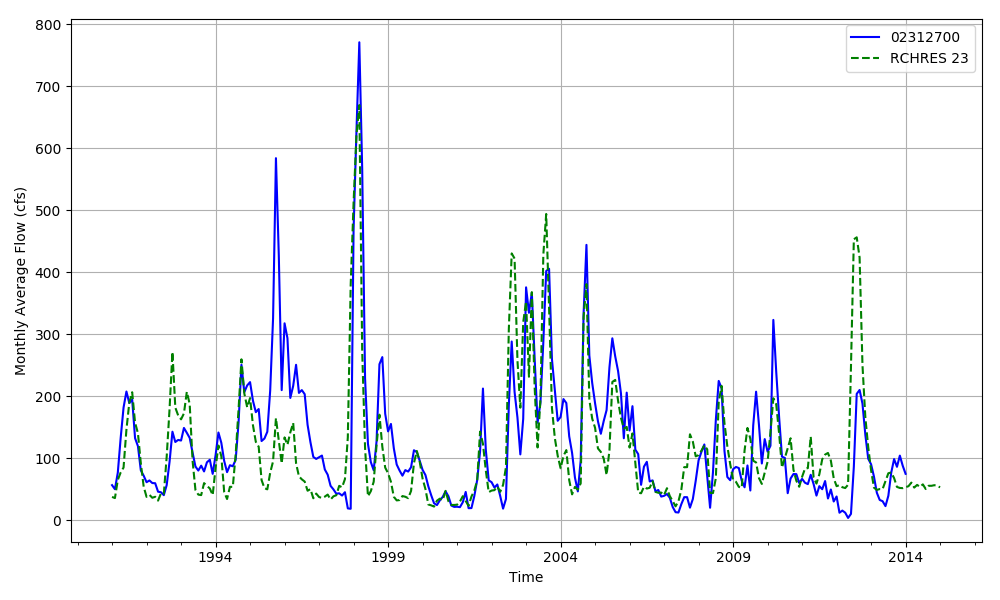


Figure 03100208-24: Monthly flow for HSFP reach 23 and USGS station 02312700.

## HSPF Reach 26, USGS Gauge 02312000

Table 03100208-15: Comparison Statistics Between HSPF Reach 26 and USGS Gauge 02312000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -25.44 |
| Standard error | 258.91 |
| Relative bias | -0.11 |
| Relative standard error | 0.61 |
| Nash-Sutcliffe coefficient | 0.63 |
| Kling-Gupta coefficient | 0.71 |
| Coefficient of efficiency | 0.52 |
| Index of agreement | 0.73 |

Table 03100208-16: Hydrologic Indices Between USGS Gauge 02312000 and HSPF Reach 26.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312000 | Simulated Reach 26 | Percent Difference |
| MA1: Mean, all daily flows | 239.40 | 213.44 | -10.84 |
| MA2: Median, all daily flows | 56.00 | 76.35 | 36.35 |
| MA3: CV, all daily flows | 133.29 | 148.23 | 11.21 |
| MA4: CV, log of all daily flows | 158.35 | 135.41 | -14.48 |
| MA5: Mean daily flow / median daily flow | 4.28 | 2.80 | -34.61 |
| MA9: (Q10 - Q90) / median daily flow | 11.72 | 7.03 | -40.03 |
| MA10: (Q20 - Q80) / median daily flow | 5.29 | 3.72 | -29.59 |
| MA11: (Q25 - Q75) / median daily flow | 3.88 | 2.70 | -30.21 |
| MA12: Mean monthly flow, January | 257.33 | 213.10 | -17.19 |
| MA13: Mean monthly flow, February | 154.28 | 189.75 | 22.99 |
| MA14: Mean monthly flow, March | 205.31 | 190.34 | -7.29 |
| MA15: Mean monthly flow, April | 169.71 | 111.31 | -34.41 |
| MA16: Mean monthly flow, May | 43.77 | 43.99 | 0.50 |
| MA17: Mean monthly flow, June | 72.63 | 130.55 | 79.75 |
| MA18: Mean monthly flow, July | 258.34 | 208.11 | -19.44 |
| MA19: Mean monthly flow, August | 344.73 | 275.72 | -20.02 |
| MA20: Mean monthly flow, September | 516.06 | 437.08 | -15.31 |
| MA21: Mean monthly flow, October | 399.08 | 292.98 | -26.59 |
| MA22: Mean monthly flow, November | 138.56 | 157.45 | 13.64 |
| MA23: Mean monthly flow, December | 188.71 | 204.54 | 8.39 |
| ML1: Mean minimum monthly flow, January | 114.17 | 123.83 | 8.45 |
| ML2: Mean minimum monthly flow, February | 108.58 | 112.21 | 3.34 |
| ML3: Mean minimum monthly flow, March | 141.15 | 116.92 | -17.16 |
| ML4: Mean minimum monthly flow, April | 65.86 | 48.06 | -27.03 |
| ML5: Mean minimum monthly flow, May | 21.95 | 15.55 | -29.15 |
| ML6: Mean minimum monthly flow, June | 24.48 | 22.44 | -8.34 |
| ML7: Mean minimum monthly flow, July | 128.60 | 113.98 | -11.37 |
| ML8: Mean minimum monthly flow, August | 207.02 | 147.21 | -28.89 |
| ML9: Mean minimum monthly flow, September | 240.64 | 181.48 | -24.59 |
| ML10: Mean minimum monthly flow, October | 163.12 | 154.99 | -4.98 |
| ML11: Mean minimum monthly flow, November | 80.41 | 101.40 | 26.10 |
| ML12: Mean minimum monthly flow, December | 62.16 | 89.28 | 43.64 |
| ML13: CV of minimum monthly flows | 189.03 | 167.26 | -11.51 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.18 | 0.09 | -50.20 |
| ML15: Mean minimum annual flow / mean annual flow | 0.07 | 0.04 | -45.54 |
| ML16: Median minimum annual flow / median annual flow | 0.17 | 0.06 | -64.68 |
| ML20: Ratio of baseflow volume to total flow volume | 0.75 | 0.64 | -14.76 |
| ML22: Mean annual minimum flow divided by catchment area | 0.15 | 0.07 | -51.64 |
| RA1: Mean of positive changes from one day to next (rise rate) | 19.71 | 115.46 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 220.84 | 550.00 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 12.14 | 34.60 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 189.12 | 788.89 |  |
| RA5: Ratio of days that are higher than previous day | 0.33 | 0.23 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.06 | 0.13 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.05 | 0.05 |  |
| RA8: Number of flow reversals from one day to the next | 64.08 | 56.17 |  |
| RA9: CV, number of flow reversals from one day to the next | 39.25 | 22.06 |  |

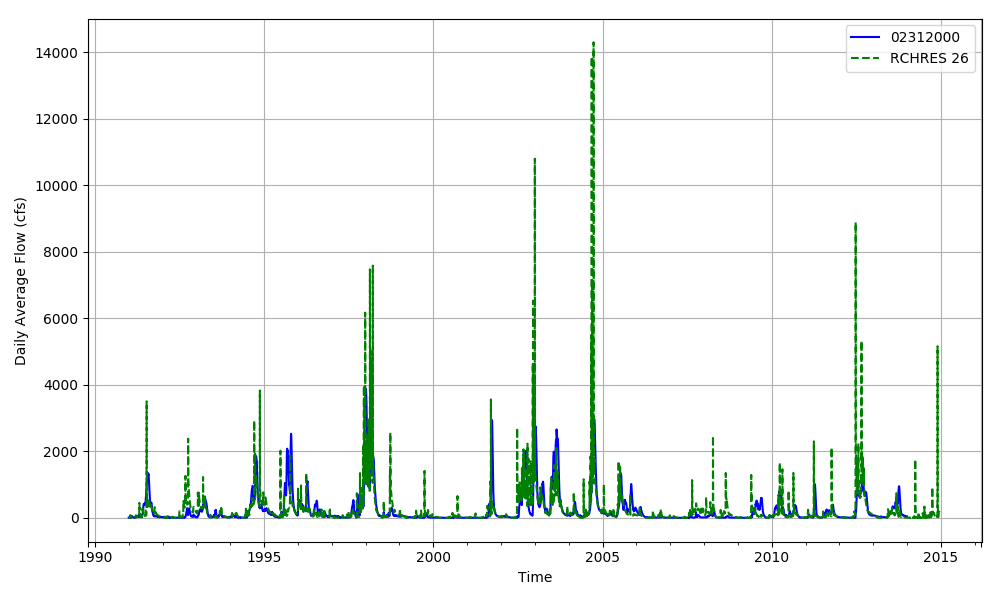


Figure 03100208-25: Daily flow for HSFP reach 26 and USGS station 02312000.

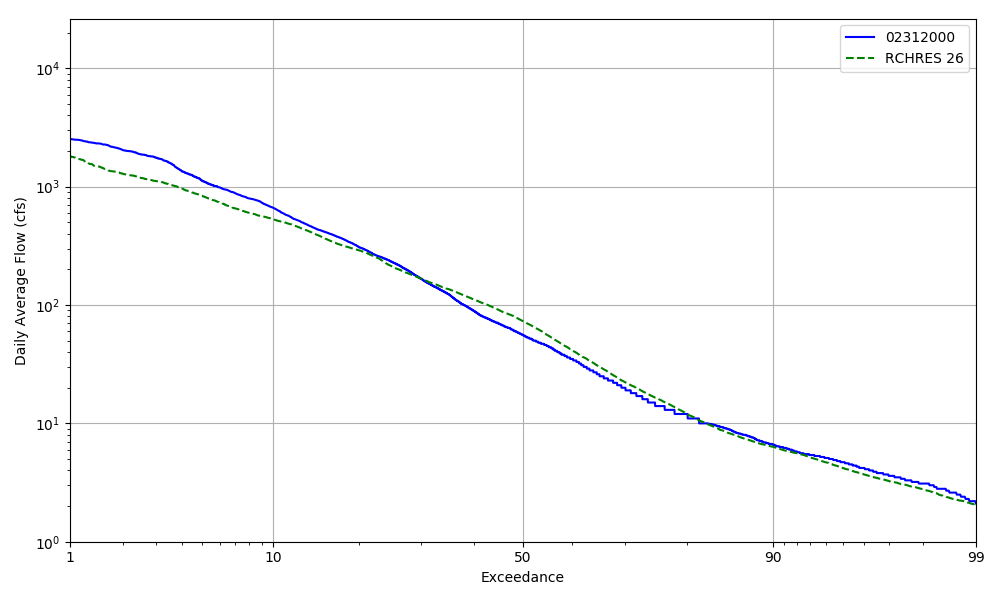


Figure 03100208-26: Daily exceedance for HSFP reach 26 and USGS station 02312000.

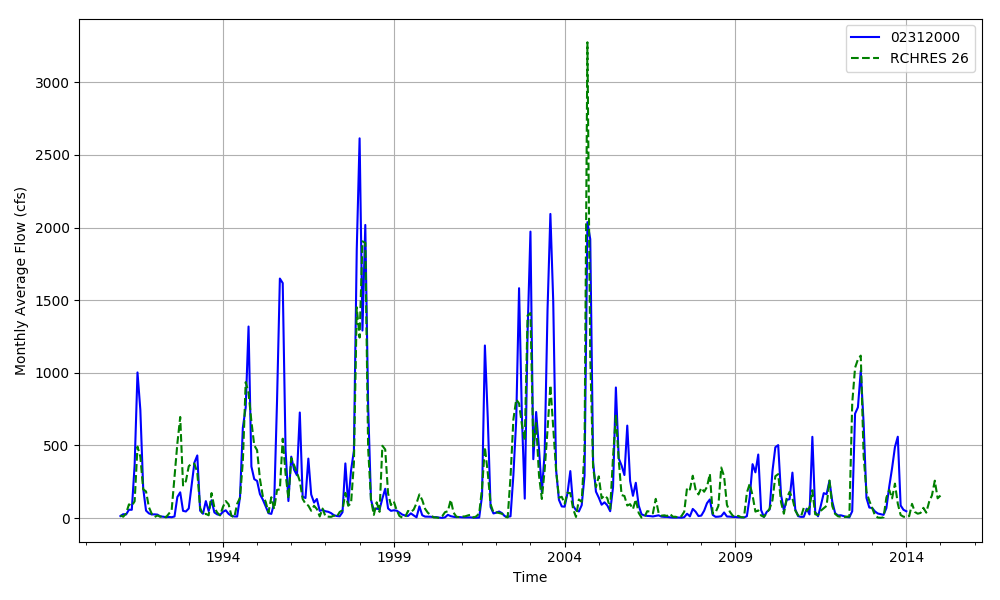


Figure 03100208-27: Monthly flow for HSFP reach 26 and USGS station 02312000.

## HSPF Reach 28, USGS Gauge 02312500

Table 03100208-17: Comparison Statistics Between HSPF Reach 28 and USGS Gauge 02312500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -20.63 |
| Standard error | 286.49 |
| Relative bias | -0.07 |
| Relative standard error | 0.57 |
| Nash-Sutcliffe coefficient | 0.68 |
| Kling-Gupta coefficient | 0.79 |
| Coefficient of efficiency | 0.52 |
| Index of agreement | 0.75 |

Table 03100208-18: Hydrologic Indices Between USGS Gauge 02312500 and HSPF Reach 28.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312500 | Simulated Reach 28 | Percent Difference |
| MA1: Mean, all daily flows | 301.82 | 280.77 | -6.98 |
| MA2: Median, all daily flows | 91.00 | 107.26 | 17.86 |
| MA3: CV, all daily flows | 116.71 | 136.28 | 16.76 |
| MA4: CV, log of all daily flows | 148.85 | 133.70 | -10.17 |
| MA5: Mean daily flow / median daily flow | 3.32 | 2.62 | -21.07 |
| MA9: (Q10 - Q90) / median daily flow | 9.13 | 6.58 | -27.87 |
| MA10: (Q20 - Q80) / median daily flow | 4.25 | 3.53 | -17.05 |
| MA11: (Q25 - Q75) / median daily flow | 3.24 | 2.52 | -22.12 |
| MA12: Mean monthly flow, January | 322.50 | 275.22 | -14.66 |
| MA13: Mean monthly flow, February | 207.89 | 252.58 | 21.49 |
| MA14: Mean monthly flow, March | 262.46 | 254.93 | -2.87 |
| MA15: Mean monthly flow, April | 221.14 | 155.22 | -29.81 |
| MA16: Mean monthly flow, May | 72.84 | 61.48 | -15.59 |
| MA17: Mean monthly flow, June | 95.76 | 167.29 | 74.69 |
| MA18: Mean monthly flow, July | 297.83 | 280.34 | -5.87 |
| MA19: Mean monthly flow, August | 407.32 | 365.55 | -10.25 |
| MA20: Mean monthly flow, September | 592.01 | 559.11 | -5.56 |
| MA21: Mean monthly flow, October | 526.39 | 383.82 | -27.08 |
| MA22: Mean monthly flow, November | 213.54 | 209.84 | -1.74 |
| MA23: Mean monthly flow, December | 247.63 | 263.86 | 6.55 |
| ML1: Mean minimum monthly flow, January | 179.61 | 166.37 | -7.37 |
| ML2: Mean minimum monthly flow, February | 149.83 | 152.34 | 1.68 |
| ML3: Mean minimum monthly flow, March | 185.92 | 162.53 | -12.58 |
| ML4: Mean minimum monthly flow, April | 102.31 | 70.37 | -31.22 |
| ML5: Mean minimum monthly flow, May | 46.93 | 22.54 | -51.98 |
| ML6: Mean minimum monthly flow, June | 46.62 | 33.77 | -27.55 |
| ML7: Mean minimum monthly flow, July | 162.53 | 167.43 | 3.02 |
| ML8: Mean minimum monthly flow, August | 268.97 | 209.09 | -22.26 |
| ML9: Mean minimum monthly flow, September | 334.39 | 247.02 | -26.13 |
| ML10: Mean minimum monthly flow, October | 268.56 | 212.66 | -20.82 |
| ML11: Mean minimum monthly flow, November | 144.11 | 141.87 | -1.56 |
| ML12: Mean minimum monthly flow, December | 120.10 | 121.97 | 1.56 |
| ML13: CV of minimum monthly flows | 167.98 | 164.17 | -2.27 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.19 | 0.10 | -46.98 |
| ML15: Mean minimum annual flow / mean annual flow | 0.10 | 0.04 | -57.55 |
| ML16: Median minimum annual flow / median annual flow | 0.18 | 0.06 | -63.46 |
| ML20: Ratio of baseflow volume to total flow volume | 0.80 | 0.66 | -17.63 |
| ML22: Mean annual minimum flow divided by catchment area | 0.37 | 0.10 | -72.21 |
| RA1: Mean of positive changes from one day to next (rise rate) | 21.19 | 117.07 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 199.16 | 591.06 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 11.37 | 36.72 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 190.72 | 778.36 |  |
| RA5: Ratio of days that are higher than previous day | 0.30 | 0.24 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.05 | 0.12 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.04 | 0.05 |  |
| RA8: Number of flow reversals from one day to the next | 45.71 | 56.12 |  |
| RA9: CV, number of flow reversals from one day to the next | 34.05 | 23.02 |  |

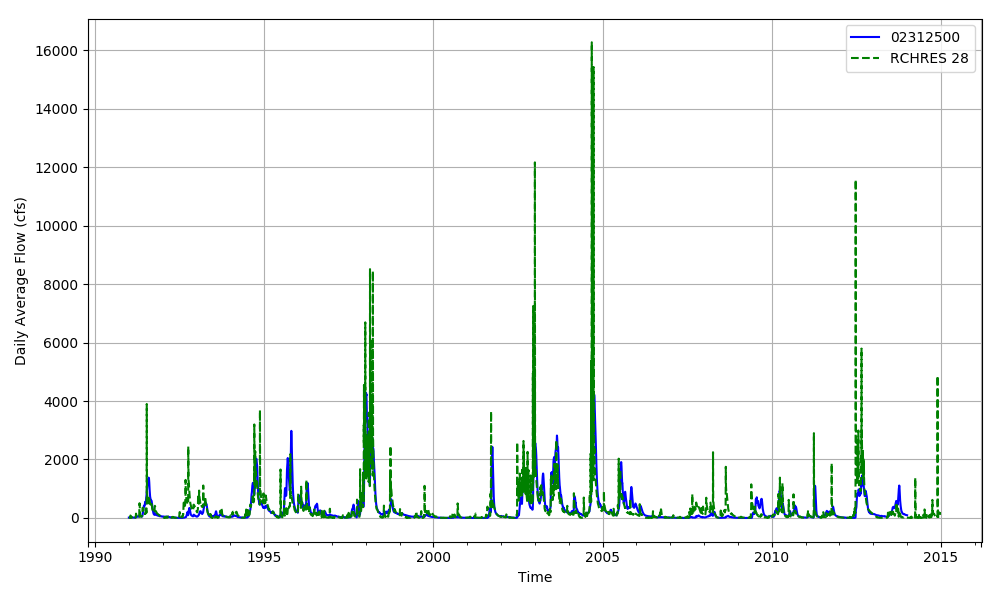


Figure 03100208-28: Daily flow for HSFP reach 28 and USGS station 02312500.

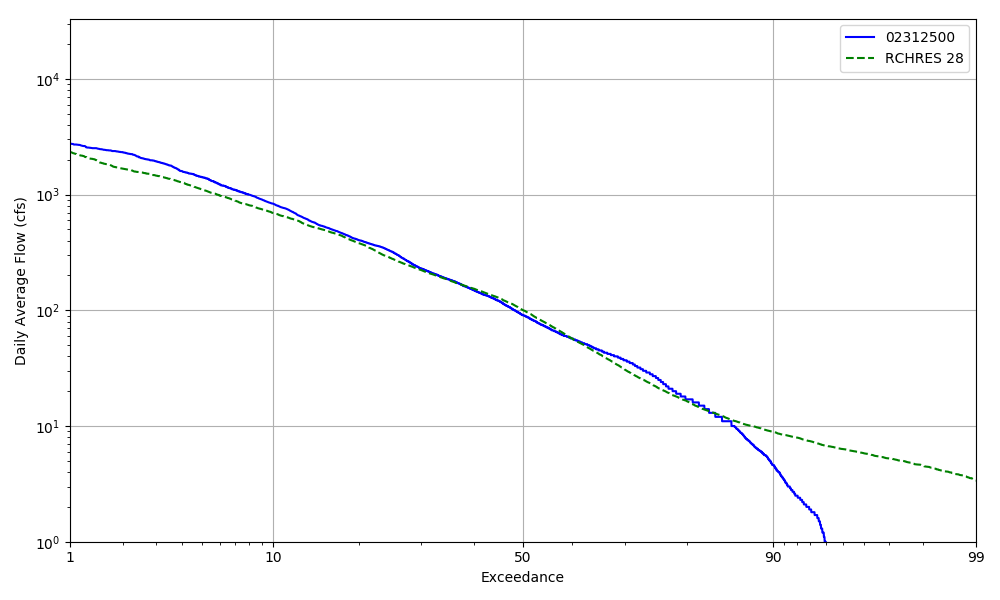


Figure 03100208-29: Daily exceedance for HSFP reach 28 and USGS station 02312500.

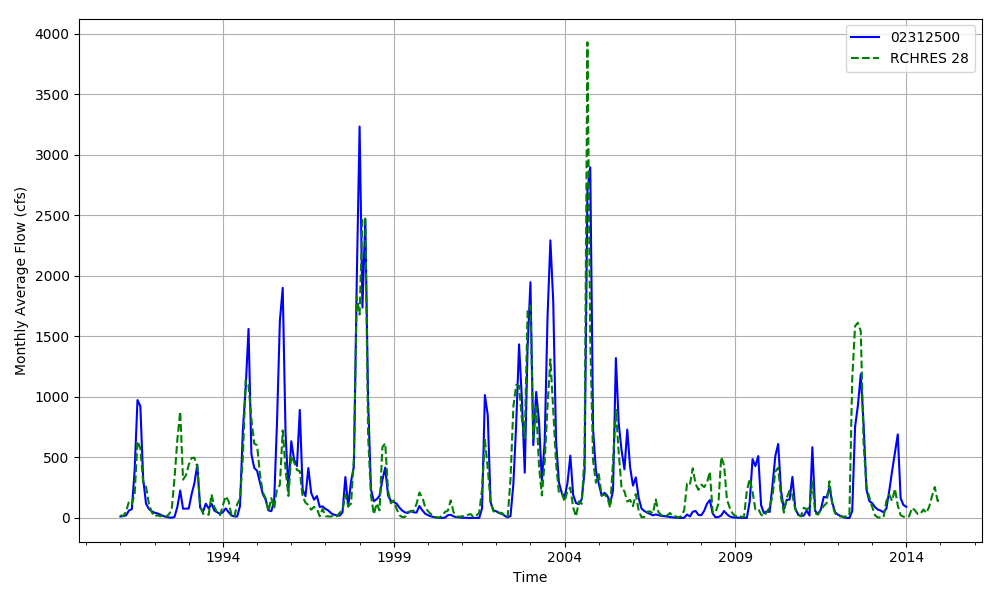


Figure 03100208-30: Monthly flow for HSFP reach 28 and USGS station 02312500.

## HSPF Reach 32, USGS Gauge 02312600

Table 03100208-19: Comparison Statistics Between HSPF Reach 32 and USGS Gauge 02312600.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 9.75 |
| Standard error | 356.31 |
| Relative bias | 0.03 |
| Relative standard error | 0.66 |
| Nash-Sutcliffe coefficient | 0.56 |
| Kling-Gupta coefficient | 0.74 |
| Coefficient of efficiency | 0.44 |
| Index of agreement | 0.71 |

Table 03100208-20: Hydrologic Indices Between USGS Gauge 02312600 and HSPF Reach 32.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312600 | Simulated Reach 32 | Percent Difference |
| MA1: Mean, all daily flows | 301.61 | 311.31 | 3.21 |
| MA2: Median, all daily flows | 89.00 | 124.56 | 39.96 |
| MA3: CV, all daily flows | 111.05 | 127.29 | 14.63 |
| MA4: CV, log of all daily flows | 155.23 | 130.59 | -15.87 |
| MA5: Mean daily flow / median daily flow | 3.39 | 2.50 | -26.25 |
| MA9: (Q10 - Q90) / median daily flow | 9.02 | 6.11 | -32.22 |
| MA10: (Q20 - Q80) / median daily flow | 4.35 | 3.33 | -23.56 |
| MA11: (Q25 - Q75) / median daily flow | 3.16 | 2.46 | -22.14 |
| MA12: Mean monthly flow, January | 355.57 | 303.91 | -14.53 |
| MA13: Mean monthly flow, February | 230.99 | 283.28 | 22.64 |
| MA14: Mean monthly flow, March | 268.73 | 285.52 | 6.25 |
| MA15: Mean monthly flow, April | 239.33 | 181.00 | -24.37 |
| MA16: Mean monthly flow, May | 87.68 | 73.76 | -15.87 |
| MA17: Mean monthly flow, June | 81.06 | 175.12 | 116.03 |
| MA18: Mean monthly flow, July | 265.46 | 311.46 | 17.33 |
| MA19: Mean monthly flow, August | 395.58 | 403.02 | 1.88 |
| MA20: Mean monthly flow, September | 544.08 | 602.05 | 10.66 |
| MA21: Mean monthly flow, October | 530.17 | 429.59 | -18.97 |
| MA22: Mean monthly flow, November | 247.22 | 239.80 | -3.00 |
| MA23: Mean monthly flow, December | 222.00 | 291.92 | 31.50 |
| ML1: Mean minimum monthly flow, January | 229.86 | 185.25 | -19.41 |
| ML2: Mean minimum monthly flow, February | 177.78 | 177.78 | -0.00 |
| ML3: Mean minimum monthly flow, March | 218.48 | 190.36 | -12.87 |
| ML4: Mean minimum monthly flow, April | 142.87 | 87.98 | -38.42 |
| ML5: Mean minimum monthly flow, May | 50.62 | 29.81 | -41.11 |
| ML6: Mean minimum monthly flow, June | 43.70 | 38.65 | -11.56 |
| ML7: Mean minimum monthly flow, July | 159.33 | 191.18 | 19.99 |
| ML8: Mean minimum monthly flow, August | 271.58 | 236.88 | -12.78 |
| ML9: Mean minimum monthly flow, September | 311.28 | 282.20 | -9.34 |
| ML10: Mean minimum monthly flow, October | 325.08 | 249.59 | -23.22 |
| ML11: Mean minimum monthly flow, November | 162.83 | 168.30 | 3.36 |
| ML12: Mean minimum monthly flow, December | 122.47 | 143.31 | 17.01 |
| ML13: CV of minimum monthly flows | 188.29 | 158.71 | -15.71 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.14 | 0.13 | -10.32 |
| ML15: Mean minimum annual flow / mean annual flow | 0.08 | 0.06 | -29.70 |
| ML16: Median minimum annual flow / median annual flow | 0.08 | 0.09 | 18.94 |
| ML20: Ratio of baseflow volume to total flow volume | 0.78 | 0.69 | -11.26 |
| ML22: Mean annual minimum flow divided by catchment area | 0.35 | 0.14 | -58.65 |
| RA1: Mean of positive changes from one day to next (rise rate) | 20.22 | 99.12 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 192.31 | 623.30 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 10.46 | 35.45 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 197.24 | 758.69 |  |
| RA5: Ratio of days that are higher than previous day | 0.26 | 0.26 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.04 | 0.09 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.03 | 0.04 |  |
| RA8: Number of flow reversals from one day to the next | 38.58 | 48.75 |  |
| RA9: CV, number of flow reversals from one day to the next | 40.36 | 21.99 |  |

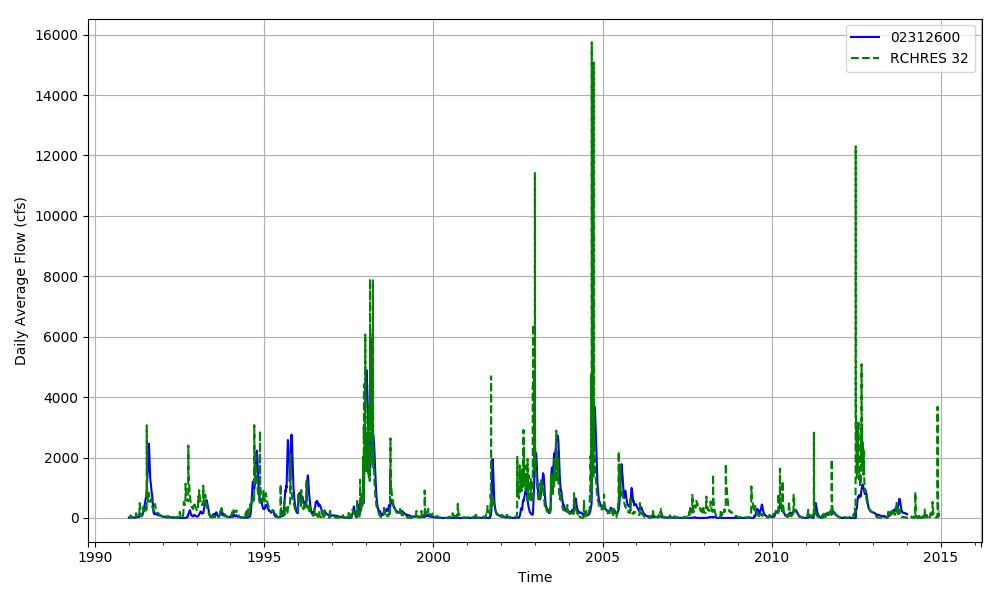


Figure 03100208-31: Daily flow for HSFP reach 32 and USGS station 02312600.

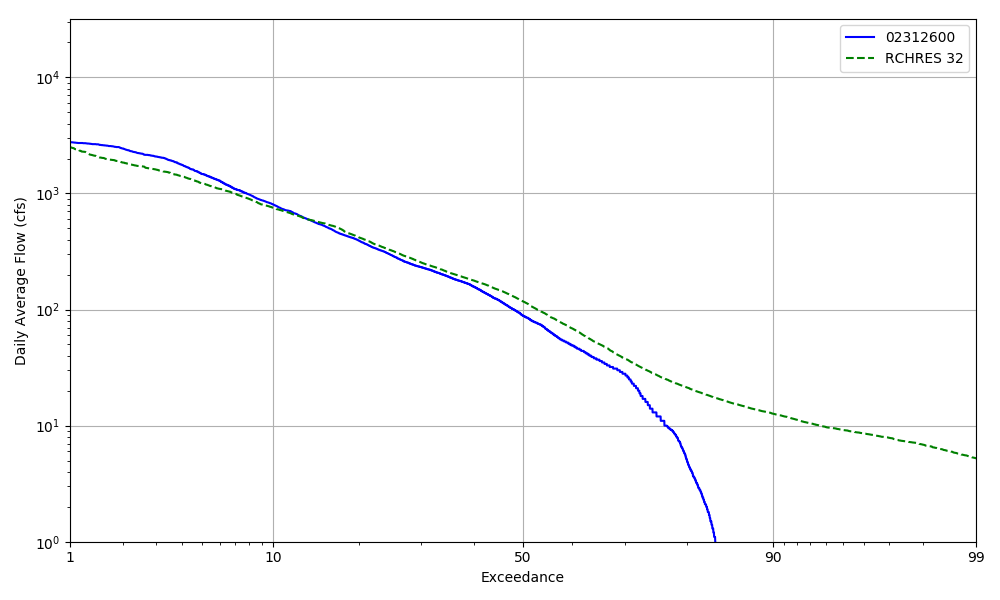


Figure 03100208-32: Daily exceedance for HSFP reach 32 and USGS station 02312600.

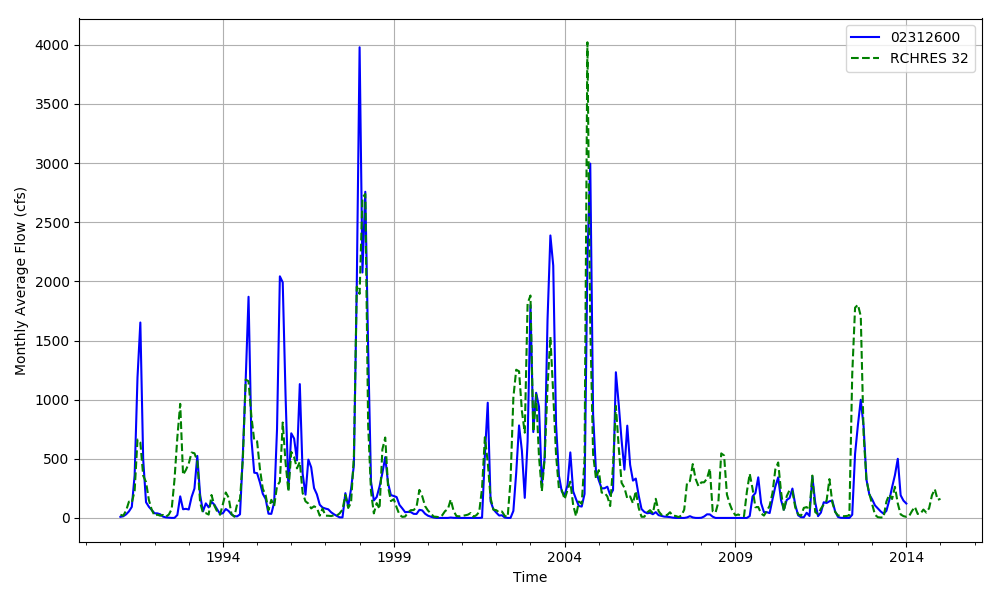


Figure 03100208-33: Monthly flow for HSFP reach 32 and USGS station 02312600.

## HSPF Reach 36, USGS Gauge 02312720

Table 03100208-21: Comparison Statistics Between HSPF Reach 36 and USGS Gauge 02312720.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 31.33 |
| Standard error | 422.33 |
| Relative bias | 0.07 |
| Relative standard error | 0.66 |
| Nash-Sutcliffe coefficient | 0.57 |
| Kling-Gupta coefficient | 0.78 |
| Coefficient of efficiency | 0.42 |
| Index of agreement | 0.71 |

Table 03100208-22: Hydrologic Indices Between USGS Gauge 02312720 and HSPF Reach 36.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312720 | Simulated Reach 36 | Percent Difference |
| MA1: Mean, all daily flows | 456.27 | 488.23 | 7.00 |
| MA2: Median, all daily flows | 218.00 | 243.90 | 11.88 |
| MA3: CV, all daily flows | 81.81 | 103.03 | 25.94 |
| MA4: CV, log of all daily flows | 112.74 | 113.93 | 1.06 |
| MA5: Mean daily flow / median daily flow | 2.09 | 2.00 | -4.36 |
| MA9: (Q10 - Q90) / median daily flow | 4.94 | 4.35 | -12.03 |
| MA10: (Q20 - Q80) / median daily flow | 2.52 | 2.44 | -2.98 |
| MA11: (Q25 - Q75) / median daily flow | 1.94 | 1.90 | -2.07 |
| MA12: Mean monthly flow, January | 518.47 | 476.55 | -8.09 |
| MA13: Mean monthly flow, February | 435.57 | 456.01 | 4.69 |
| MA14: Mean monthly flow, March | 470.56 | 471.25 | 0.15 |
| MA15: Mean monthly flow, April | 409.25 | 316.09 | -22.76 |
| MA16: Mean monthly flow, May | 198.24 | 158.01 | -20.30 |
| MA17: Mean monthly flow, June | 177.84 | 276.31 | 55.37 |
| MA18: Mean monthly flow, July | 367.85 | 485.63 | 32.02 |
| MA19: Mean monthly flow, August | 529.46 | 623.12 | 17.69 |
| MA20: Mean monthly flow, September | 672.46 | 842.05 | 25.22 |
| MA21: Mean monthly flow, October | 721.50 | 653.04 | -9.49 |
| MA22: Mean monthly flow, November | 425.00 | 403.07 | -5.16 |
| MA23: Mean monthly flow, December | 329.67 | 456.31 | 38.41 |
| ML1: Mean minimum monthly flow, January | 386.38 | 321.18 | -16.87 |
| ML2: Mean minimum monthly flow, February | 360.04 | 314.23 | -12.73 |
| ML3: Mean minimum monthly flow, March | 409.43 | 336.99 | -17.69 |
| ML4: Mean minimum monthly flow, April | 282.63 | 190.57 | -32.57 |
| ML5: Mean minimum monthly flow, May | 131.25 | 86.15 | -34.36 |
| ML6: Mean minimum monthly flow, June | 113.29 | 102.30 | -9.70 |
| ML7: Mean minimum monthly flow, July | 269.13 | 322.90 | 19.98 |
| ML8: Mean minimum monthly flow, August | 396.74 | 410.63 | 3.50 |
| ML9: Mean minimum monthly flow, September | 483.04 | 453.29 | -6.16 |
| ML10: Mean minimum monthly flow, October | 569.83 | 426.07 | -25.23 |
| ML11: Mean minimum monthly flow, November | 305.48 | 313.31 | 2.56 |
| ML12: Mean minimum monthly flow, December | 243.83 | 267.31 | 9.63 |
| ML13: CV of minimum monthly flows | 151.28 | 131.38 | -13.15 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.23 | 0.27 | 18.49 |
| ML15: Mean minimum annual flow / mean annual flow | 0.17 | 0.17 | 2.25 |
| ML16: Median minimum annual flow / median annual flow | 0.22 | 0.22 | 3.76 |
| ML20: Ratio of baseflow volume to total flow volume | 0.93 | 0.75 | -19.50 |
| ML22: Mean annual minimum flow divided by catchment area | 0.80 | 0.58 | -27.51 |
| RA1: Mean of positive changes from one day to next (rise rate) | 18.89 | 109.68 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 179.88 | 585.86 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 12.02 | 38.98 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 159.93 | 689.98 |  |
| RA5: Ratio of days that are higher than previous day | 0.35 | 0.26 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.03 | 0.06 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.03 | 0.03 |  |
| RA8: Number of flow reversals from one day to the next | 78.58 | 60.83 |  |
| RA9: CV, number of flow reversals from one day to the next | 34.92 | 22.00 |  |

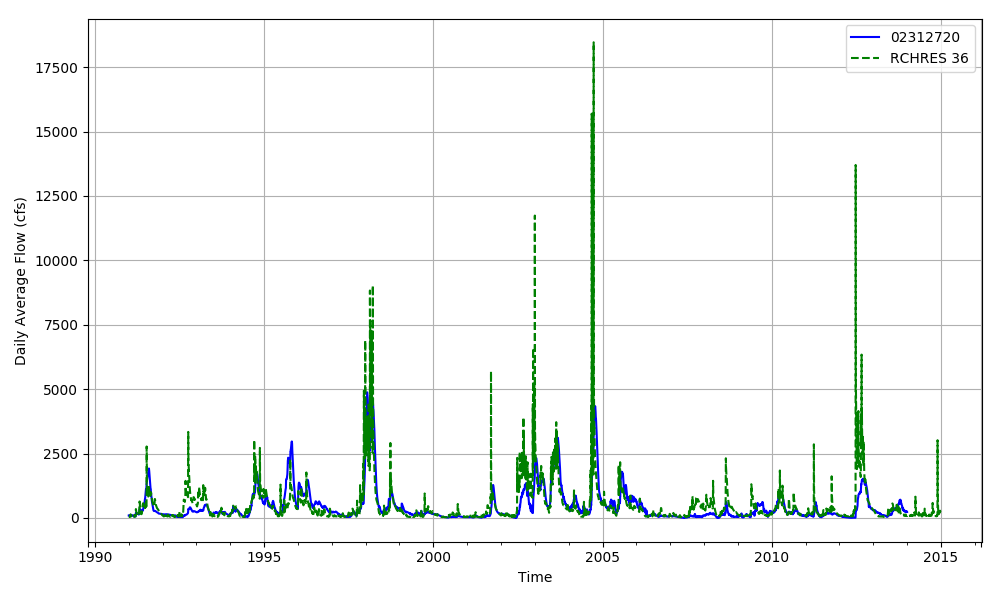


Figure 03100208-34: Daily flow for HSFP reach 36 and USGS station 02312720.

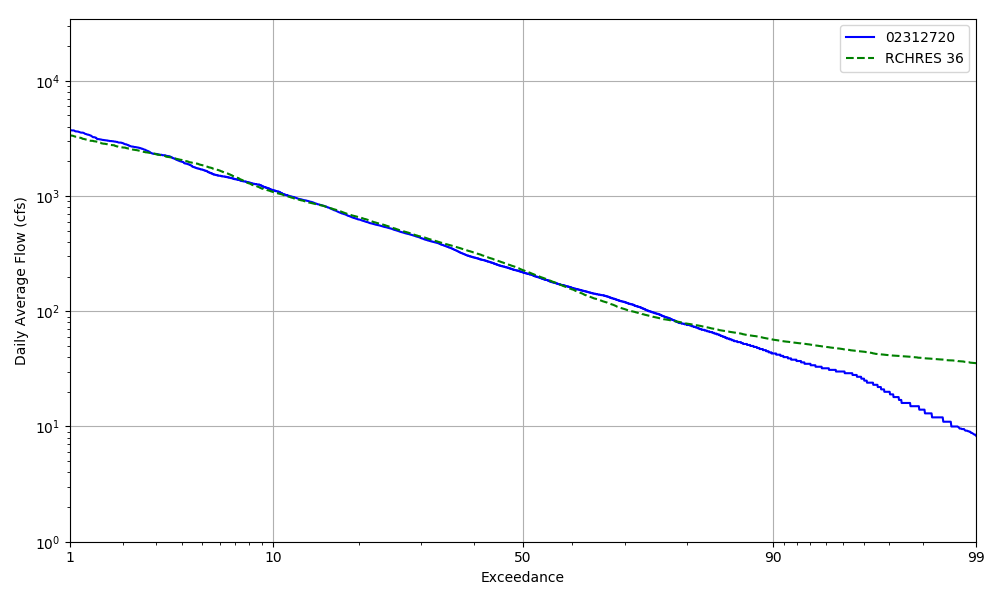


Figure 03100208-35: Daily exceedance for HSFP reach 36 and USGS station 02312720.

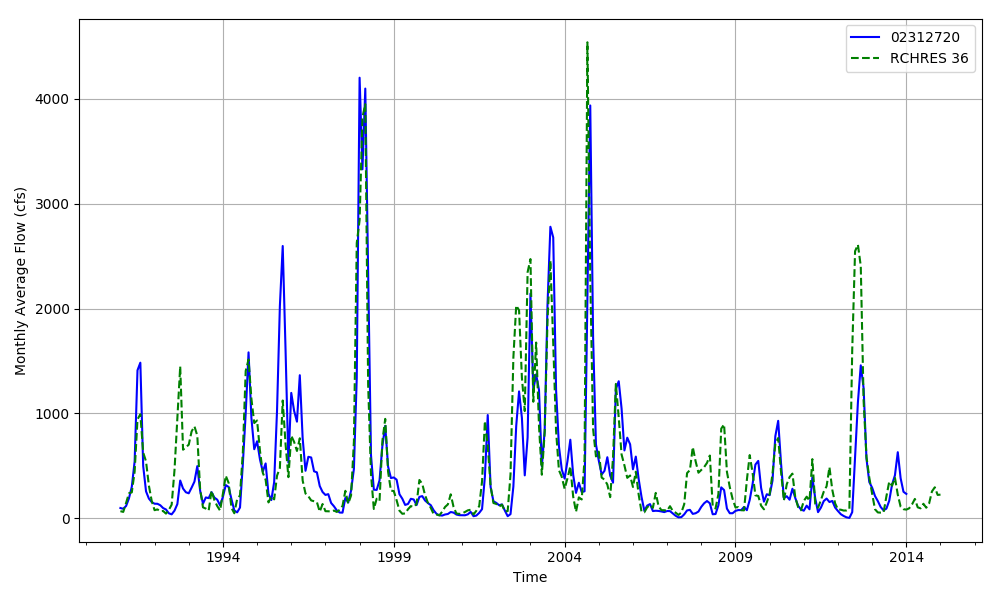


Figure 03100208-36: Monthly flow for HSFP reach 36 and USGS station 02312720.

## HSPF Reach 37, USGS Gauge 02312722

Table 03100208-23: Comparison Statistics Between HSPF Reach 37 and USGS Gauge 02312722.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 110.55 |
| Standard error | 377.58 |
| Relative bias | 0.43 |
| Relative standard error | 1.43 |
| Nash-Sutcliffe coefficient | -1.05 |
| Kling-Gupta coefficient | 0.05 |
| Coefficient of efficiency | -0.06 |
| Index of agreement | 0.54 |

Table 03100208-24: Hydrologic Indices Between USGS Gauge 02312722 and HSPF Reach 37.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02312722 | Simulated Reach 37 | Percent Difference |
| MA1: Mean, all daily flows | 260.22 | 373.44 | 43.51 |
| MA2: Median, all daily flows | 160.00 | 221.66 | 38.54 |
| MA3: CV, all daily flows | 80.37 | 94.12 | 17.10 |
| MA4: CV, log of all daily flows | 94.08 | 87.94 | -6.53 |
| MA5: Mean daily flow / median daily flow | 1.63 | 1.68 | 3.59 |
| MA9: (Q10 - Q90) / median daily flow | 3.98 | 2.71 | -31.77 |
| MA10: (Q20 - Q80) / median daily flow | 2.16 | 1.68 | -22.46 |
| MA11: (Q25 - Q75) / median daily flow | 1.50 | 1.44 | -4.26 |
| MA12: Mean monthly flow, January | 195.43 | 207.82 | 6.34 |
| MA13: Mean monthly flow, February | 195.89 | 232.39 | 18.63 |
| MA14: Mean monthly flow, March | 210.51 | 227.19 | 7.92 |
| MA15: Mean monthly flow, April | 223.96 | 265.64 | 18.61 |
| MA16: Mean monthly flow, May | 118.67 | 158.51 | 33.57 |
| MA17: Mean monthly flow, June | 97.55 | 340.46 | 249.01 |
| MA18: Mean monthly flow, July | 207.51 | 497.47 | 139.73 |
| MA19: Mean monthly flow, August | 318.67 | 592.53 | 85.94 |
| MA20: Mean monthly flow, September | 390.81 | 612.39 | 56.70 |
| MA21: Mean monthly flow, October | 400.50 | 452.93 | 13.09 |
| MA22: Mean monthly flow, November | 296.31 | 292.61 | -1.25 |
| MA23: Mean monthly flow, December | 229.76 | 233.97 | 1.83 |
| ML1: Mean minimum monthly flow, January | 160.11 | 147.41 | -7.93 |
| ML2: Mean minimum monthly flow, February | 157.25 | 186.32 | 18.48 |
| ML3: Mean minimum monthly flow, March | 156.25 | 164.41 | 5.22 |
| ML4: Mean minimum monthly flow, April | 176.62 | 176.27 | -0.20 |
| ML5: Mean minimum monthly flow, May | 72.00 | 91.36 | 26.89 |
| ML6: Mean minimum monthly flow, June | 62.65 | 127.42 | 103.38 |
| ML7: Mean minimum monthly flow, July | 138.38 | 384.75 | 178.05 |
| ML8: Mean minimum monthly flow, August | 281.62 | 381.62 | 35.51 |
| ML9: Mean minimum monthly flow, September | 378.50 | 442.17 | 16.82 |
| ML10: Mean minimum monthly flow, October | 330.56 | 307.44 | -6.99 |
| ML11: Mean minimum monthly flow, November | 210.89 | 228.04 | 8.14 |
| ML12: Mean minimum monthly flow, December | 189.67 | 185.85 | -2.01 |
| ML13: CV of minimum monthly flows | 119.72 | 124.03 | 3.60 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.20 | 0.36 | 79.87 |
| ML15: Mean minimum annual flow / mean annual flow | 0.16 | 0.26 | 61.57 |
| ML16: Median minimum annual flow / median annual flow | 0.18 | 0.35 | 93.96 |
| ML20: Ratio of baseflow volume to total flow volume | 0.89 | 0.76 | -15.34 |
| ML22: Mean annual minimum flow divided by catchment area | 0.48 | 0.71 | 48.23 |
| RA1: Mean of positive changes from one day to next (rise rate) | 11.48 | 65.94 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 172.55 | 753.89 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 7.37 | 23.78 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 115.08 | 664.31 |  |
| RA5: Ratio of days that are higher than previous day | 0.34 | 0.26 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.03 | 0.05 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.03 | 0.03 |  |
| RA8: Number of flow reversals from one day to the next | 75.67 | 58.11 |  |
| RA9: CV, number of flow reversals from one day to the next | 35.10 | 35.61 |  |

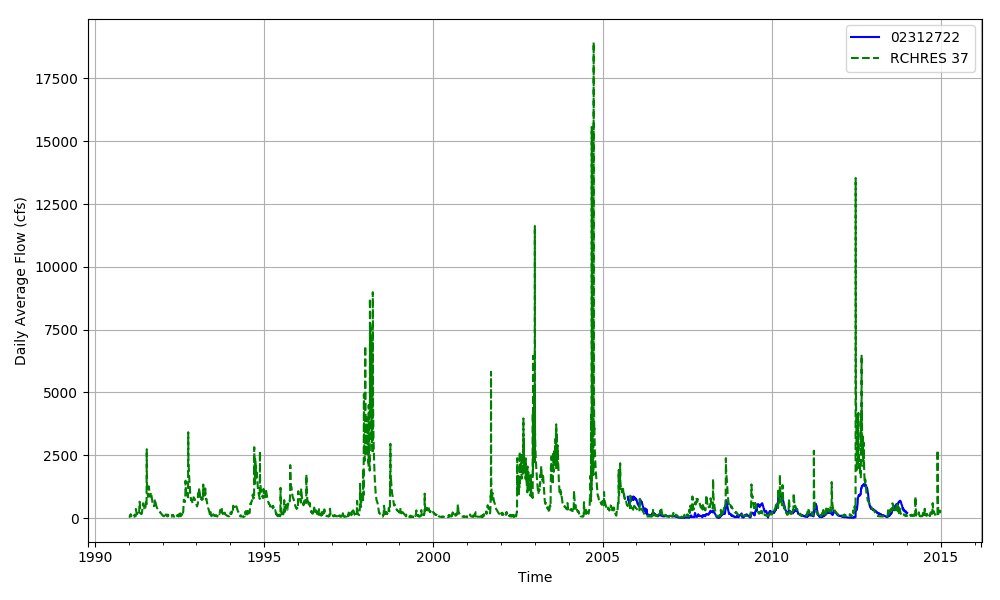


Figure 03100208-37: Daily flow for HSFP reach 37 and USGS station 02312722.

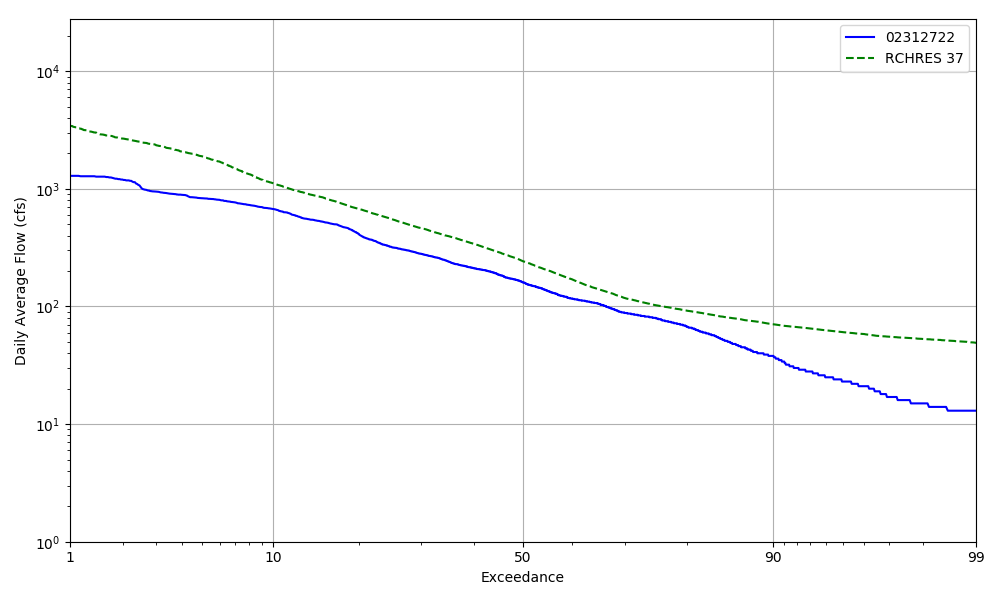


Figure 03100208-38: Daily exceedance for HSFP reach 37 and USGS station 02312722.

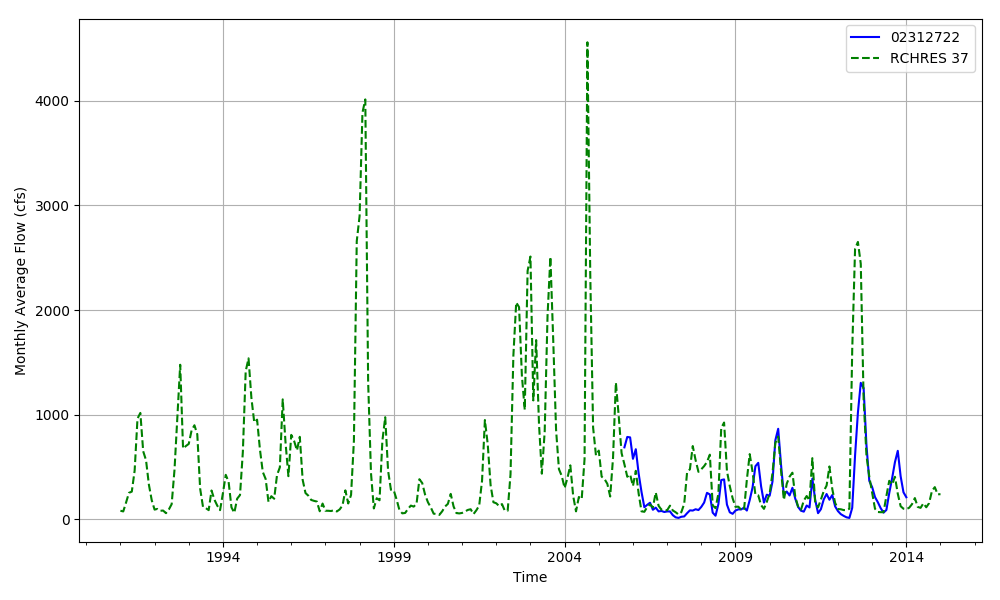


Figure 03100208-39: Monthly flow for HSFP reach 37 and USGS station 02312722.

## HSPF Reach 41, USGS Gauge 02313000

Table 03100208-25: Comparison Statistics Between HSPF Reach 41 and USGS Gauge 02313000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 12.18 |
| Standard error | 464.25 |
| Relative bias | 0.02 |
| Relative standard error | 0.60 |
| Nash-Sutcliffe coefficient | 0.64 |
| Kling-Gupta coefficient | 0.81 |
| Coefficient of efficiency | 0.47 |
| Index of agreement | 0.73 |

Table 03100208-26: Hydrologic Indices Between USGS Gauge 02313000 and HSPF Reach 41.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02313000 | Simulated Reach 41 | Percent Difference |
| MA1: Mean, all daily flows | 646.54 | 659.32 | 1.98 |
| MA2: Median, all daily flows | 360.00 | 384.39 | 6.77 |
| MA3: CV, all daily flows | 68.14 | 83.70 | 22.84 |
| MA4: CV, log of all daily flows | 93.64 | 93.00 | -0.68 |
| MA5: Mean daily flow / median daily flow | 1.80 | 1.72 | -4.49 |
| MA9: (Q10 - Q90) / median daily flow | 3.54 | 3.25 | -8.41 |
| MA10: (Q20 - Q80) / median daily flow | 2.11 | 1.86 | -11.68 |
| MA11: (Q25 - Q75) / median daily flow | 1.58 | 1.46 | -7.88 |
| MA12: Mean monthly flow, January | 680.98 | 645.74 | -5.17 |
| MA13: Mean monthly flow, February | 616.09 | 629.84 | 2.23 |
| MA14: Mean monthly flow, March | 649.91 | 653.09 | 0.49 |
| MA15: Mean monthly flow, April | 574.80 | 470.34 | -18.17 |
| MA16: Mean monthly flow, May | 331.02 | 279.19 | -15.66 |
| MA17: Mean monthly flow, June | 320.57 | 383.72 | 19.70 |
| MA18: Mean monthly flow, July | 529.03 | 639.43 | 20.87 |
| MA19: Mean monthly flow, August | 733.98 | 800.39 | 9.05 |
| MA20: Mean monthly flow, September | 896.10 | 1037.05 | 15.73 |
| MA21: Mean monthly flow, October | 964.22 | 858.84 | -10.93 |
| MA22: Mean monthly flow, November | 645.23 | 571.95 | -11.36 |
| MA23: Mean monthly flow, December | 508.67 | 621.66 | 22.21 |
| ML1: Mean minimum monthly flow, January | 526.00 | 476.66 | -9.38 |
| ML2: Mean minimum monthly flow, February | 523.22 | 469.36 | -10.29 |
| ML3: Mean minimum monthly flow, March | 573.43 | 506.03 | -11.76 |
| ML4: Mean minimum monthly flow, April | 426.09 | 333.68 | -21.69 |
| ML5: Mean minimum monthly flow, May | 242.22 | 194.97 | -19.51 |
| ML6: Mean minimum monthly flow, June | 229.30 | 211.02 | -7.97 |
| ML7: Mean minimum monthly flow, July | 411.43 | 464.38 | 12.87 |
| ML8: Mean minimum monthly flow, August | 571.74 | 574.27 | 0.44 |
| ML9: Mean minimum monthly flow, September | 635.26 | 635.79 | 0.08 |
| ML10: Mean minimum monthly flow, October | 795.26 | 614.53 | -22.73 |
| ML11: Mean minimum monthly flow, November | 492.13 | 479.83 | -2.50 |
| ML12: Mean minimum monthly flow, December | 426.13 | 416.61 | -2.23 |
| ML13: CV of minimum monthly flows | 125.40 | 102.66 | -18.13 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.37 | 0.40 | 7.99 |
| ML15: Mean minimum annual flow / mean annual flow | 0.29 | 0.30 | 3.07 |
| ML16: Median minimum annual flow / median annual flow | 0.36 | 0.33 | -8.19 |
| ML20: Ratio of baseflow volume to total flow volume | 0.93 | 0.81 | -12.54 |
| ML22: Mean annual minimum flow divided by catchment area | 1.79 | 1.55 | -13.30 |
| RA1: Mean of positive changes from one day to next (rise rate) | 27.95 | 94.72 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 179.30 | 578.43 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 16.57 | 37.67 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 118.52 | 678.95 |  |
| RA5: Ratio of days that are higher than previous day | 0.36 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.03 | 0.04 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.03 | 0.02 |  |
| RA8: Number of flow reversals from one day to the next | 82.88 | 55.88 |  |
| RA9: CV, number of flow reversals from one day to the next | 31.16 | 21.81 |  |

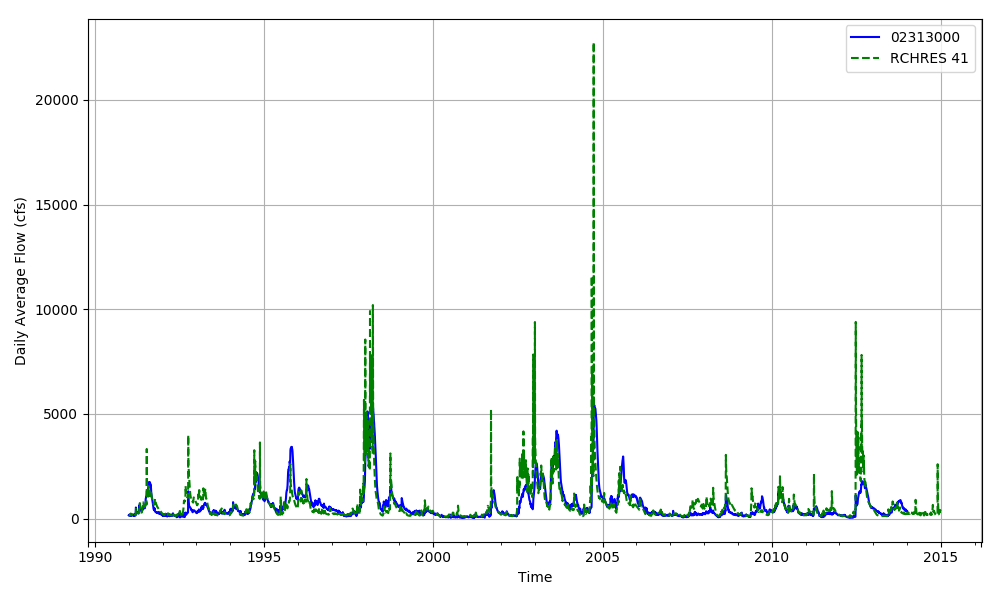


Figure 03100208-40: Daily flow for HSFP reach 41 and USGS station 02313000.

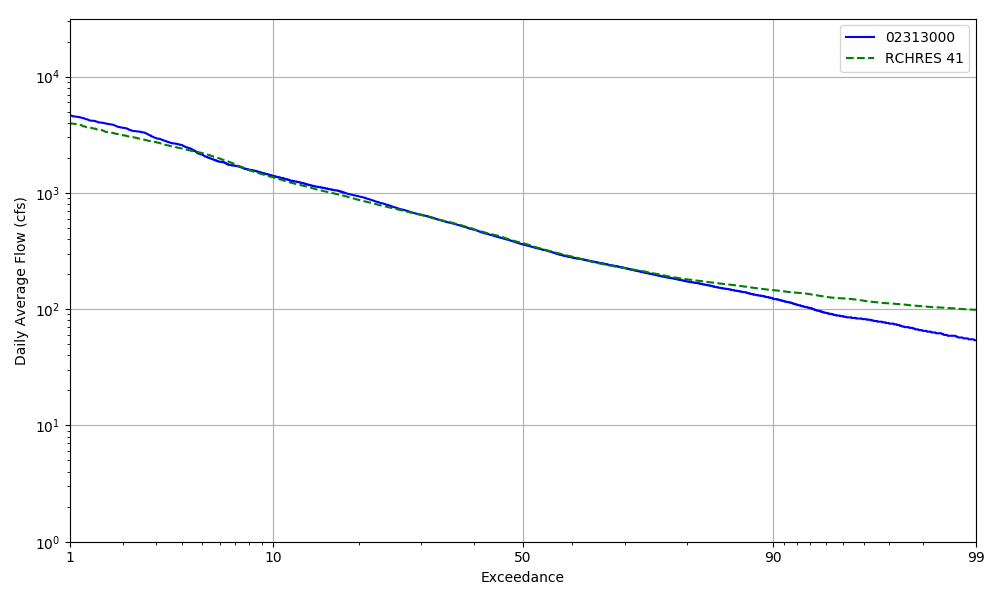


Figure 03100208-41: Daily exceedance for HSFP reach 41 and USGS station 02313000.

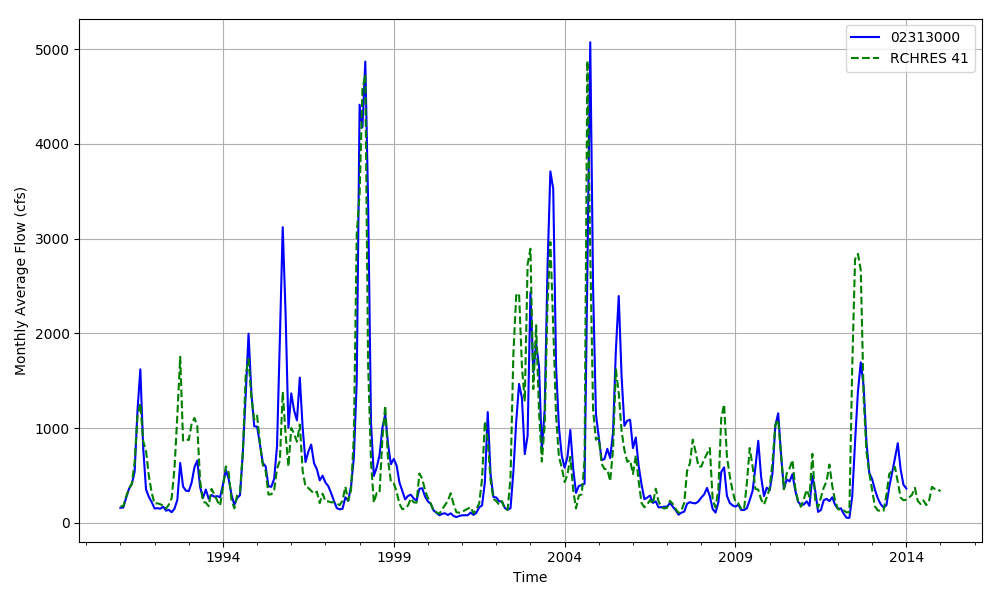


Figure 03100208-42: Monthly flow for HSFP reach 41 and USGS station 02313000.