# Appendix for Model 03070103

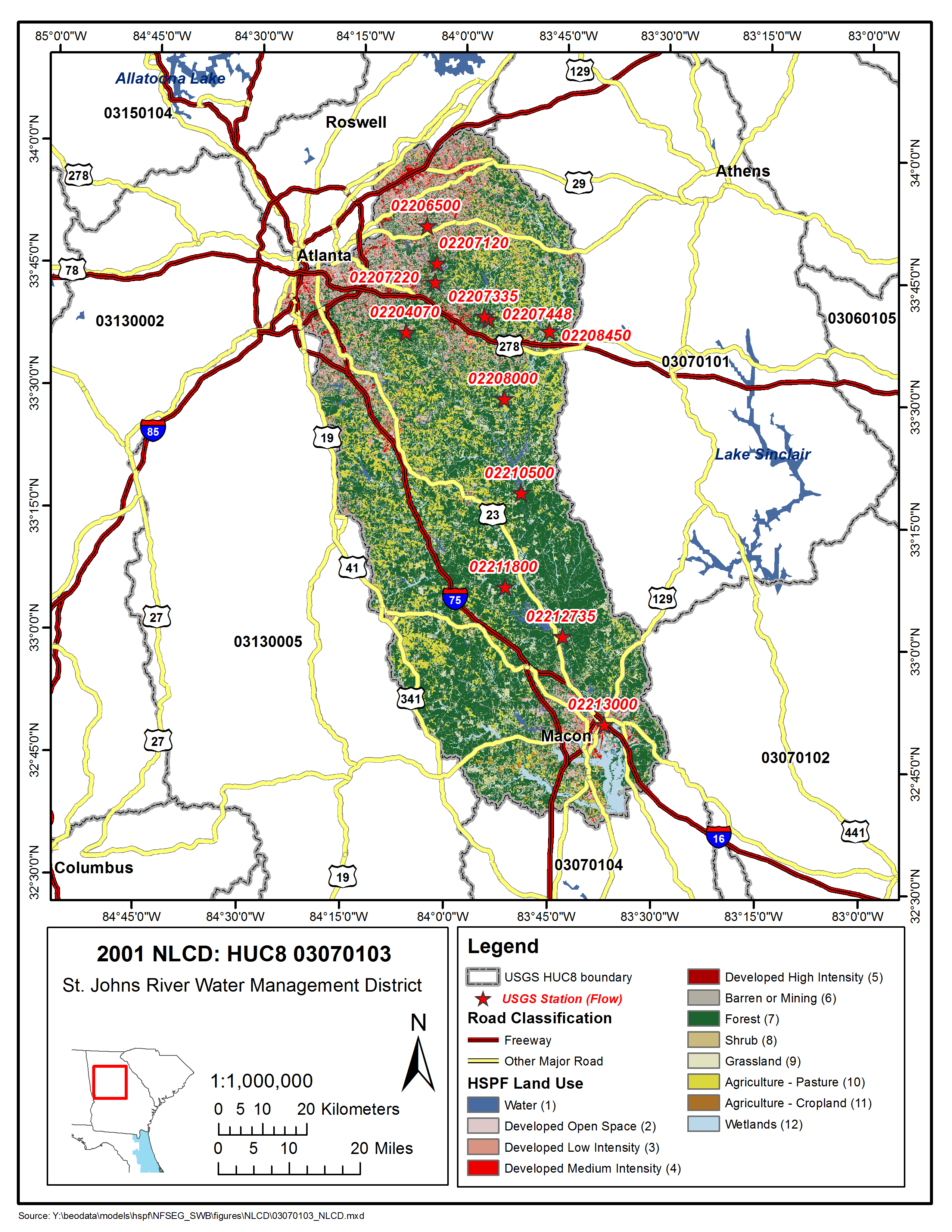


Figure 03070103-1: Land Cover from the National Land Cover Database.

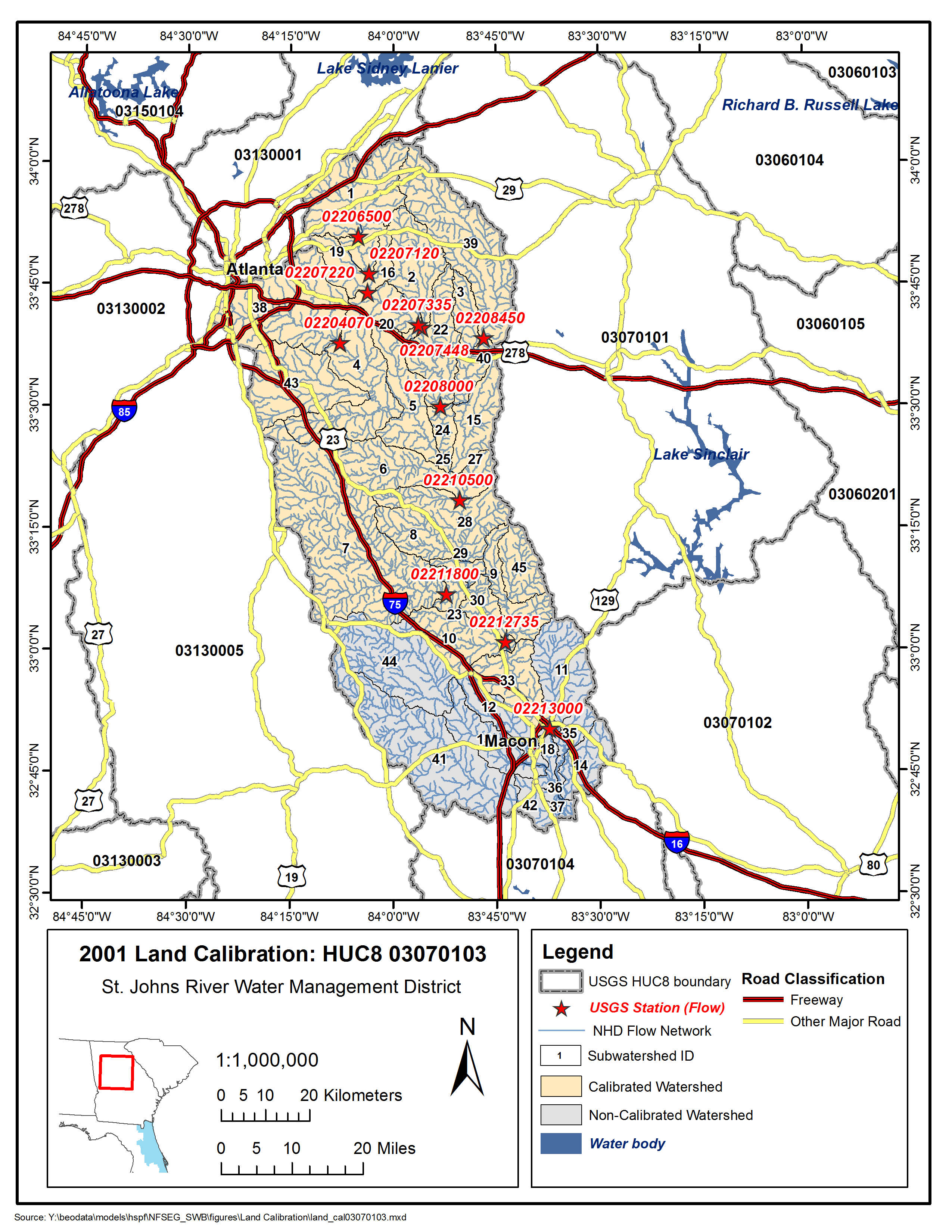


Figure 03070103-2: Calibrated sub-watersheds.

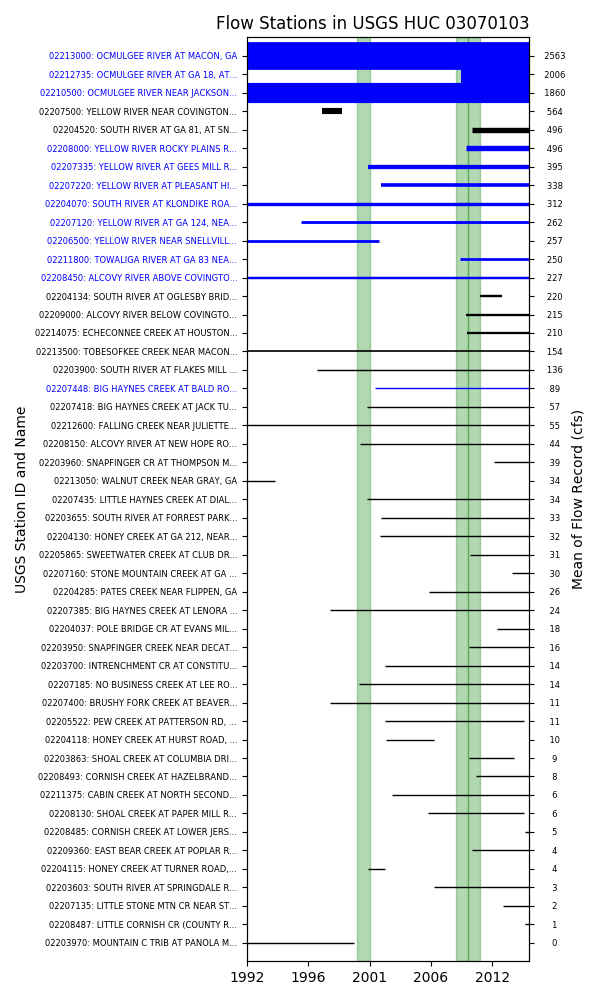


Figure 03070103-3: Station period of record. Blue color identifies gauges used for calibration.

## HSPF Reach 01, USGS Gauge 02206500

Table 03070103-1: Comparison Statistics Between HSPF Reach 01 and USGS Gauge 02206500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -26.12 |
| Standard error | 58.42 |
| Relative bias | -0.10 |
| Relative standard error | 0.39 |
| Nash-Sutcliffe coefficient | 0.84 |
| Coefficient of efficiency | 0.62 |
| Index of agreement | 0.81 |

Table 03070103-2: Hydrologic Indices Between USGS Gauge 02206500 and HSPF Reach 01.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02206500 | Simulated Reach 01 | Percent Difference |
| MA1: Mean, all daily flows | 255.88 | 229.77 | -10.20 |
| MA2: Median, all daily flows | 152.00 | 136.36 | -10.29 |
| MA4: CV, log of all daily flows | 86.50 | 82.28 | -4.88 |
| MA5: Mean daily flow / median daily flow | 1.68 | 1.69 | 0.10 |
| MA9: (Q10 - Q90) / median daily flow | 2.82 | 2.08 | -26.39 |
| MA10: (Q20 - Q80) / median daily flow | 1.36 | 1.27 | -6.83 |
| MA11: (Q25 - Q75) / median daily flow | 0.99 | 1.05 | 6.05 |
| MA12: Mean monthly flow, January | 318.40 | 315.29 | -0.97 |
| MA13: Mean monthly flow, February | 343.69 | 335.12 | -2.49 |
| MA14: Mean monthly flow, March | 376.82 | 327.31 | -13.14 |
| MA15: Mean monthly flow, April | 246.79 | 232.83 | -5.66 |
| MA16: Mean monthly flow, May | 193.93 | 174.07 | -10.24 |
| MA17: Mean monthly flow, June | 212.85 | 149.61 | -29.71 |
| MA18: Mean monthly flow, July | 172.44 | 142.02 | -17.64 |
| MA19: Mean monthly flow, August | 167.15 | 125.35 | -25.01 |
| MA20: Mean monthly flow, September | 178.47 | 164.79 | -7.67 |
| MA21: Mean monthly flow, October | 170.49 | 160.27 | -6.00 |
| MA22: Mean monthly flow, November | 219.86 | 194.70 | -11.44 |
| MA23: Mean monthly flow, December | 191.11 | 185.29 | -3.05 |
| ML1: Mean minimum monthly flow, January | 127.42 | 130.43 | 2.37 |
| ML2: Mean minimum monthly flow, February | 148.50 | 152.27 | 2.54 |
| ML3: Mean minimum monthly flow, March | 146.67 | 151.15 | 3.06 |
| ML4: Mean minimum monthly flow, April | 128.42 | 127.74 | -0.52 |
| ML5: Mean minimum monthly flow, May | 96.83 | 93.76 | -3.17 |
| ML6: Mean minimum monthly flow, June | 84.00 | 72.67 | -13.48 |
| ML7: Mean minimum monthly flow, July | 71.25 | 66.18 | -7.11 |
| ML8: Mean minimum monthly flow, August | 62.50 | 63.11 | 0.97 |
| ML9: Mean minimum monthly flow, September | 60.75 | 63.61 | 4.71 |
| ML10: Mean minimum monthly flow, October | 75.92 | 76.22 | 0.40 |
| ML11: Mean minimum monthly flow, November | 94.45 | 94.58 | 0.14 |
| ML12: Mean minimum monthly flow, December | 117.27 | 115.85 | -1.21 |
| ML13: CV of minimum monthly flows | 43.75 | 55.93 | 27.83 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.37 | 0.37 | -0.87 |
| ML15: Mean minimum annual flow / mean annual flow | 0.26 | 0.27 | 1.85 |
| ML16: Median minimum annual flow / median annual flow | 0.33 | 0.32 | -2.85 |
| ML20: Ratio of baseflow volume to total flow volume | 0.45 | 0.50 | 11.12 |
| ML22: Mean annual minimum flow divided by catchment area | 0.54 | 0.48 | -11.94 |
| RA1: Mean of positive changes from one day to next (rise rate) | 203.12 | 252.07 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 205.36 | 248.91 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 96.68 | 100.61 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 284.10 | 393.71 |  |
| RA5: Ratio of days that are higher than previous day | 0.31 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.25 | 0.25 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.12 | 0.07 |  |
| RA8: Number of flow reversals from one day to the next | 113.00 | 108.38 |  |
| RA9: CV, number of flow reversals from one day to the next | 31.68 | 31.76 |  |

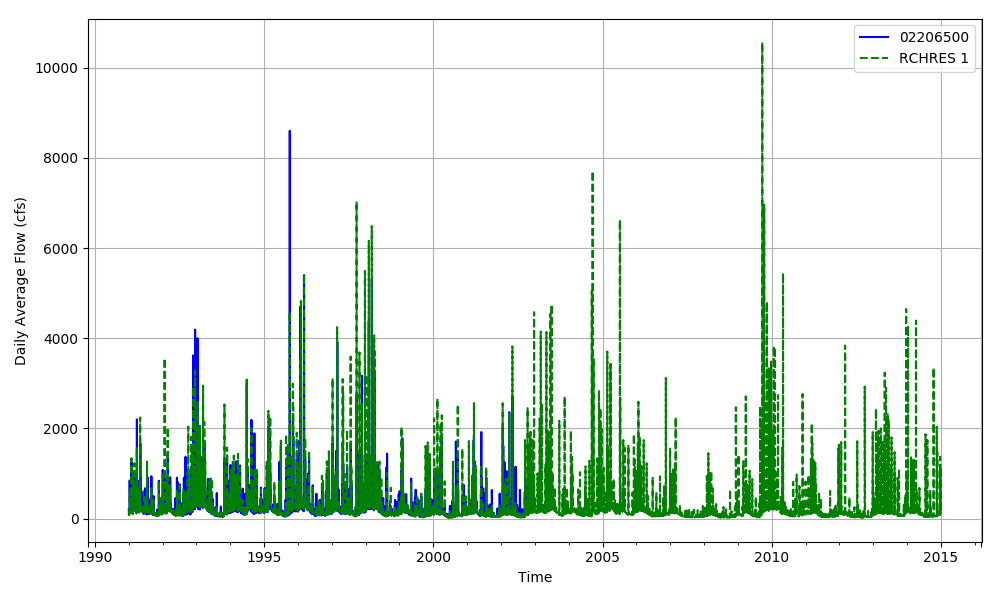


Figure 03070103-4: Daily flow for HSFP reach 01 and USGS station 02206500.

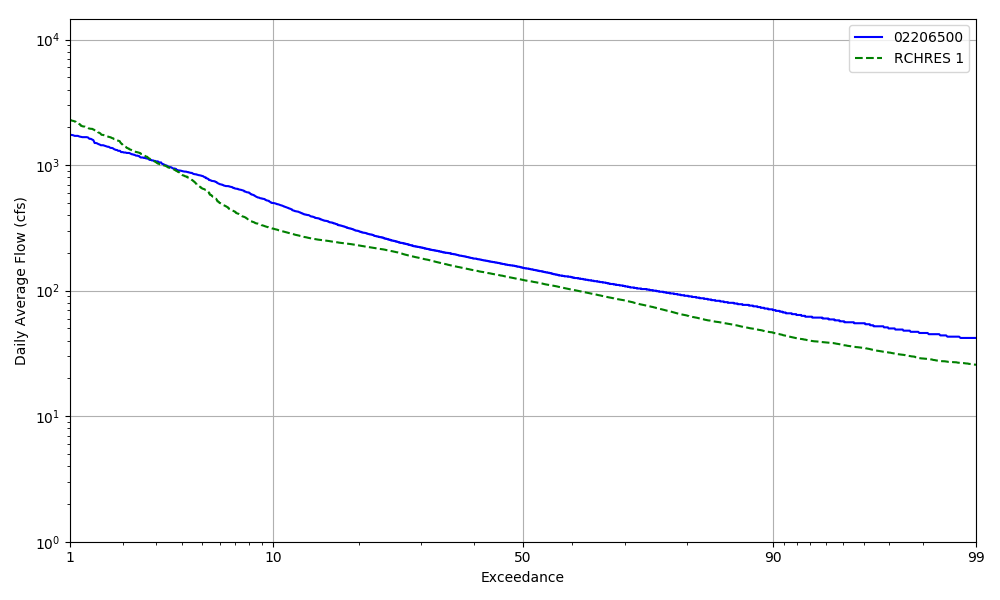


Figure 03070103-5: Daily exceedance for HSFP reach 01 and USGS station 02206500.

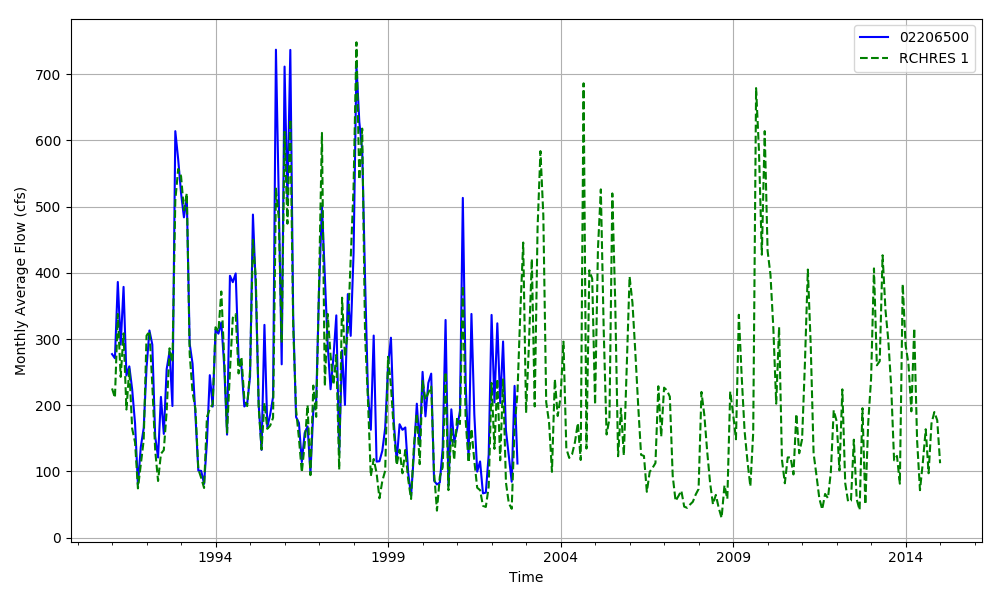


Figure 03070103-6: Monthly flow for HSFP reach 01 and USGS station 02206500.

## HSPF Reach 02, USGS Gauge 02207448

Table 03070103-3: Comparison Statistics Between HSPF Reach 02 and USGS Gauge 02207448.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 6.46 |
| Standard error | 40.07 |
| Relative bias | 0.07 |
| Relative standard error | 0.42 |
| Nash-Sutcliffe coefficient | 0.83 |
| Coefficient of efficiency | 0.64 |
| Index of agreement | 0.79 |

Table 03070103-4: Hydrologic Indices Between USGS Gauge 02207448 and HSPF Reach 02.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02207448 | Simulated Reach 02 | Percent Difference |
| MA1: Mean, all daily flows | 92.32 | 99.09 | 7.34 |
| MA2: Median, all daily flows | 45.00 | 64.63 | 43.62 |
| MA3: CV, all daily flows | 118.20 | 132.62 | 12.20 |
| MA4: CV, log of all daily flows | 97.65 | 67.23 | -31.16 |
| MA5: Mean daily flow / median daily flow | 2.05 | 1.53 | -25.26 |
| MA9: (Q10 - Q90) / median daily flow | 3.93 | 2.07 | -47.31 |
| MA10: (Q20 - Q80) / median daily flow | 2.55 | 1.33 | -47.60 |
| MA11: (Q25 - Q75) / median daily flow | 2.07 | 1.15 | -44.15 |
| MA12: Mean monthly flow, January | 91.65 | 103.28 | 12.69 |
| MA13: Mean monthly flow, February | 115.25 | 117.92 | 2.31 |
| MA14: Mean monthly flow, March | 133.42 | 129.65 | -2.82 |
| MA15: Mean monthly flow, April | 88.87 | 85.34 | -3.97 |
| MA16: Mean monthly flow, May | 96.73 | 84.02 | -13.15 |
| MA17: Mean monthly flow, June | 72.15 | 74.15 | 2.76 |
| MA18: Mean monthly flow, July | 88.52 | 92.41 | 4.39 |
| MA19: Mean monthly flow, August | 37.06 | 49.23 | 32.86 |
| MA20: Mean monthly flow, September | 57.62 | 71.48 | 24.06 |
| MA21: Mean monthly flow, October | 50.30 | 67.17 | 33.54 |
| MA22: Mean monthly flow, November | 74.06 | 80.43 | 8.59 |
| MA23: Mean monthly flow, December | 87.67 | 107.80 | 22.97 |
| ML1: Mean minimum monthly flow, January | 55.23 | 71.56 | 29.57 |
| ML2: Mean minimum monthly flow, February | 63.44 | 79.68 | 25.61 |
| ML3: Mean minimum monthly flow, March | 73.59 | 79.48 | 8.01 |
| ML4: Mean minimum monthly flow, April | 53.61 | 66.20 | 23.48 |
| ML5: Mean minimum monthly flow, May | 36.00 | 47.54 | 32.06 |
| ML6: Mean minimum monthly flow, June | 19.27 | 38.90 | 101.91 |
| ML7: Mean minimum monthly flow, July | 31.38 | 40.49 | 29.01 |
| ML8: Mean minimum monthly flow, August | 17.19 | 31.88 | 85.43 |
| ML9: Mean minimum monthly flow, September | 13.96 | 28.29 | 102.71 |
| ML10: Mean minimum monthly flow, October | 20.60 | 38.18 | 85.35 |
| ML11: Mean minimum monthly flow, November | 28.70 | 47.09 | 64.10 |
| ML12: Mean minimum monthly flow, December | 40.06 | 59.05 | 47.41 |
| ML13: CV of minimum monthly flows | 105.21 | 63.89 | -39.28 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.14 | 0.35 | 160.64 |
| ML15: Mean minimum annual flow / mean annual flow | 0.09 | 0.25 | 184.16 |
| ML16: Median minimum annual flow / median annual flow | 0.12 | 0.33 | 173.63 |
| ML20: Ratio of baseflow volume to total flow volume | 0.49 | 0.60 | 23.11 |
| ML22: Mean annual minimum flow divided by catchment area | 0.07 | 0.23 | 242.52 |
| RA1: Mean of positive changes from one day to next (rise rate) | 44.42 | 75.02 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 322.92 | 333.34 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 26.22 | 34.91 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 342.79 | 468.23 |  |
| RA5: Ratio of days that are higher than previous day | 0.35 | 0.32 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.19 | 0.11 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.13 | 0.06 |  |
| RA8: Number of flow reversals from one day to the next | 118.23 | 115.08 |  |
| RA9: CV, number of flow reversals from one day to the next | 33.82 | 34.51 |  |

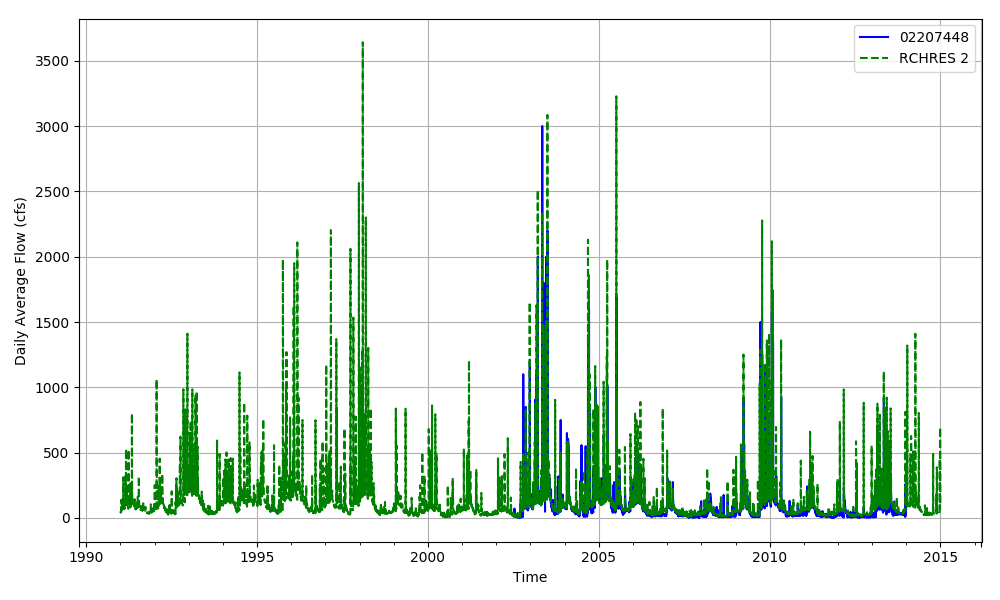


Figure 03070103-7: Daily flow for HSFP reach 02 and USGS station 02207448.

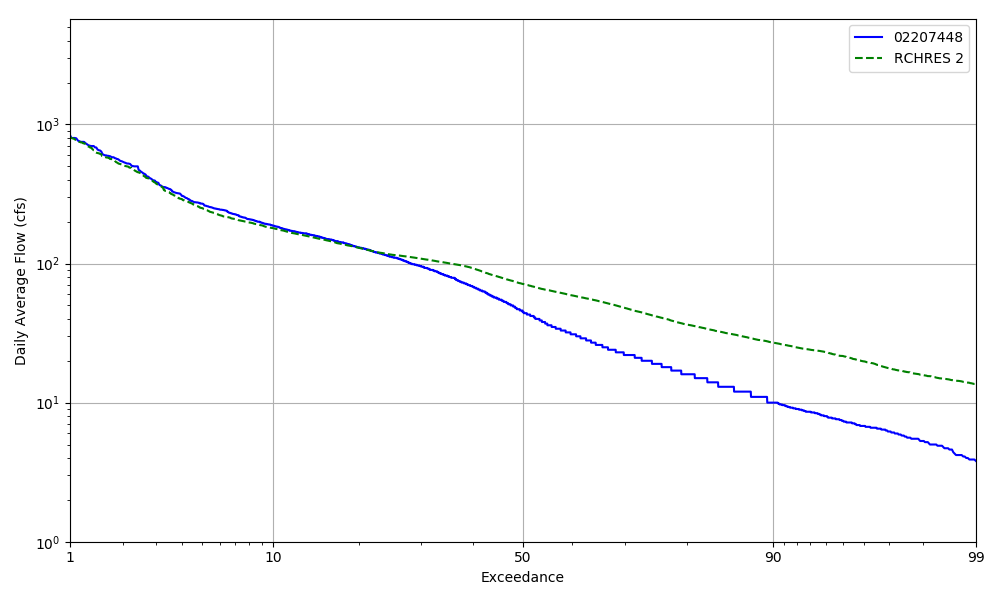


Figure 03070103-8: Daily exceedance for HSFP reach 02 and USGS station 02207448.

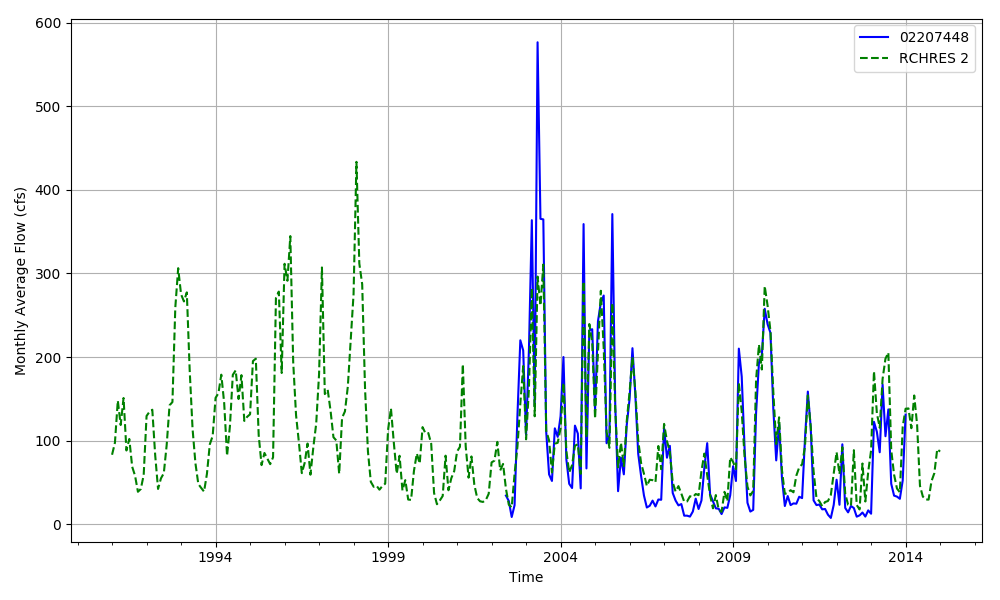


Figure 03070103-9: Monthly flow for HSFP reach 02 and USGS station 02207448.

## HSPF Reach 07, USGS Gauge 02211800

Table 03070103-5: Comparison Statistics Between HSPF Reach 07 and USGS Gauge 02211800.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 20.49 |
| Standard error | 92.65 |
| Relative bias | 0.08 |
| Relative standard error | 0.32 |
| Nash-Sutcliffe coefficient | 0.90 |
| Coefficient of efficiency | 0.72 |
| Index of agreement | 0.86 |

Table 03070103-6: Hydrologic Indices Between USGS Gauge 02211800 and HSPF Reach 07.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02211800 | Simulated Reach 07 | Percent Difference |
| MA1: Mean, all daily flows | 249.94 | 269.88 | 7.98 |
| MA2: Median, all daily flows | 115.00 | 117.06 | 1.79 |
| MA3: CV, all daily flows | 150.10 | 149.68 | -0.28 |
| MA4: CV, log of all daily flows | 106.45 | 118.23 | 11.07 |
| MA5: Mean daily flow / median daily flow | 2.17 | 2.31 | 6.08 |
| MA9: (Q10 - Q90) / median daily flow | 4.24 | 5.28 | 24.58 |
| MA10: (Q20 - Q80) / median daily flow | 2.38 | 2.60 | 9.07 |
| MA11: (Q25 - Q75) / median daily flow | 1.90 | 1.91 | 0.30 |
| MA12: Mean monthly flow, January | 323.99 | 363.79 | 12.28 |
| MA13: Mean monthly flow, February | 368.34 | 404.66 | 9.86 |
| MA14: Mean monthly flow, March | 326.77 | 329.39 | 0.80 |
| MA15: Mean monthly flow, April | 181.41 | 196.86 | 8.52 |
| MA16: Mean monthly flow, May | 210.28 | 262.37 | 24.77 |
| MA17: Mean monthly flow, June | 111.66 | 116.41 | 4.25 |
| MA18: Mean monthly flow, July | 87.57 | 76.84 | -12.25 |
| MA19: Mean monthly flow, August | 80.78 | 123.57 | 52.97 |
| MA20: Mean monthly flow, September | 63.29 | 62.69 | -0.95 |
| MA21: Mean monthly flow, October | 92.71 | 133.10 | 43.57 |
| MA22: Mean monthly flow, November | 195.68 | 160.44 | -18.01 |
| MA23: Mean monthly flow, December | 408.40 | 415.45 | 1.73 |
| ML1: Mean minimum monthly flow, January | 244.80 | 265.98 | 8.65 |
| ML2: Mean minimum monthly flow, February | 193.75 | 210.59 | 8.69 |
| ML3: Mean minimum monthly flow, March | 229.25 | 208.89 | -8.88 |
| ML4: Mean minimum monthly flow, April | 142.00 | 129.05 | -9.12 |
| ML5: Mean minimum monthly flow, May | 101.40 | 106.27 | 4.80 |
| ML6: Mean minimum monthly flow, June | 57.32 | 62.76 | 9.49 |
| ML7: Mean minimum monthly flow, July | 54.20 | 53.82 | -0.69 |
| ML8: Mean minimum monthly flow, August | 39.06 | 45.19 | 15.70 |
| ML9: Mean minimum monthly flow, September | 32.17 | 34.52 | 7.31 |
| ML10: Mean minimum monthly flow, October | 39.40 | 43.88 | 11.36 |
| ML11: Mean minimum monthly flow, November | 67.60 | 71.08 | 5.15 |
| ML12: Mean minimum monthly flow, December | 97.80 | 102.38 | 4.69 |
| ML13: CV of minimum monthly flows | 111.32 | 110.65 | -0.60 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.24 | 0.30 | 27.16 |
| ML15: Mean minimum annual flow / mean annual flow | 0.11 | 0.13 | 17.84 |
| ML16: Median minimum annual flow / median annual flow | 0.16 | 0.17 | 8.31 |
| ML20: Ratio of baseflow volume to total flow volume | 0.46 | 0.42 | -8.61 |
| ML22: Mean annual minimum flow divided by catchment area | 0.22 | 0.29 | 32.14 |
| RA1: Mean of positive changes from one day to next (rise rate) | 168.54 | 145.67 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 346.48 | 307.76 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 69.29 | 56.75 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 413.93 | 290.07 |  |
| RA5: Ratio of days that are higher than previous day | 0.28 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.17 | 0.11 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.10 | 0.09 |  |
| RA8: Number of flow reversals from one day to the next | 77.00 | 75.67 |  |
| RA9: CV, number of flow reversals from one day to the next | 42.41 | 43.29 |  |

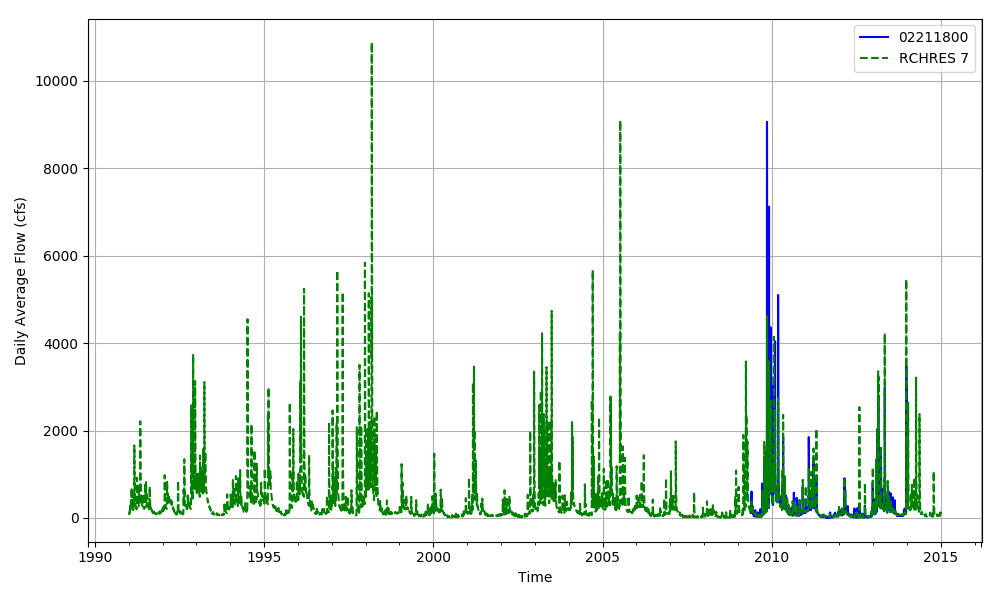


Figure 03070103-10: Daily flow for HSFP reach 07 and USGS station 02211800.

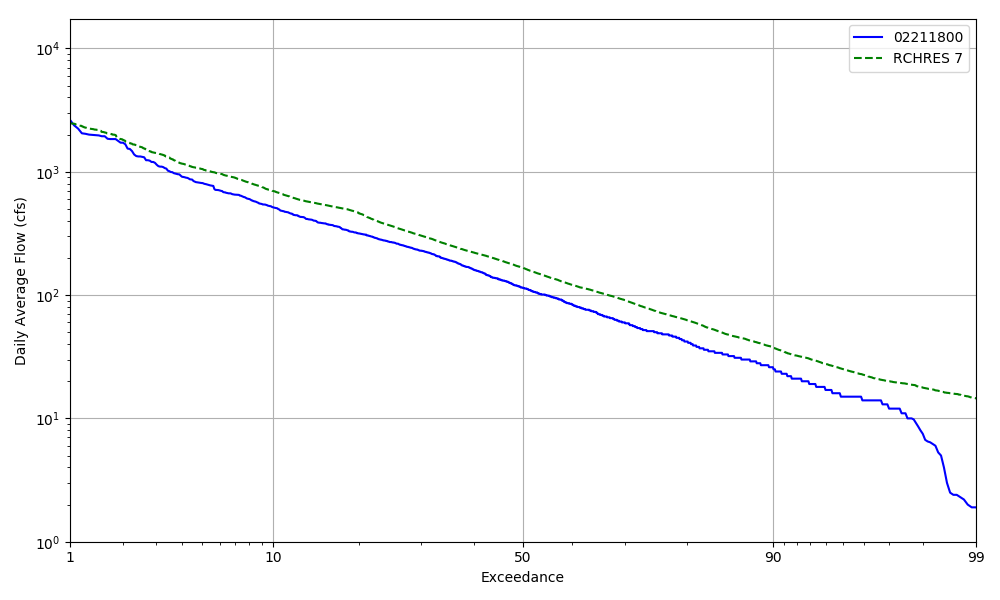


Figure 03070103-11: Daily exceedance for HSFP reach 07 and USGS station 02211800.

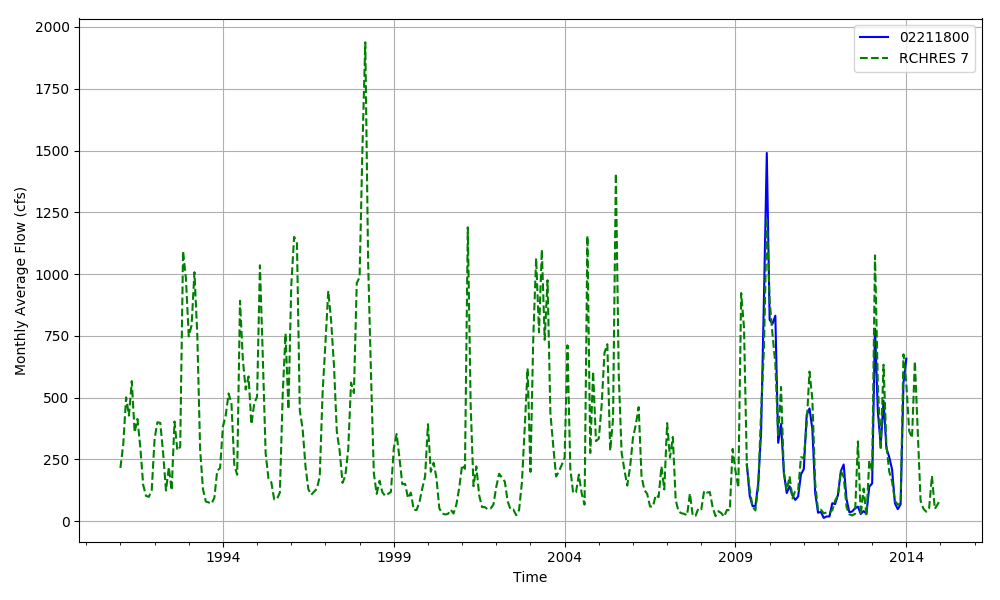


Figure 03070103-12: Monthly flow for HSFP reach 07 and USGS station 02211800.

## HSPF Reach 16, USGS Gauge 02207120

Table 03070103-7: Comparison Statistics Between HSPF Reach 16 and USGS Gauge 02207120.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -28.92 |
| Standard error | 80.81 |
| Relative bias | -0.11 |
| Relative standard error | 0.40 |
| Nash-Sutcliffe coefficient | 0.84 |
| Coefficient of efficiency | 0.69 |
| Index of agreement | 0.84 |

Table 03070103-8: Hydrologic Indices Between USGS Gauge 02207120 and HSPF Reach 16.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02207120 | Simulated Reach 16 | Percent Difference |
| MA1: Mean, all daily flows | 284.38 | 248.11 | -12.75 |
| MA2: Median, all daily flows | 150.00 | 137.05 | -8.63 |
| MA4: CV, log of all daily flows | 96.83 | 84.41 | -12.83 |
| MA5: Mean daily flow / median daily flow | 1.90 | 1.81 | -4.51 |
| MA9: (Q10 - Q90) / median daily flow | 3.25 | 2.28 | -29.68 |
| MA10: (Q20 - Q80) / median daily flow | 1.47 | 1.37 | -7.10 |
| MA11: (Q25 - Q75) / median daily flow | 1.08 | 1.08 | 0.20 |
| MA12: Mean monthly flow, January | 188.45 | 170.05 | -9.77 |
| MA13: Mean monthly flow, February | 221.91 | 198.06 | -10.75 |
| MA14: Mean monthly flow, March | 232.80 | 210.90 | -9.41 |
| MA15: Mean monthly flow, April | 151.25 | 129.72 | -14.24 |
| MA16: Mean monthly flow, May | 183.53 | 150.80 | -17.84 |
| MA17: Mean monthly flow, June | 139.33 | 115.74 | -16.93 |
| MA18: Mean monthly flow, July | 161.10 | 125.82 | -21.90 |
| MA19: Mean monthly flow, August | 116.86 | 97.55 | -16.53 |
| MA20: Mean monthly flow, September | 218.05 | 170.37 | -21.87 |
| MA21: Mean monthly flow, October | 125.16 | 119.89 | -4.21 |
| MA22: Mean monthly flow, November | 166.07 | 151.44 | -8.81 |
| MA23: Mean monthly flow, December | 194.91 | 188.64 | -3.21 |
| ML1: Mean minimum monthly flow, January | 128.11 | 123.46 | -3.63 |
| ML2: Mean minimum monthly flow, February | 154.56 | 145.06 | -6.15 |
| ML3: Mean minimum monthly flow, March | 157.56 | 145.84 | -7.44 |
| ML4: Mean minimum monthly flow, April | 123.22 | 122.01 | -0.98 |
| ML5: Mean minimum monthly flow, May | 112.30 | 102.42 | -8.80 |
| ML6: Mean minimum monthly flow, June | 79.44 | 77.08 | -2.98 |
| ML7: Mean minimum monthly flow, July | 73.78 | 74.14 | 0.50 |
| ML8: Mean minimum monthly flow, August | 69.70 | 66.78 | -4.19 |
| ML9: Mean minimum monthly flow, September | 58.90 | 56.26 | -4.48 |
| ML10: Mean minimum monthly flow, October | 76.67 | 80.36 | 4.82 |
| ML11: Mean minimum monthly flow, November | 93.00 | 92.24 | -0.82 |
| ML12: Mean minimum monthly flow, December | 116.11 | 118.94 | 2.44 |
| ML13: CV of minimum monthly flows | 49.44 | 55.20 | 11.65 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.31 | 0.34 | 9.81 |
| ML15: Mean minimum annual flow / mean annual flow | 0.22 | 0.23 | 8.73 |
| ML16: Median minimum annual flow / median annual flow | 0.36 | 0.34 | -6.77 |
| ML20: Ratio of baseflow volume to total flow volume | 0.41 | 0.46 | 12.40 |
| ML22: Mean annual minimum flow divided by catchment area | 26667.18 | 26667.14 | -0.00 |
| RA1: Mean of positive changes from one day to next (rise rate) | 277.07 | 307.46 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 215.61 | 297.11 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 116.17 | 130.84 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 331.06 | 432.51 |  |
| RA5: Ratio of days that are higher than previous day | 0.28 | 0.30 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.32 | 0.22 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.11 | 0.08 |  |
| RA8: Number of flow reversals from one day to the next | 71.47 | 75.40 |  |
| RA9: CV, number of flow reversals from one day to the next | 82.11 | 82.37 |  |

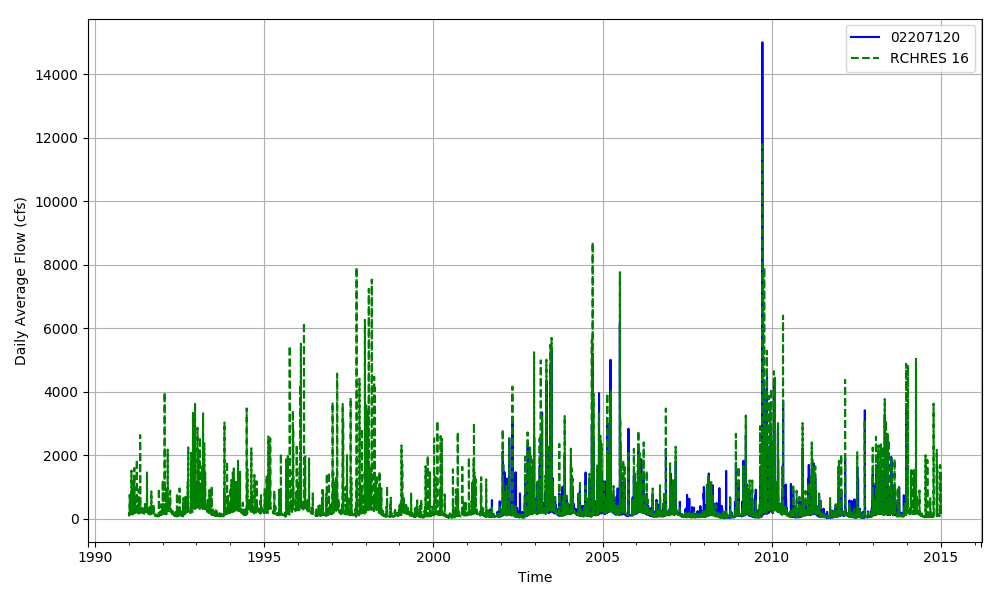


Figure 03070103-13: Daily flow for HSFP reach 16 and USGS station 02207120.

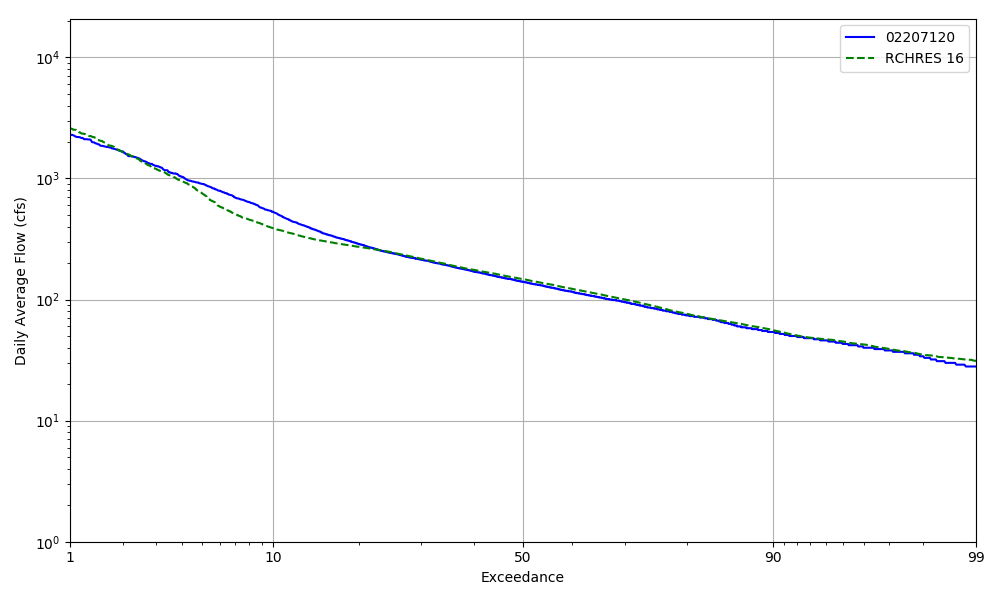


Figure 03070103-14: Daily exceedance for HSFP reach 16 and USGS station 02207120.

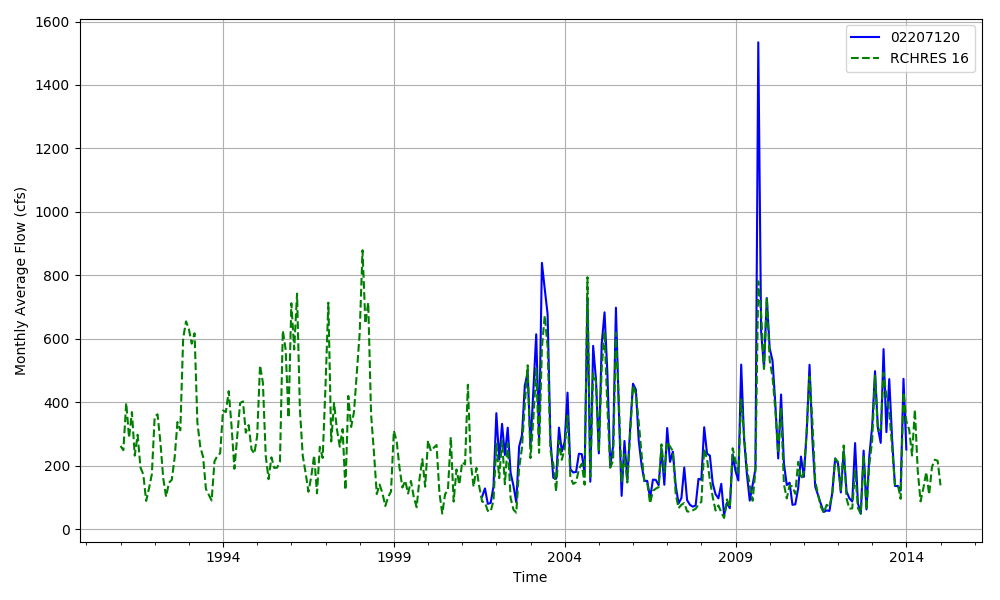


Figure 03070103-15: Monthly flow for HSFP reach 16 and USGS station 02207120.

## HSPF Reach 19, USGS Gauge 02207220

Table 03070103-9: Comparison Statistics Between HSPF Reach 19 and USGS Gauge 02207220.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -28.57 |
| Standard error | 123.04 |
| Relative bias | -0.08 |
| Relative standard error | 0.43 |
| Nash-Sutcliffe coefficient | 0.81 |
| Coefficient of efficiency | 0.72 |
| Index of agreement | 0.85 |

Table 03070103-10: Hydrologic Indices Between USGS Gauge 02207220 and HSPF Reach 19.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02207220 | Simulated Reach 19 | Percent Difference |
| MA1: Mean, all daily flows | 345.05 | 316.60 | -8.24 |
| MA2: Median, all daily flows | 192.00 | 181.70 | -5.36 |
| MA3: CV, all daily flows | 156.73 | 188.88 | 20.52 |
| MA4: CV, log of all daily flows | 94.29 | 84.72 | -10.16 |
| MA5: Mean daily flow / median daily flow | 1.80 | 1.74 | -3.05 |
| MA9: (Q10 - Q90) / median daily flow | 3.26 | 2.25 | -30.95 |
| MA10: (Q20 - Q80) / median daily flow | 1.58 | 1.32 | -16.34 |
| MA11: (Q25 - Q75) / median daily flow | 1.16 | 1.04 | -9.77 |
| MA12: Mean monthly flow, January | 367.60 | 340.48 | -7.38 |
| MA13: Mean monthly flow, February | 429.38 | 402.96 | -6.15 |
| MA14: Mean monthly flow, March | 454.01 | 426.75 | -6.00 |
| MA15: Mean monthly flow, April | 289.80 | 279.32 | -3.62 |
| MA16: Mean monthly flow, May | 326.59 | 273.66 | -16.21 |
| MA17: Mean monthly flow, June | 259.01 | 240.07 | -7.31 |
| MA18: Mean monthly flow, July | 317.55 | 266.06 | -16.22 |
| MA19: Mean monthly flow, August | 200.05 | 182.10 | -8.97 |
| MA20: Mean monthly flow, September | 335.63 | 264.86 | -21.09 |
| MA21: Mean monthly flow, October | 215.60 | 217.33 | 0.80 |
| MA22: Mean monthly flow, November | 271.44 | 264.92 | -2.40 |
| MA23: Mean monthly flow, December | 410.71 | 397.42 | -3.24 |
| ML1: Mean minimum monthly flow, January | 184.92 | 176.23 | -4.70 |
| ML2: Mean minimum monthly flow, February | 196.00 | 193.59 | -1.23 |
| ML3: Mean minimum monthly flow, March | 199.73 | 196.79 | -1.47 |
| ML4: Mean minimum monthly flow, April | 155.82 | 164.15 | 5.35 |
| ML5: Mean minimum monthly flow, May | 123.82 | 124.33 | 0.41 |
| ML6: Mean minimum monthly flow, June | 96.73 | 105.23 | 8.80 |
| ML7: Mean minimum monthly flow, July | 94.27 | 104.11 | 10.44 |
| ML8: Mean minimum monthly flow, August | 84.64 | 93.87 | 10.91 |
| ML9: Mean minimum monthly flow, September | 69.82 | 77.88 | 11.54 |
| ML10: Mean minimum monthly flow, October | 83.64 | 99.61 | 19.10 |
| ML11: Mean minimum monthly flow, November | 110.33 | 119.72 | 8.51 |
| ML12: Mean minimum monthly flow, December | 140.42 | 148.77 | 5.95 |
| ML13: CV of minimum monthly flows | 60.45 | 54.77 | -9.38 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.30 | 0.40 | 34.43 |
| ML15: Mean minimum annual flow / mean annual flow | 0.17 | 0.23 | 35.55 |
| ML16: Median minimum annual flow / median annual flow | 0.21 | 0.37 | 79.84 |
| ML20: Ratio of baseflow volume to total flow volume | 0.42 | 0.48 | 14.30 |
| ML22: Mean annual minimum flow divided by catchment area | 0.60 | 0.71 | 18.96 |
| RA1: Mean of positive changes from one day to next (rise rate) | 292.74 | 381.01 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 234.33 | 282.29 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 128.21 | 153.87 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 331.49 | 421.39 |  |
| RA5: Ratio of days that are higher than previous day | 0.30 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.29 | 0.24 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.13 | 0.07 |  |
| RA8: Number of flow reversals from one day to the next | 109.17 | 114.58 |  |
| RA9: CV, number of flow reversals from one day to the next | 23.19 | 24.20 |  |

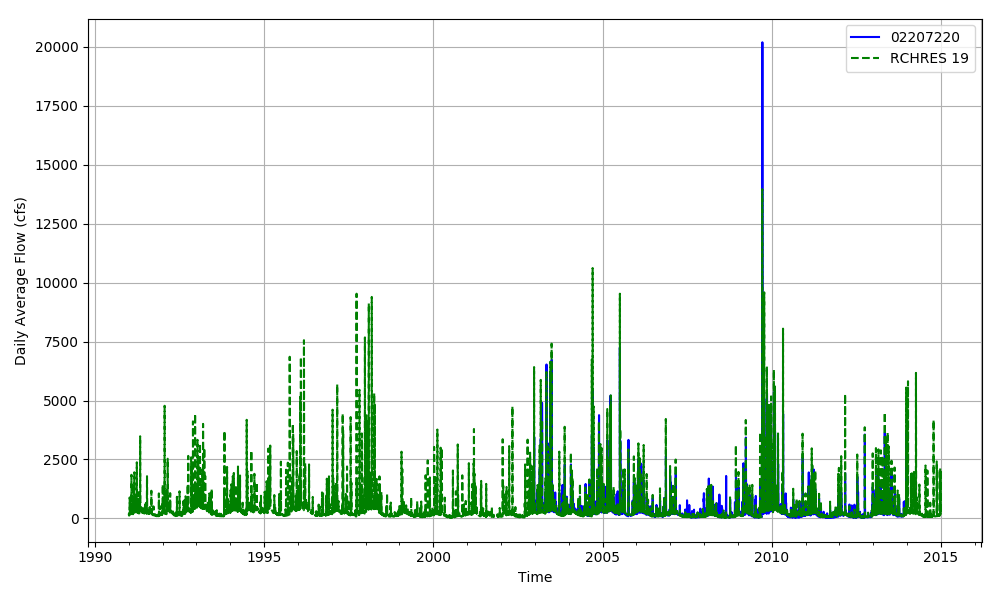


Figure 03070103-16: Daily flow for HSFP reach 19 and USGS station 02207220.

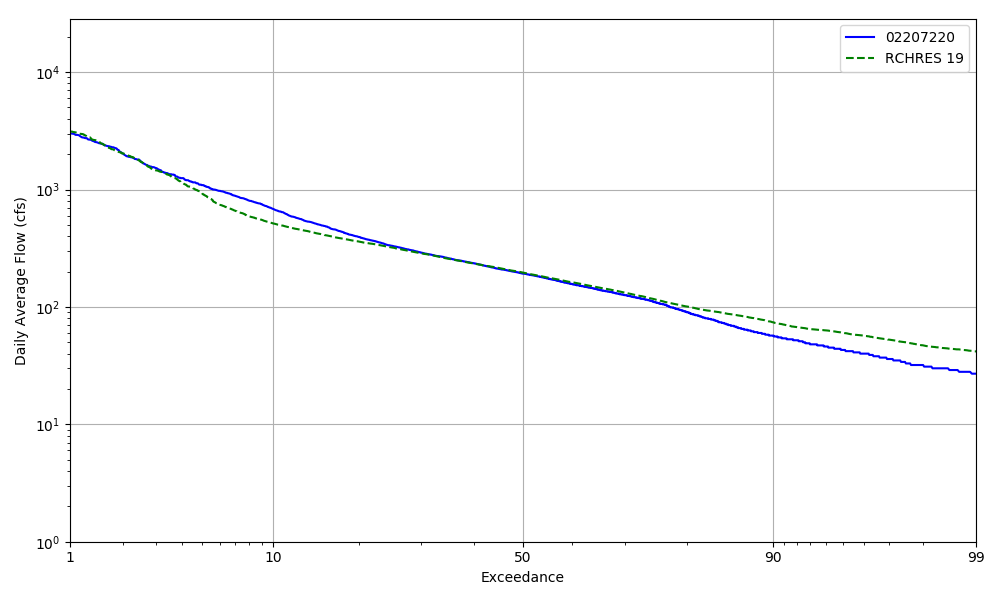


Figure 03070103-17: Daily exceedance for HSFP reach 19 and USGS station 02207220.

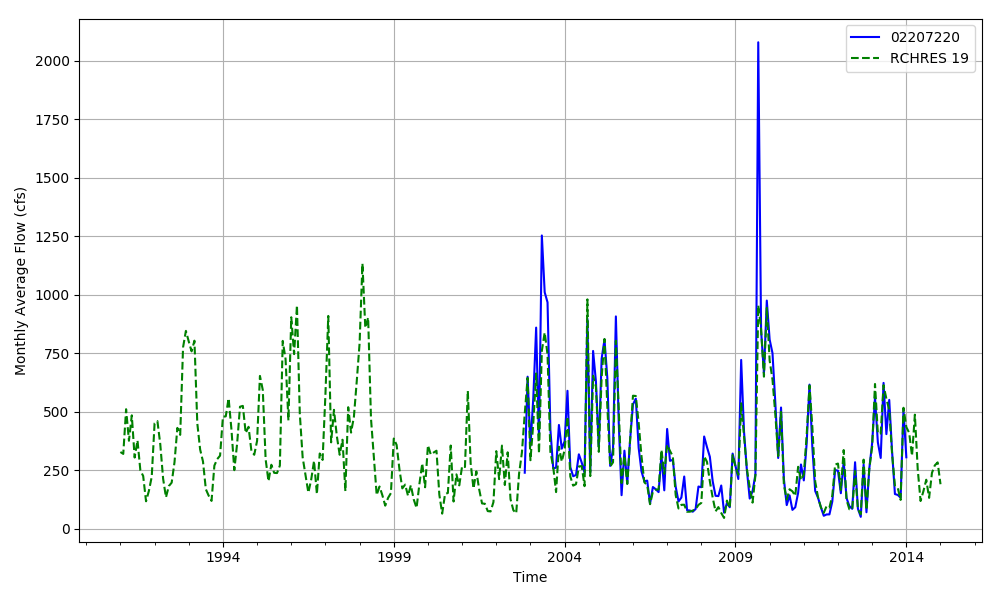


Figure 03070103-18: Monthly flow for HSFP reach 19 and USGS station 02207220.

## HSPF Reach 20, USGS Gauge 02207335

Table 03070103-11: Comparison Statistics Between HSPF Reach 20 and USGS Gauge 02207335.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -46.68 |
| Standard error | 137.57 |
| Relative bias | -0.12 |
| Relative standard error | 0.42 |
| Nash-Sutcliffe coefficient | 0.82 |
| Coefficient of efficiency | 0.67 |
| Index of agreement | 0.83 |

Table 03070103-12: Hydrologic Indices Between USGS Gauge 02207335 and HSPF Reach 20.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02207335 | Simulated Reach 20 | Percent Difference |
| MA1: Mean, all daily flows | 402.81 | 356.05 | -11.61 |
| MA2: Median, all daily flows | 228.00 | 208.78 | -8.43 |
| MA3: CV, all daily flows | 143.21 | 173.39 | 21.07 |
| MA4: CV, log of all daily flows | 92.95 | 78.47 | -15.58 |
| MA5: Mean daily flow / median daily flow | 1.77 | 1.71 | -3.47 |
| MA9: (Q10 - Q90) / median daily flow | 2.98 | 2.33 | -21.96 |
| MA10: (Q20 - Q80) / median daily flow | 1.55 | 1.45 | -6.14 |
| MA11: (Q25 - Q75) / median daily flow | 1.16 | 1.17 | 1.55 |
| MA12: Mean monthly flow, January | 435.17 | 397.65 | -8.62 |
| MA13: Mean monthly flow, February | 505.35 | 451.39 | -10.68 |
| MA14: Mean monthly flow, March | 533.22 | 492.46 | -7.64 |
| MA15: Mean monthly flow, April | 360.01 | 320.40 | -11.00 |
| MA16: Mean monthly flow, May | 391.86 | 322.45 | -17.71 |
| MA17: Mean monthly flow, June | 305.13 | 264.61 | -13.28 |
| MA18: Mean monthly flow, July | 374.03 | 290.03 | -22.46 |
| MA19: Mean monthly flow, August | 227.93 | 199.26 | -12.58 |
| MA20: Mean monthly flow, September | 373.22 | 294.90 | -20.98 |
| MA21: Mean monthly flow, October | 262.91 | 259.03 | -1.47 |
| MA22: Mean monthly flow, November | 340.42 | 309.06 | -9.21 |
| MA23: Mean monthly flow, December | 449.54 | 429.69 | -4.41 |
| ML1: Mean minimum monthly flow, January | 214.31 | 205.65 | -4.04 |
| ML2: Mean minimum monthly flow, February | 243.50 | 229.32 | -5.82 |
| ML3: Mean minimum monthly flow, March | 237.17 | 234.72 | -1.03 |
| ML4: Mean minimum monthly flow, April | 196.42 | 195.69 | -0.37 |
| ML5: Mean minimum monthly flow, May | 153.08 | 144.83 | -5.39 |
| ML6: Mean minimum monthly flow, June | 121.50 | 122.98 | 1.22 |
| ML7: Mean minimum monthly flow, July | 120.17 | 119.35 | -0.68 |
| ML8: Mean minimum monthly flow, August | 102.25 | 106.03 | 3.70 |
| ML9: Mean minimum monthly flow, September | 79.92 | 87.65 | 9.67 |
| ML10: Mean minimum monthly flow, October | 104.00 | 118.49 | 13.93 |
| ML11: Mean minimum monthly flow, November | 125.46 | 132.28 | 5.44 |
| ML12: Mean minimum monthly flow, December | 177.77 | 170.86 | -3.89 |
| ML13: CV of minimum monthly flows | 59.48 | 58.10 | -2.31 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.29 | 0.37 | 28.78 |
| ML15: Mean minimum annual flow / mean annual flow | 0.17 | 0.22 | 28.38 |
| ML16: Median minimum annual flow / median annual flow | 0.27 | 0.34 | 25.52 |
| ML20: Ratio of baseflow volume to total flow volume | 0.44 | 0.49 | 13.36 |
| ML22: Mean annual minimum flow divided by catchment area | 0.69 | 0.79 | 14.16 |
| RA1: Mean of positive changes from one day to next (rise rate) | 296.28 | 373.55 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 232.06 | 297.83 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 135.40 | 156.57 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 311.58 | 425.11 |  |
| RA5: Ratio of days that are higher than previous day | 0.30 | 0.30 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.23 | 0.19 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.12 | 0.08 |  |
| RA8: Number of flow reversals from one day to the next | 107.31 | 109.77 |  |
| RA9: CV, number of flow reversals from one day to the next | 22.32 | 22.26 |  |

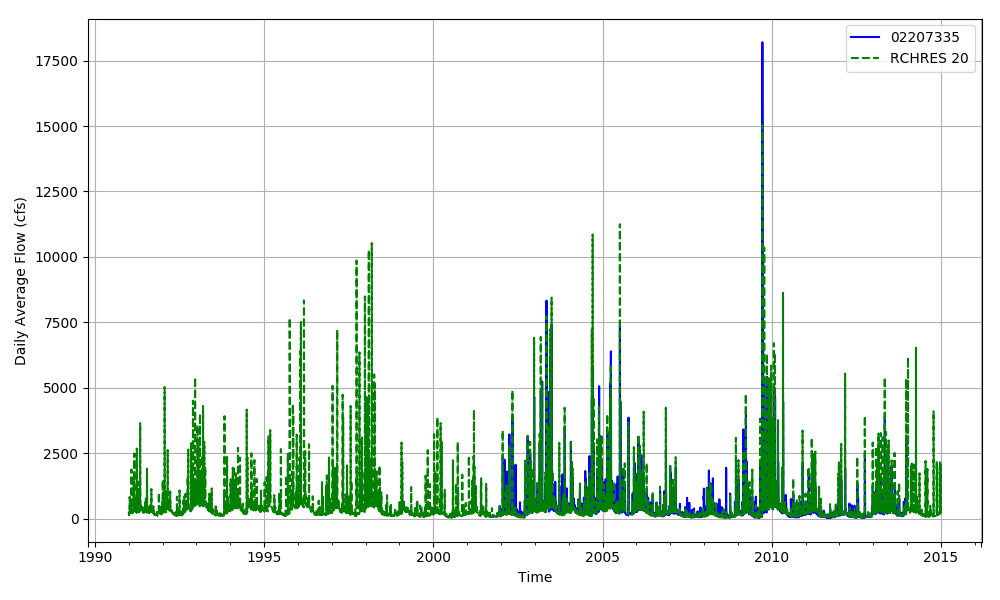


Figure 03070103-19: Daily flow for HSFP reach 20 and USGS station 02207335.

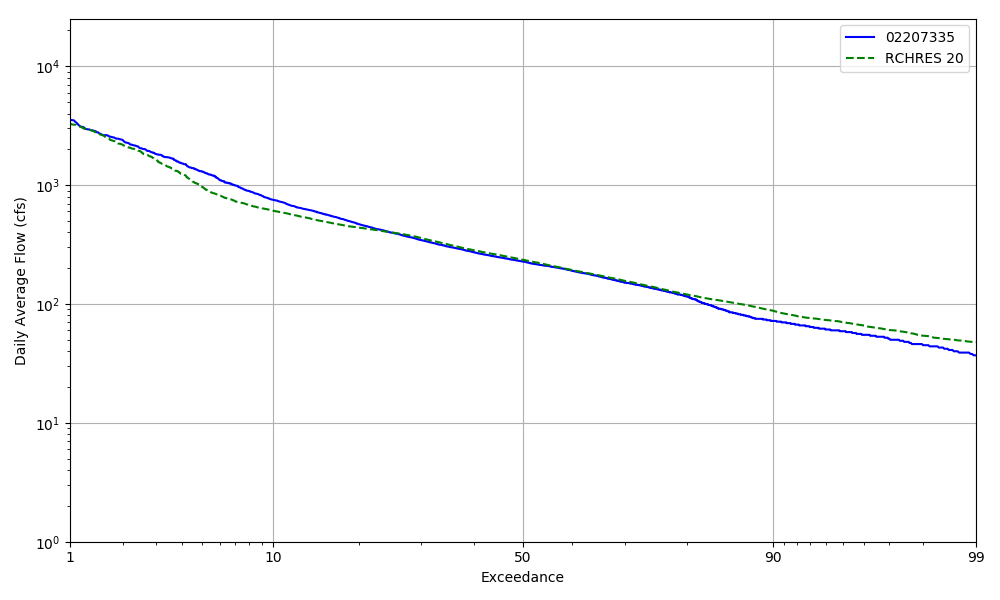


Figure 03070103-20: Daily exceedance for HSFP reach 20 and USGS station 02207335.

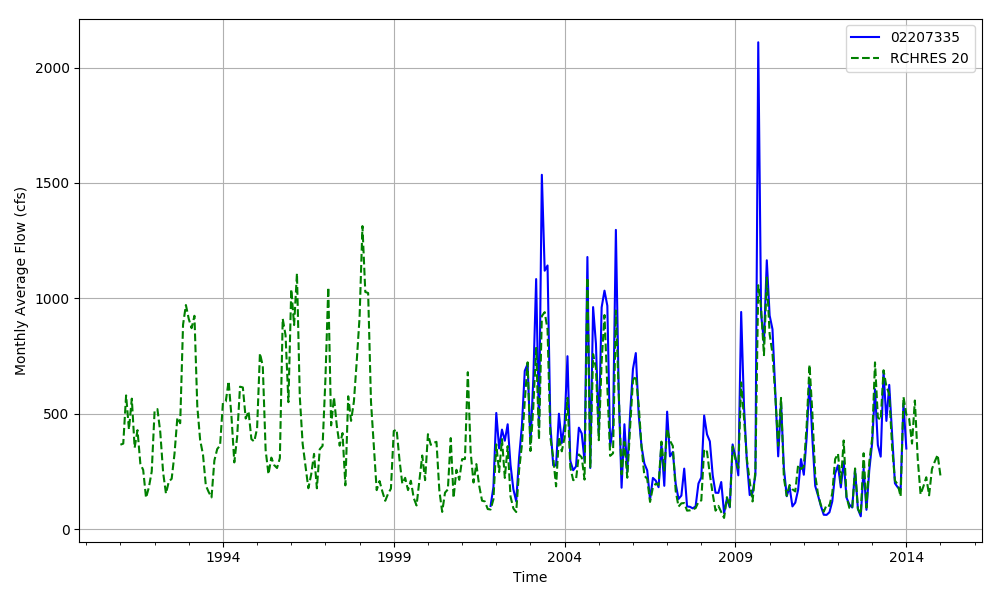


Figure 03070103-21: Monthly flow for HSFP reach 20 and USGS station 02207335.

## HSPF Reach 22, USGS Gauge 02208000

Table 03070103-13: Comparison Statistics Between HSPF Reach 22 and USGS Gauge 02208000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | 2.15 |
| Standard error | 71.98 |
| Relative bias | 0.00 |
| Relative standard error | 0.18 |
| Nash-Sutcliffe coefficient | 0.97 |
| Coefficient of efficiency | 0.83 |
| Index of agreement | 0.91 |

Table 03070103-14: Hydrologic Indices Between USGS Gauge 02208000 and HSPF Reach 22.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02208000 | Simulated Reach 22 | Percent Difference |
| MA1: Mean, all daily flows | 499.26 | 503.25 | 0.80 |
| MA2: Median, all daily flows | 292.50 | 295.59 | 1.06 |
| MA3: CV, all daily flows | 122.08 | 152.18 | 24.65 |
| MA4: CV, log of all daily flows | 96.81 | 83.20 | -14.06 |
| MA5: Mean daily flow / median daily flow | 1.71 | 1.70 | -0.26 |
| MA9: (Q10 - Q90) / median daily flow | 3.34 | 2.72 | -18.71 |
| MA10: (Q20 - Q80) / median daily flow | 1.82 | 1.67 | -8.03 |
| MA11: (Q25 - Q75) / median daily flow | 1.38 | 1.38 | 0.24 |
| MA12: Mean monthly flow, January | 698.58 | 689.64 | -1.28 |
| MA13: Mean monthly flow, February | 699.99 | 669.85 | -4.31 |
| MA14: Mean monthly flow, March | 648.99 | 656.07 | 1.09 |
| MA15: Mean monthly flow, April | 402.15 | 428.15 | 6.47 |
| MA16: Mean monthly flow, May | 483.31 | 463.38 | -4.12 |
| MA17: Mean monthly flow, June | 307.27 | 326.36 | 6.21 |
| MA18: Mean monthly flow, July | 355.58 | 330.93 | -6.93 |
| MA19: Mean monthly flow, August | 204.74 | 195.71 | -4.41 |
| MA20: Mean monthly flow, September | 119.25 | 147.14 | 23.39 |
| MA21: Mean monthly flow, October | 171.29 | 208.30 | 21.61 |
| MA22: Mean monthly flow, November | 306.18 | 308.04 | 0.61 |
| MA23: Mean monthly flow, December | 774.38 | 770.01 | -0.56 |
| ML1: Mean minimum monthly flow, January | 385.80 | 390.17 | 1.13 |
| ML2: Mean minimum monthly flow, February | 360.25 | 379.48 | 5.34 |
| ML3: Mean minimum monthly flow, March | 375.50 | 392.73 | 4.59 |
| ML4: Mean minimum monthly flow, April | 286.75 | 284.80 | -0.68 |
| ML5: Mean minimum monthly flow, May | 226.00 | 221.27 | -2.09 |
| ML6: Mean minimum monthly flow, June | 175.00 | 175.88 | 0.50 |
| ML7: Mean minimum monthly flow, July | 158.25 | 181.56 | 14.73 |
| ML8: Mean minimum monthly flow, August | 122.25 | 133.59 | 9.28 |
| ML9: Mean minimum monthly flow, September | 81.25 | 108.54 | 33.58 |
| ML10: Mean minimum monthly flow, October | 95.75 | 118.96 | 24.24 |
| ML11: Mean minimum monthly flow, November | 205.60 | 221.02 | 7.50 |
| ML12: Mean minimum monthly flow, December | 246.20 | 245.49 | -0.29 |
| ML13: CV of minimum monthly flows | 73.26 | 68.12 | -7.01 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.30 | 0.37 | 20.12 |
| ML15: Mean minimum annual flow / mean annual flow | 0.17 | 0.20 | 18.83 |
| ML16: Median minimum annual flow / median annual flow | 0.18 | 0.25 | 38.91 |
| ML20: Ratio of baseflow volume to total flow volume | 0.50 | 0.52 | 2.44 |
| ML22: Mean annual minimum flow divided by catchment area | 0.77 | 0.97 | 25.70 |
| RA1: Mean of positive changes from one day to next (rise rate) | 269.96 | 433.18 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 174.66 | 277.58 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 130.33 | 177.04 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 246.25 | 387.24 |  |
| RA5: Ratio of days that are higher than previous day | 0.32 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.24 | 0.14 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.10 | 0.08 |  |
| RA8: Number of flow reversals from one day to the next | 90.40 | 85.80 |  |
| RA9: CV, number of flow reversals from one day to the next | 38.71 | 38.87 |  |

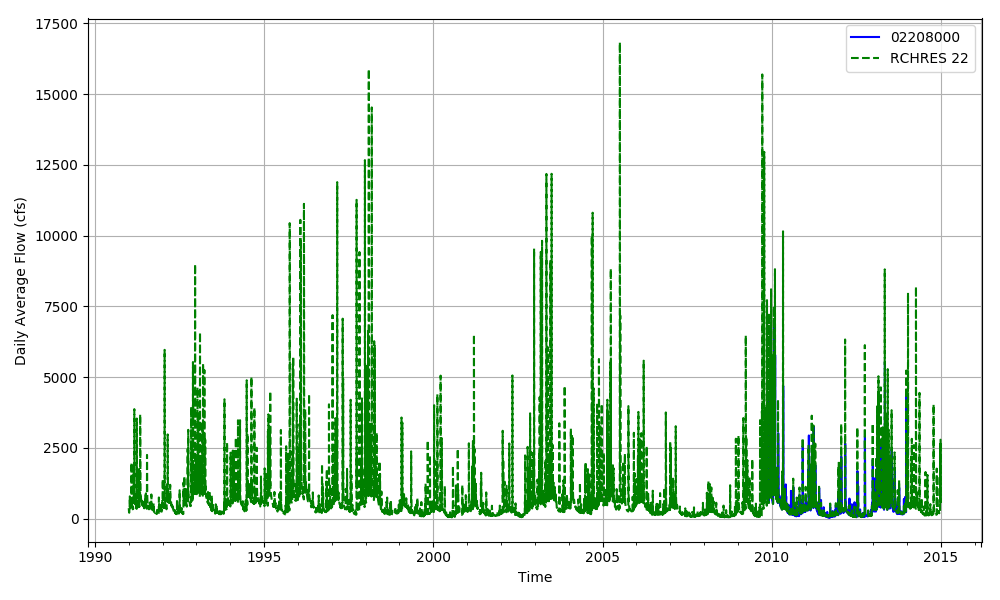


Figure 03070103-22: Daily flow for HSFP reach 22 and USGS station 02208000.

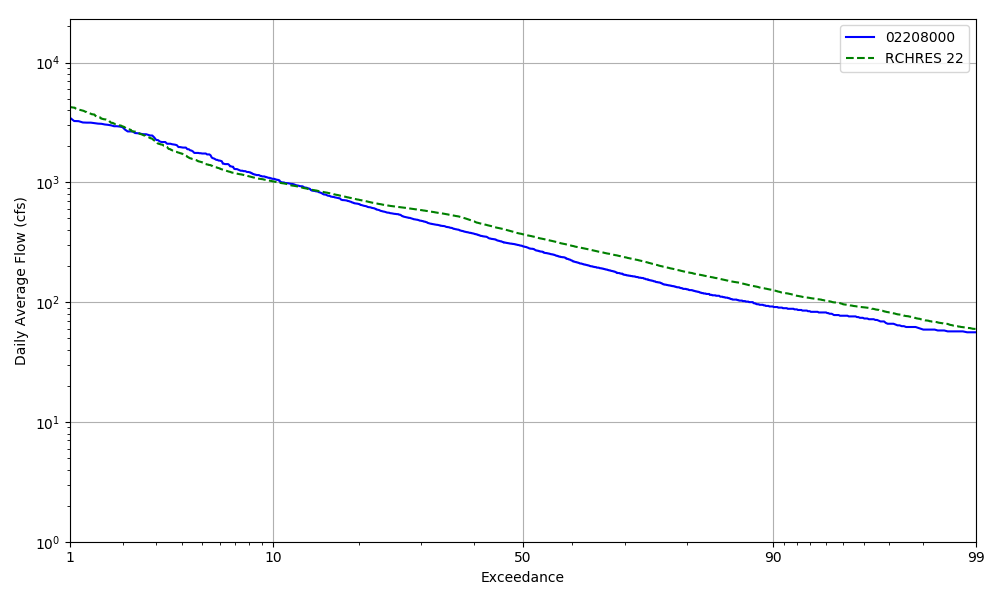


Figure 03070103-23: Daily exceedance for HSFP reach 22 and USGS station 02208000.

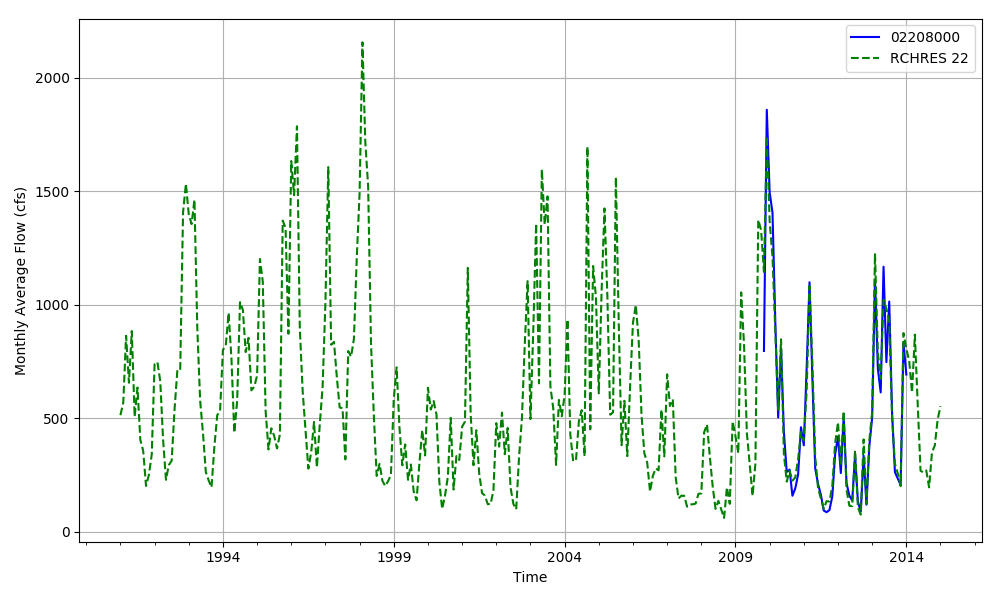


Figure 03070103-24: Monthly flow for HSFP reach 22 and USGS station 02208000.

## HSPF Reach 27, USGS Gauge 02210500

Table 03070103-15: Comparison Statistics Between HSPF Reach 27 and USGS Gauge 02210500.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -229.08 |
| Standard error | 474.44 |
| Relative bias | -0.12 |
| Relative standard error | 0.33 |
| Nash-Sutcliffe coefficient | 0.89 |
| Coefficient of efficiency | 0.72 |
| Index of agreement | 0.86 |

Table 03070103-16: Hydrologic Indices Between USGS Gauge 02210500 and HSPF Reach 27.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02210500 | Simulated Reach 27 | Percent Difference |
| MA1: Mean, all daily flows | 1875.83 | 1647.98 | -12.15 |
| MA2: Median, all daily flows | 1170.00 | 1037.96 | -11.29 |
| MA3: CV, all daily flows | 114.18 | 119.78 | 4.91 |
| MA4: CV, log of all daily flows | 79.60 | 82.61 | 3.78 |
| MA5: Mean daily flow / median daily flow | 1.60 | 1.59 | -0.97 |
| MA9: (Q10 - Q90) / median daily flow | 2.85 | 2.81 | -1.34 |
| MA10: (Q20 - Q80) / median daily flow | 1.85 | 1.62 | -12.30 |
| MA11: (Q25 - Q75) / median daily flow | 1.52 | 1.29 | -14.82 |
| MA12: Mean monthly flow, January | 2139.61 | 2107.71 | -1.49 |
| MA13: Mean monthly flow, February | 2849.28 | 2534.91 | -11.03 |
| MA14: Mean monthly flow, March | 3112.50 | 2769.48 | -11.02 |
| MA15: Mean monthly flow, April | 2051.93 | 1718.69 | -16.24 |
| MA16: Mean monthly flow, May | 1631.38 | 1406.47 | -13.79 |
| MA17: Mean monthly flow, June | 1316.07 | 1019.32 | -22.55 |
| MA18: Mean monthly flow, July | 1607.68 | 1236.08 | -23.11 |
| MA19: Mean monthly flow, August | 1065.21 | 870.62 | -18.27 |
| MA20: Mean monthly flow, September | 1243.04 | 1141.87 | -8.14 |
| MA21: Mean monthly flow, October | 1208.09 | 1110.80 | -8.05 |
| MA22: Mean monthly flow, November | 1583.90 | 1418.15 | -10.46 |
| MA23: Mean monthly flow, December | 1947.01 | 1777.63 | -8.70 |
| ML1: Mean minimum monthly flow, January | 970.71 | 1057.15 | 8.90 |
| ML2: Mean minimum monthly flow, February | 1175.39 | 1245.42 | 5.96 |
| ML3: Mean minimum monthly flow, March | 1074.57 | 1241.72 | 15.56 |
| ML4: Mean minimum monthly flow, April | 658.48 | 998.07 | 51.57 |
| ML5: Mean minimum monthly flow, May | 563.57 | 702.95 | 24.73 |
| ML6: Mean minimum monthly flow, June | 486.30 | 556.18 | 14.37 |
| ML7: Mean minimum monthly flow, July | 506.09 | 550.24 | 8.73 |
| ML8: Mean minimum monthly flow, August | 462.57 | 473.24 | 2.31 |
| ML9: Mean minimum monthly flow, September | 460.09 | 421.43 | -8.40 |
| ML10: Mean minimum monthly flow, October | 461.22 | 525.68 | 13.98 |
| ML11: Mean minimum monthly flow, November | 560.96 | 652.30 | 16.28 |
| ML12: Mean minimum monthly flow, December | 852.65 | 886.43 | 3.96 |
| ML13: CV of minimum monthly flows | 70.85 | 70.75 | -0.14 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.34 | 0.28 | -19.73 |
| ML15: Mean minimum annual flow / mean annual flow | 0.22 | 0.18 | -15.64 |
| ML16: Median minimum annual flow / median annual flow | 0.29 | 0.24 | -19.89 |
| ML20: Ratio of baseflow volume to total flow volume | 0.46 | 0.55 | 19.46 |
| ML22: Mean annual minimum flow divided by catchment area | 3.56 | 2.98 | -16.50 |
| RA1: Mean of positive changes from one day to next (rise rate) | 637.67 | 1007.15 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 285.92 | 292.44 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 513.23 | 376.45 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 231.31 | 351.67 |  |
| RA5: Ratio of days that are higher than previous day | 0.40 | 0.27 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.15 | 0.12 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.12 | 0.08 |  |
| RA8: Number of flow reversals from one day to the next | 126.12 | 85.33 |  |
| RA9: CV, number of flow reversals from one day to the next | 24.17 | 17.37 |  |

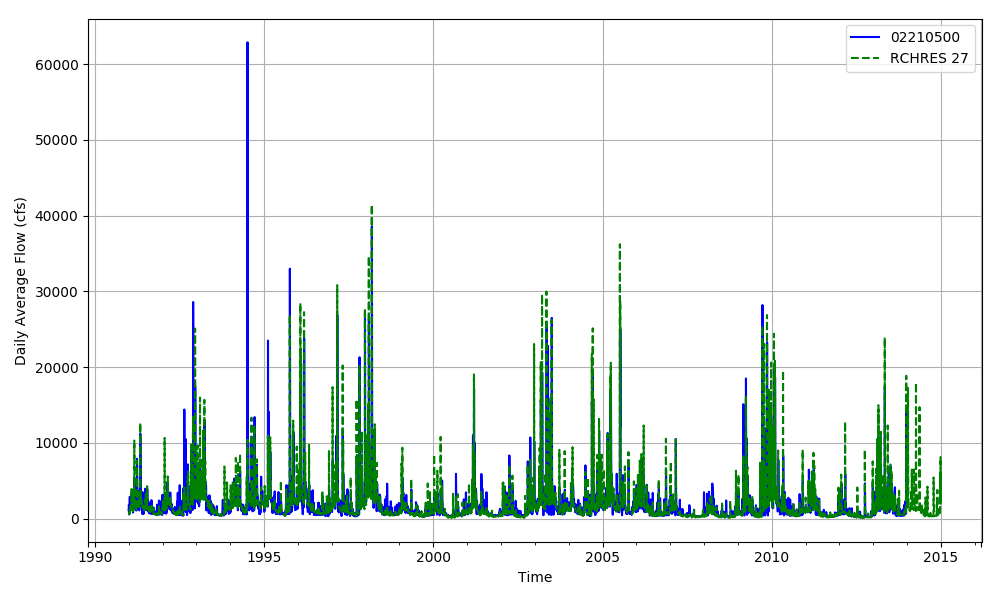


Figure 03070103-25: Daily flow for HSFP reach 27 and USGS station 02210500.

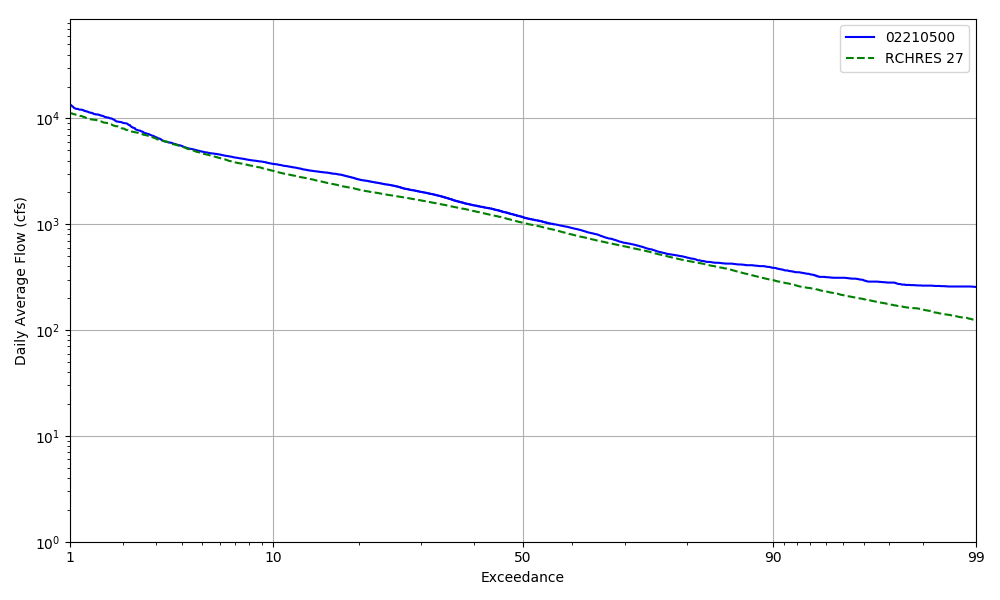


Figure 03070103-26: Daily exceedance for HSFP reach 27 and USGS station 02210500.

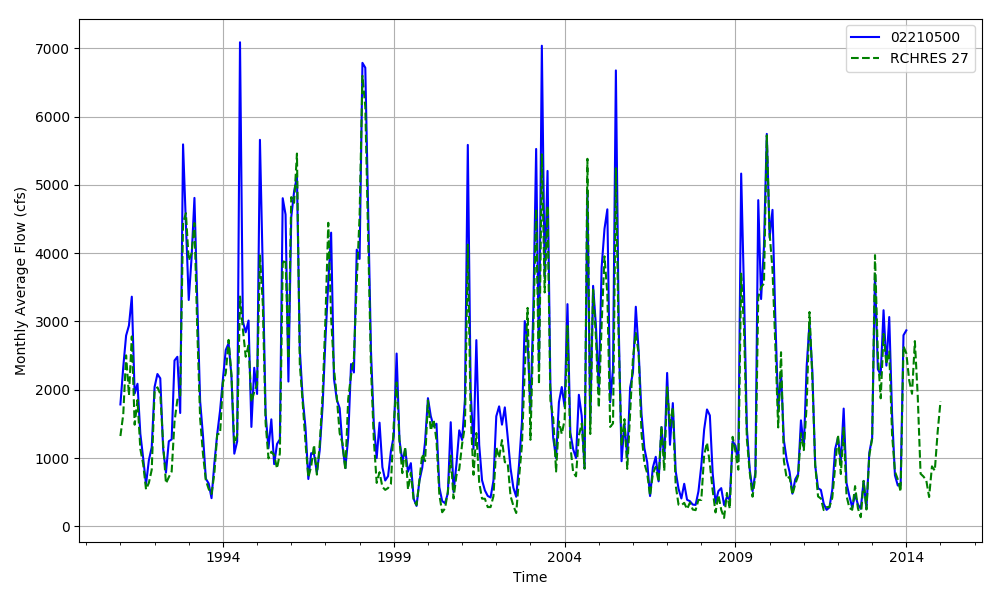


Figure 03070103-27: Monthly flow for HSFP reach 27 and USGS station 02210500.

## HSPF Reach 31, USGS Gauge 02212735

Table 03070103-17: Comparison Statistics Between HSPF Reach 31 and USGS Gauge 02212735.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -35.40 |
| Standard error | 372.74 |
| Relative bias | -0.02 |
| Relative standard error | 0.20 |
| Nash-Sutcliffe coefficient | 0.96 |
| Coefficient of efficiency | 0.83 |
| Index of agreement | 0.91 |

Table 03070103-18: Hydrologic Indices Between USGS Gauge 02212735 and HSPF Reach 31.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02212735 | Simulated Reach 31 | Percent Difference |
| MA1: Mean, all daily flows | 2015.29 | 1979.58 | -1.77 |
| MA2: Median, all daily flows | 887.00 | 1057.53 | 19.22 |
| MA3: CV, all daily flows | 134.80 | 141.83 | 5.21 |
| MA4: CV, log of all daily flows | 104.34 | 98.16 | -5.92 |
| MA5: Mean daily flow / median daily flow | 2.27 | 1.87 | -17.61 |
| MA9: (Q10 - Q90) / median daily flow | 5.10 | 3.70 | -27.51 |
| MA10: (Q20 - Q80) / median daily flow | 3.10 | 2.07 | -33.19 |
| MA11: (Q25 - Q75) / median daily flow | 2.27 | 1.68 | -26.29 |
| MA12: Mean monthly flow, January | 2337.26 | 2486.03 | 6.37 |
| MA13: Mean monthly flow, February | 2502.41 | 2416.45 | -3.43 |
| MA14: Mean monthly flow, March | 2282.45 | 2235.57 | -2.05 |
| MA15: Mean monthly flow, April | 1559.13 | 1338.94 | -14.12 |
| MA16: Mean monthly flow, May | 1482.75 | 1520.64 | 2.56 |
| MA17: Mean monthly flow, June | 951.99 | 917.34 | -3.64 |
| MA18: Mean monthly flow, July | 1063.90 | 980.66 | -7.82 |
| MA19: Mean monthly flow, August | 752.25 | 743.73 | -1.13 |
| MA20: Mean monthly flow, September | 1109.66 | 994.75 | -10.36 |
| MA21: Mean monthly flow, October | 1040.23 | 1182.27 | 13.65 |
| MA22: Mean monthly flow, November | 1352.41 | 1218.20 | -9.92 |
| MA23: Mean monthly flow, December | 2623.89 | 2693.39 | 2.65 |
| ML1: Mean minimum monthly flow, January | 1624.80 | 1750.83 | 7.76 |
| ML2: Mean minimum monthly flow, February | 1288.75 | 1535.60 | 19.15 |
| ML3: Mean minimum monthly flow, March | 1176.75 | 1540.36 | 30.90 |
| ML4: Mean minimum monthly flow, April | 895.25 | 1068.36 | 19.34 |
| ML5: Mean minimum monthly flow, May | 621.25 | 803.62 | 29.36 |
| ML6: Mean minimum monthly flow, June | 547.40 | 563.12 | 2.87 |
| ML7: Mean minimum monthly flow, July | 546.20 | 550.06 | 0.71 |
| ML8: Mean minimum monthly flow, August | 448.20 | 421.30 | -6.00 |
| ML9: Mean minimum monthly flow, September | 354.60 | 318.84 | -10.09 |
| ML10: Mean minimum monthly flow, October | 398.80 | 525.72 | 31.83 |
| ML11: Mean minimum monthly flow, November | 476.60 | 675.41 | 41.71 |
| ML12: Mean minimum monthly flow, December | 901.40 | 860.46 | -4.54 |
| ML13: CV of minimum monthly flows | 92.60 | 90.50 | -2.27 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.43 | 0.33 | -24.03 |
| ML15: Mean minimum annual flow / mean annual flow | 0.20 | 0.15 | -24.31 |
| ML16: Median minimum annual flow / median annual flow | 0.42 | 0.21 | -50.08 |
| ML20: Ratio of baseflow volume to total flow volume | 0.44 | 0.49 | 10.85 |
| ML22: Mean annual minimum flow divided by catchment area | 3.27 | 2.69 | -17.52 |
| RA1: Mean of positive changes from one day to next (rise rate) | 699.65 | 1218.95 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 242.60 | 307.02 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 482.88 | 465.89 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 228.41 | 345.45 |  |
| RA5: Ratio of days that are higher than previous day | 0.40 | 0.28 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.11 | 0.12 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.08 | 0.08 |  |
| RA8: Number of flow reversals from one day to the next | 99.00 | 61.83 |  |
| RA9: CV, number of flow reversals from one day to the next | 53.82 | 46.82 |  |

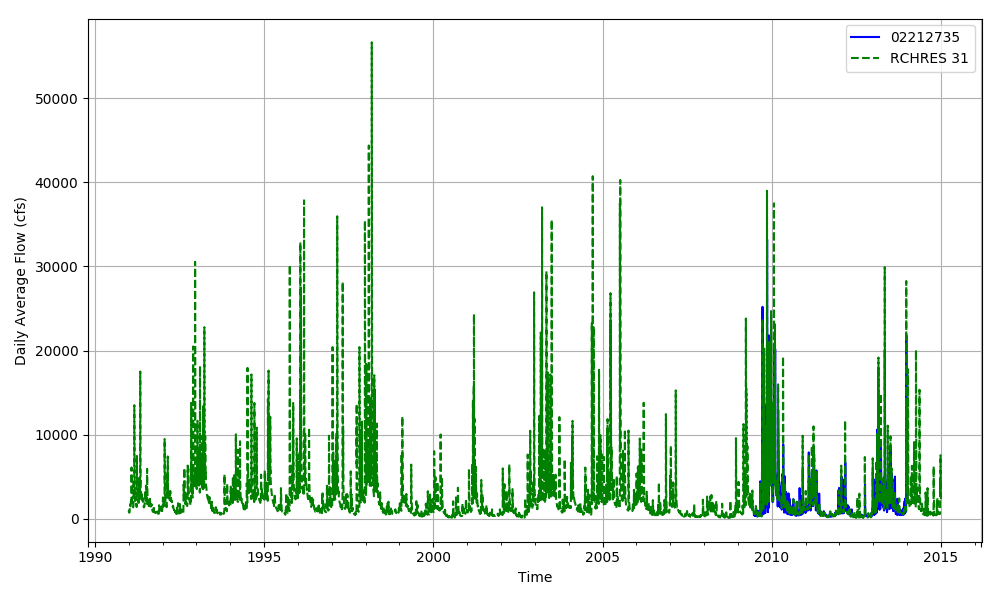


Figure 03070103-28: Daily flow for HSFP reach 31 and USGS station 02212735.

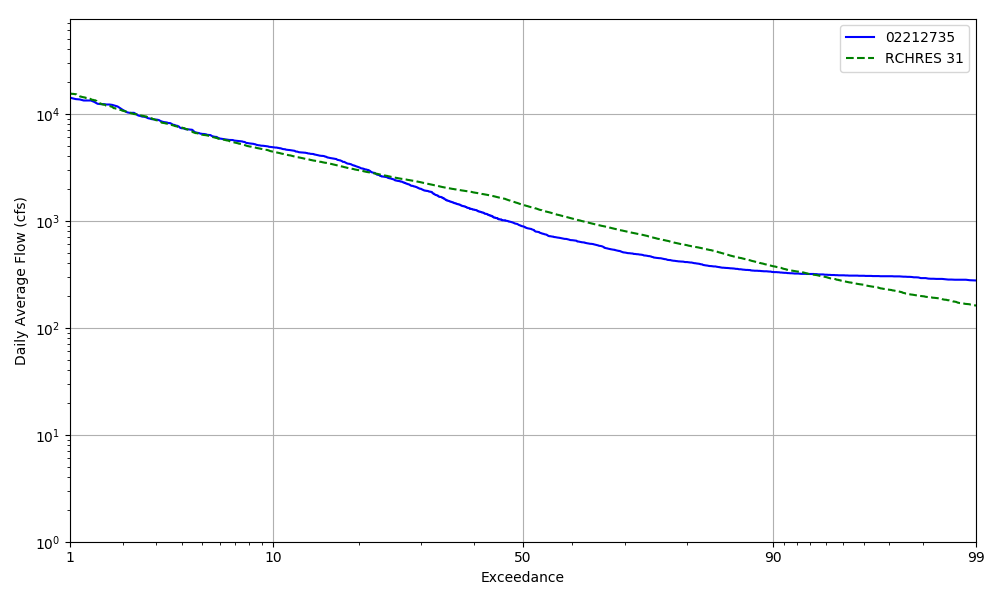


Figure 03070103-29: Daily exceedance for HSFP reach 31 and USGS station 02212735.

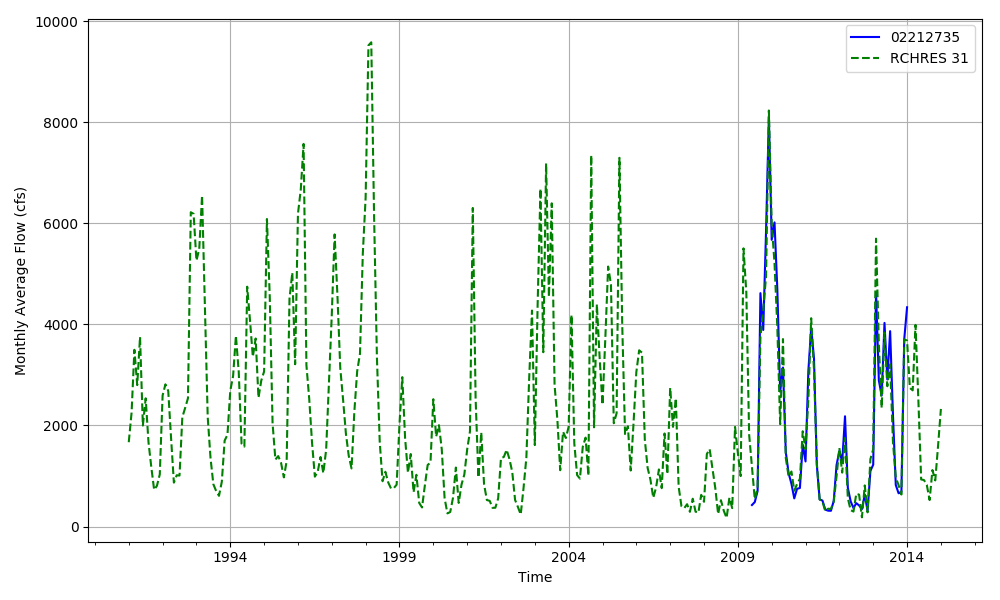


Figure 03070103-30: Monthly flow for HSFP reach 31 and USGS station 02212735.

## HSPF Reach 33, USGS Gauge 02213000

Table 03070103-19: Comparison Statistics Between HSPF Reach 33 and USGS Gauge 02213000.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -229.44 |
| Standard error | 733.94 |
| Relative bias | -0.09 |
| Relative standard error | 0.33 |
| Nash-Sutcliffe coefficient | 0.89 |
| Coefficient of efficiency | 0.77 |
| Index of agreement | 0.88 |

Table 03070103-20: Hydrologic Indices Between USGS Gauge 02213000 and HSPF Reach 33.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02213000 | Simulated Reach 33 | Percent Difference |
| MA1: Mean, all daily flows | 2582.90 | 2357.05 | -8.74 |
| MA2: Median, all daily flows | 1510.00 | 1565.60 | 3.68 |
| MA3: CV, all daily flows | 117.35 | 112.94 | -3.75 |
| MA4: CV, log of all daily flows | 90.49 | 83.76 | -7.43 |
| MA5: Mean daily flow / median daily flow | 1.71 | 1.51 | -11.98 |
| MA9: (Q10 - Q90) / median daily flow | 3.37 | 2.75 | -18.44 |
| MA10: (Q20 - Q80) / median daily flow | 1.93 | 1.64 | -15.28 |
| MA11: (Q25 - Q75) / median daily flow | 1.50 | 1.28 | -14.66 |
| MA12: Mean monthly flow, January | 3070.72 | 3002.94 | -2.21 |
| MA13: Mean monthly flow, February | 4153.41 | 3713.07 | -10.60 |
| MA14: Mean monthly flow, March | 4681.07 | 4194.52 | -10.39 |
| MA15: Mean monthly flow, April | 2964.55 | 2592.64 | -12.55 |
| MA16: Mean monthly flow, May | 2141.24 | 2005.62 | -6.33 |
| MA17: Mean monthly flow, June | 1614.55 | 1390.35 | -13.89 |
| MA18: Mean monthly flow, July | 2164.81 | 1708.22 | -21.09 |
| MA19: Mean monthly flow, August | 1444.15 | 1250.53 | -13.41 |
| MA20: Mean monthly flow, September | 1528.55 | 1543.68 | 0.99 |
| MA21: Mean monthly flow, October | 1493.70 | 1479.87 | -0.93 |
| MA22: Mean monthly flow, November | 2072.76 | 1940.99 | -6.36 |
| MA23: Mean monthly flow, December | 2706.32 | 2565.23 | -5.21 |
| ML1: Mean minimum monthly flow, January | 1514.54 | 1603.70 | 5.89 |
| ML2: Mean minimum monthly flow, February | 1764.48 | 1860.95 | 5.47 |
| ML3: Mean minimum monthly flow, March | 1786.00 | 1909.70 | 6.93 |
| ML4: Mean minimum monthly flow, April | 1163.87 | 1490.26 | 28.04 |
| ML5: Mean minimum monthly flow, May | 889.17 | 1042.93 | 17.29 |
| ML6: Mean minimum monthly flow, June | 686.74 | 815.57 | 18.76 |
| ML7: Mean minimum monthly flow, July | 726.83 | 814.64 | 12.08 |
| ML8: Mean minimum monthly flow, August | 624.61 | 695.15 | 11.29 |
| ML9: Mean minimum monthly flow, September | 583.91 | 605.44 | 3.69 |
| ML10: Mean minimum monthly flow, October | 630.35 | 750.26 | 19.02 |
| ML11: Mean minimum monthly flow, November | 792.00 | 935.44 | 18.11 |
| ML12: Mean minimum monthly flow, December | 1122.91 | 1302.75 | 16.02 |
| ML13: CV of minimum monthly flows | 77.90 | 74.75 | -4.05 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.28 | 0.27 | -1.42 |
| ML15: Mean minimum annual flow / mean annual flow | 0.17 | 0.18 | 5.32 |
| ML16: Median minimum annual flow / median annual flow | 0.23 | 0.24 | 7.38 |
| ML20: Ratio of baseflow volume to total flow volume | 0.48 | 0.57 | 17.76 |
| ML22: Mean annual minimum flow divided by catchment area | 3.95 | 4.17 | 5.62 |
| RA1: Mean of positive changes from one day to next (rise rate) | 811.70 | 1059.38 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 283.07 | 323.00 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 534.23 | 431.46 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 248.18 | 341.65 |  |
| RA5: Ratio of days that are higher than previous day | 0.39 | 0.29 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.14 | 0.08 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.10 | 0.07 |  |
| RA8: Number of flow reversals from one day to the next | 129.21 | 68.33 |  |
| RA9: CV, number of flow reversals from one day to the next | 19.56 | 17.61 |  |

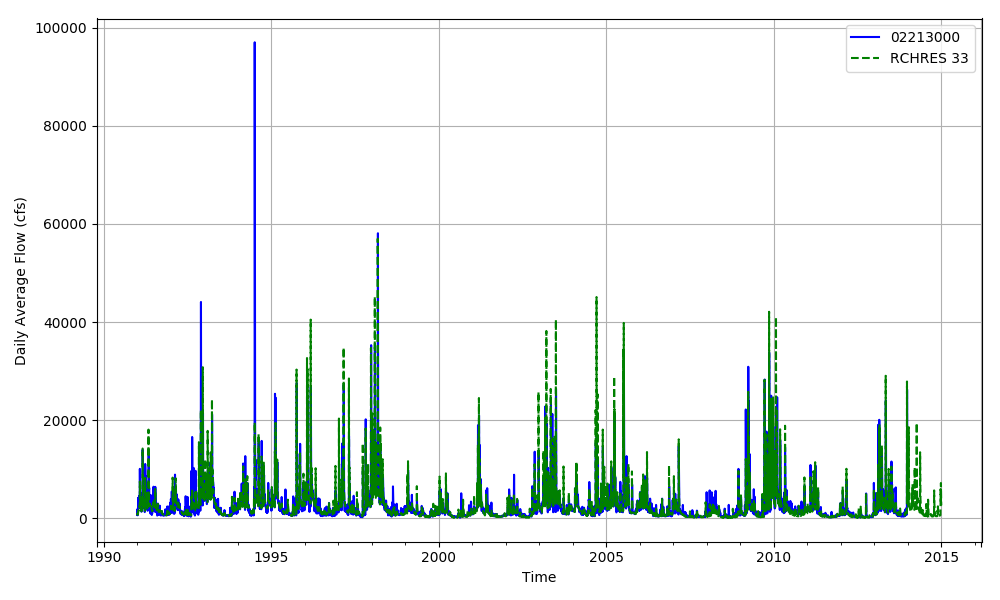


Figure 03070103-31: Daily flow for HSFP reach 33 and USGS station 02213000.

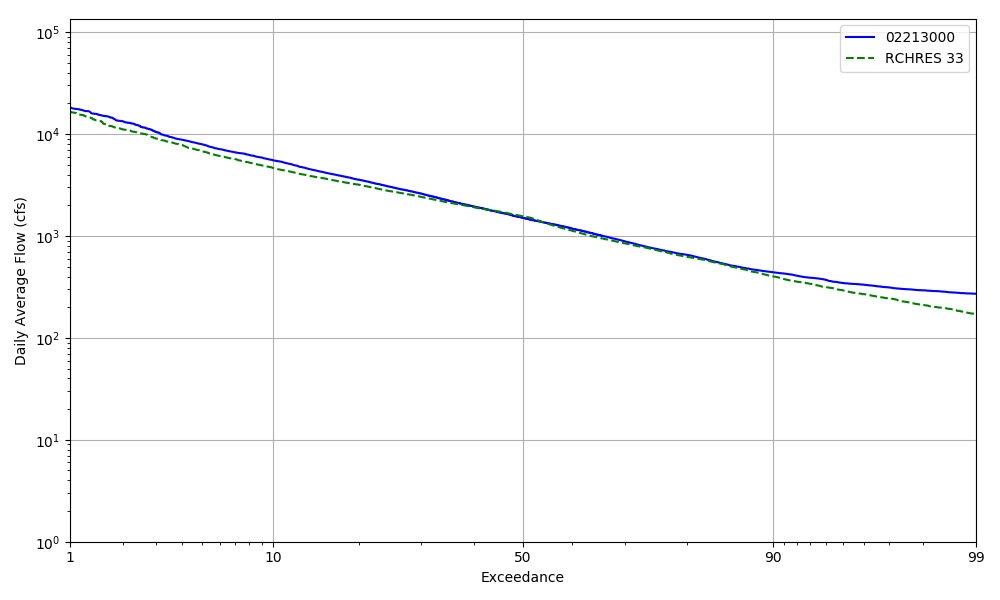


Figure 03070103-32: Daily exceedance for HSFP reach 33 and USGS station 02213000.

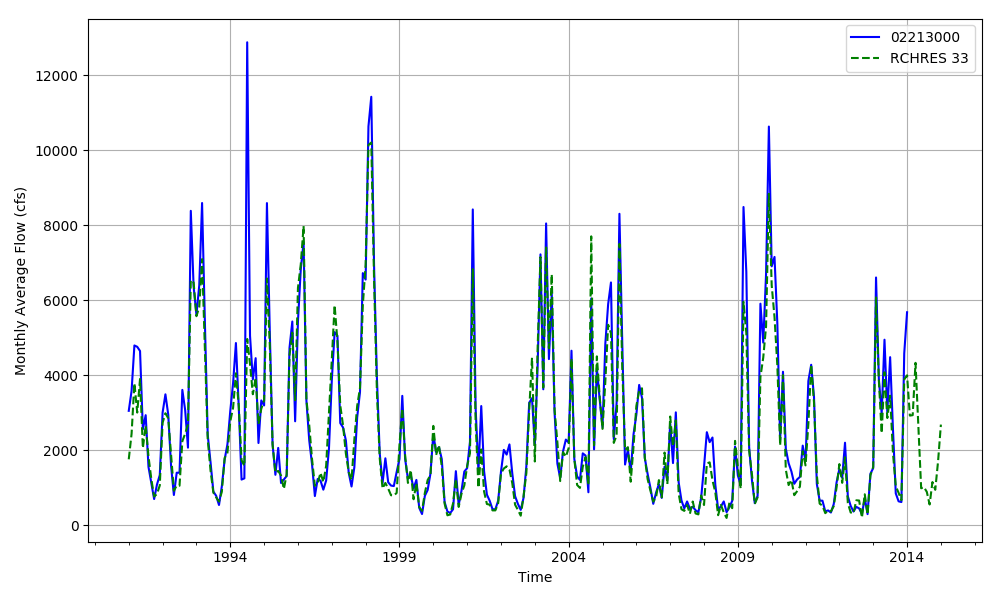


Figure 03070103-33: Monthly flow for HSFP reach 33 and USGS station 02213000.

## HSPF Reach 38, USGS Gauge 02204070

Table 03070103-21: Comparison Statistics Between HSPF Reach 38 and USGS Gauge 02204070.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -38.98 |
| Standard error | 72.15 |
| Relative bias | -0.12 |
| Relative standard error | 0.37 |
| Nash-Sutcliffe coefficient | 0.86 |
| Coefficient of efficiency | 0.63 |
| Index of agreement | 0.82 |

Table 03070103-22: Hydrologic Indices Between USGS Gauge 02204070 and HSPF Reach 38.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02204070 | Simulated Reach 38 | Percent Difference |
| MA1: Mean, all daily flows | 314.33 | 275.25 | -12.43 |
| MA2: Median, all daily flows | 183.00 | 168.64 | -7.85 |
| MA3: CV, all daily flows | 153.56 | 177.40 | 15.53 |
| MA4: CV, log of all daily flows | 82.82 | 85.81 | 3.61 |
| MA5: Mean daily flow / median daily flow | 1.72 | 1.63 | -4.98 |
| MA9: (Q10 - Q90) / median daily flow | 2.52 | 2.03 | -19.43 |
| MA10: (Q20 - Q80) / median daily flow | 1.19 | 1.19 | -0.41 |
| MA11: (Q25 - Q75) / median daily flow | 0.88 | 0.94 | 6.56 |
| MA12: Mean monthly flow, January | 356.06 | 336.42 | -5.52 |
| MA13: Mean monthly flow, February | 411.40 | 396.51 | -3.62 |
| MA14: Mean monthly flow, March | 457.04 | 425.23 | -6.96 |
| MA15: Mean monthly flow, April | 302.04 | 274.40 | -9.15 |
| MA16: Mean monthly flow, May | 281.83 | 234.01 | -16.97 |
| MA17: Mean monthly flow, June | 256.29 | 179.52 | -29.95 |
| MA18: Mean monthly flow, July | 289.06 | 228.00 | -21.12 |
| MA19: Mean monthly flow, August | 224.29 | 167.61 | -25.27 |
| MA20: Mean monthly flow, September | 263.31 | 214.66 | -18.47 |
| MA21: Mean monthly flow, October | 219.26 | 186.56 | -14.91 |
| MA22: Mean monthly flow, November | 272.69 | 250.34 | -8.19 |
| MA23: Mean monthly flow, December | 299.24 | 289.28 | -3.33 |
| ML1: Mean minimum monthly flow, January | 159.83 | 155.46 | -2.74 |
| ML2: Mean minimum monthly flow, February | 176.13 | 178.24 | 1.20 |
| ML3: Mean minimum monthly flow, March | 185.35 | 183.00 | -1.27 |
| ML4: Mean minimum monthly flow, April | 169.17 | 155.68 | -7.98 |
| ML5: Mean minimum monthly flow, May | 132.57 | 109.01 | -17.77 |
| ML6: Mean minimum monthly flow, June | 119.78 | 76.72 | -35.95 |
| ML7: Mean minimum monthly flow, July | 113.96 | 79.32 | -30.39 |
| ML8: Mean minimum monthly flow, August | 103.61 | 74.24 | -28.35 |
| ML9: Mean minimum monthly flow, September | 95.22 | 67.79 | -28.81 |
| ML10: Mean minimum monthly flow, October | 100.74 | 83.08 | -17.53 |
| ML11: Mean minimum monthly flow, November | 119.83 | 101.96 | -14.91 |
| ML12: Mean minimum monthly flow, December | 141.48 | 134.46 | -4.96 |
| ML13: CV of minimum monthly flows | 37.98 | 61.28 | 61.36 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.46 | 0.26 | -42.57 |
| ML15: Mean minimum annual flow / mean annual flow | 0.27 | 0.16 | -41.17 |
| ML16: Median minimum annual flow / median annual flow | 0.44 | 0.25 | -42.31 |
| ML20: Ratio of baseflow volume to total flow volume | 0.47 | 0.49 | 2.87 |
| ML22: Mean annual minimum flow divided by catchment area | 0.82 | 0.45 | -44.41 |
| RA1: Mean of positive changes from one day to next (rise rate) | 310.29 | 350.43 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 227.58 | 242.23 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 139.90 | 121.64 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 322.69 | 409.99 |  |
| RA5: Ratio of days that are higher than previous day | 0.30 | 0.26 |  |
| RA6: Median of difference in log of flows over two consecutive days of rising | 0.27 | 0.24 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.10 | 0.07 |  |
| RA8: Number of flow reversals from one day to the next | 124.25 | 104.17 |  |
| RA9: CV, number of flow reversals from one day to the next | 17.71 | 18.13 |  |

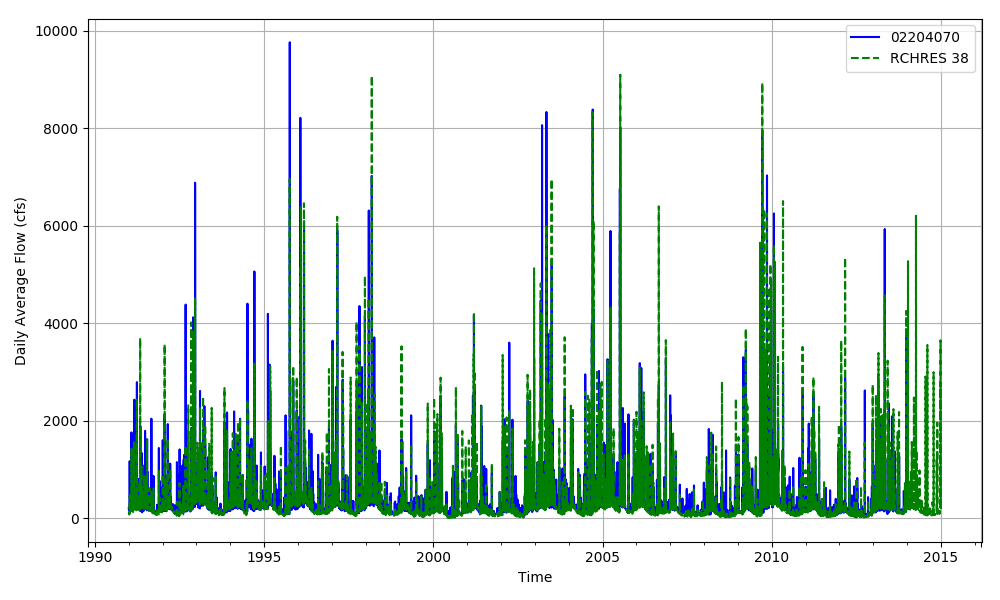


Figure 03070103-34: Daily flow for HSFP reach 38 and USGS station 02204070.

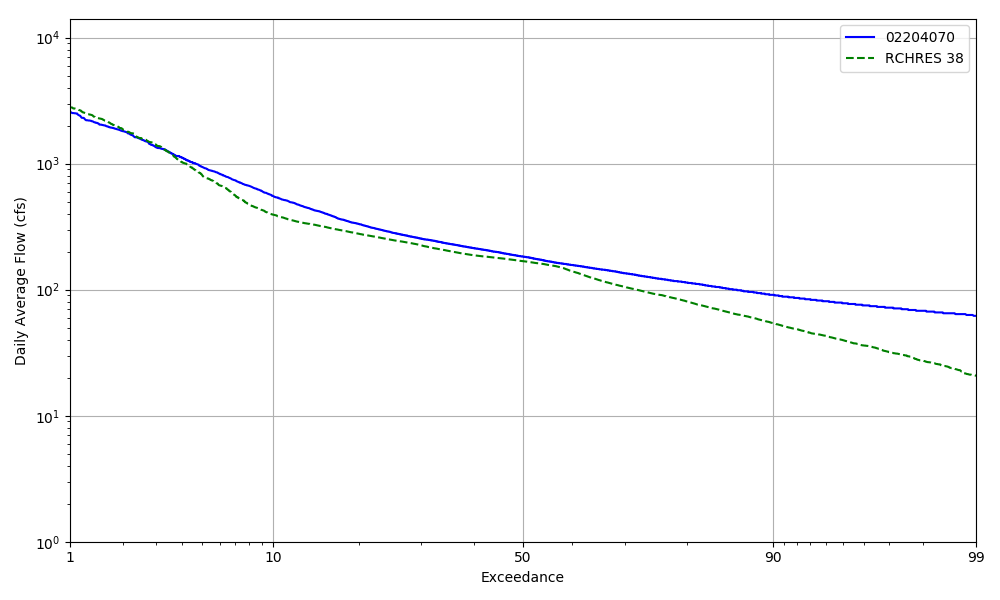


Figure 03070103-35: Daily exceedance for HSFP reach 38 and USGS station 02204070.

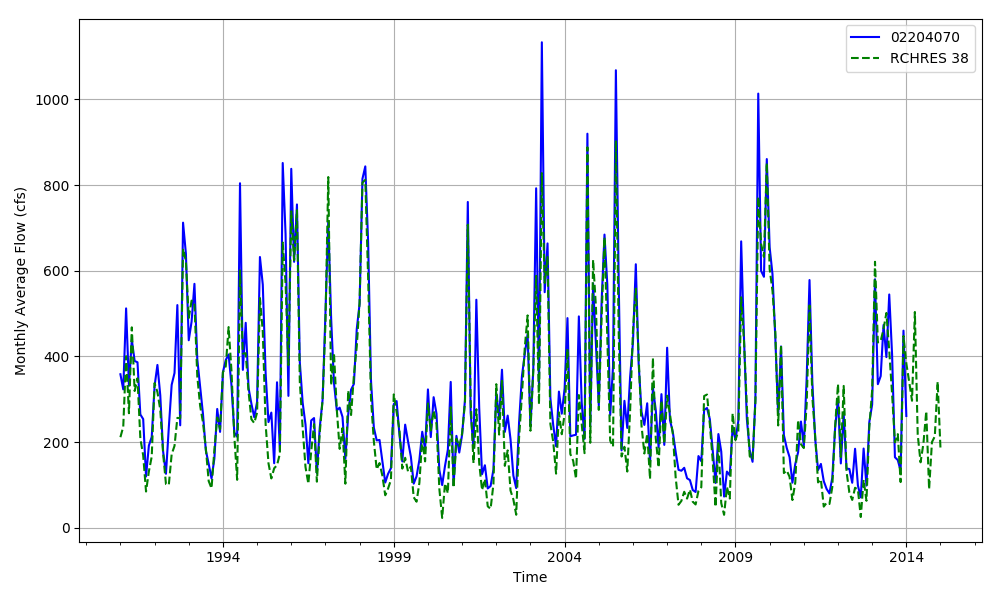


Figure 03070103-36: Monthly flow for HSFP reach 38 and USGS station 02204070.

## HSPF Reach 39, USGS Gauge 02208450

Table 03070103-23: Comparison Statistics Between HSPF Reach 39 and USGS Gauge 02208450.

|  |  |
| --- | --- |
| Statistic | Value |
| Bias | -31.22 |
| Standard error | 63.16 |
| Relative bias | -0.13 |
| Relative standard error | 0.33 |
| Nash-Sutcliffe coefficient | 0.89 |
| Coefficient of efficiency | 0.68 |
| Index of agreement | 0.84 |

Table 03070103-24: Hydrologic Indices Between USGS Gauge 02208450 and HSPF Reach 39.

|  |  |  |  |
| --- | --- | --- | --- |
| Hydrologic Index and description (Olden and Poff, 2003) | Observed 02208450 | Simulated Reach 39 | Percent Difference |
| MA1: Mean, all daily flows | 230.18 | 199.54 | -13.31 |
| MA2: Median, all daily flows | 145.00 | 110.54 | -23.77 |
| MA3: CV, all daily flows | 113.60 | 123.62 | 8.82 |
| MA4: CV, log of all daily flows | 88.39 | 101.36 | 14.68 |
| MA5: Mean daily flow / median daily flow | 1.59 | 1.81 | 13.72 |
| MA9: (Q10 - Q90) / median daily flow | 3.12 | 3.66 | 17.26 |
| MA10: (Q20 - Q80) / median daily flow | 1.88 | 2.00 | 6.72 |
| MA11: (Q25 - Q75) / median daily flow | 1.48 | 1.56 | 5.70 |
| MA12: Mean monthly flow, January | 282.12 | 257.61 | -8.69 |
| MA13: Mean monthly flow, February | 353.93 | 314.42 | -11.16 |
| MA14: Mean monthly flow, March | 390.50 | 332.08 | -14.96 |
| MA15: Mean monthly flow, April | 257.75 | 200.39 | -22.25 |
| MA16: Mean monthly flow, May | 205.27 | 168.72 | -17.80 |
| MA17: Mean monthly flow, June | 160.62 | 122.34 | -23.83 |
| MA18: Mean monthly flow, July | 168.85 | 151.01 | -10.56 |
| MA19: Mean monthly flow, August | 114.67 | 85.71 | -25.26 |
| MA20: Mean monthly flow, September | 149.25 | 141.72 | -5.04 |
| MA21: Mean monthly flow, October | 149.06 | 141.49 | -5.07 |
| MA22: Mean monthly flow, November | 205.91 | 181.19 | -12.00 |
| MA23: Mean monthly flow, December | 236.15 | 217.04 | -8.09 |
| ML1: Mean minimum monthly flow, January | 151.79 | 120.05 | -20.91 |
| ML2: Mean minimum monthly flow, February | 177.26 | 143.07 | -19.29 |
| ML3: Mean minimum monthly flow, March | 188.57 | 135.97 | -27.89 |
| ML4: Mean minimum monthly flow, April | 151.74 | 101.38 | -33.19 |
| ML5: Mean minimum monthly flow, May | 96.61 | 72.62 | -24.83 |
| ML6: Mean minimum monthly flow, June | 72.30 | 57.96 | -19.83 |
| ML7: Mean minimum monthly flow, July | 65.02 | 60.12 | -7.52 |
| ML8: Mean minimum monthly flow, August | 48.49 | 45.79 | -5.57 |
| ML9: Mean minimum monthly flow, September | 48.93 | 43.76 | -10.58 |
| ML10: Mean minimum monthly flow, October | 63.93 | 55.92 | -12.53 |
| ML11: Mean minimum monthly flow, November | 90.30 | 72.05 | -20.22 |
| ML12: Mean minimum monthly flow, December | 120.91 | 98.31 | -18.69 |
| ML13: CV of minimum monthly flows | 79.72 | 83.03 | 4.15 |
| ML14: Mean minimum daily flow / mean median annual flow | 0.16 | 0.24 | 50.82 |
| ML15: Mean minimum annual flow / mean annual flow | 0.10 | 0.14 | 38.12 |
| ML16: Median minimum annual flow / median annual flow | 0.14 | 0.20 | 44.87 |
| ML20: Ratio of baseflow volume to total flow volume | 0.54 | 0.50 | -7.15 |
| ML22: Mean annual minimum flow divided by catchment area | 0.28 | 0.28 | -0.51 |
| RA1: Mean of positive changes from one day to next (rise rate) | 88.18 | 108.44 |  |
| RA2: CV, mean of positive changes from one day to next (rise rate) | 278.79 | 290.77 |  |
| RA3: Mean of negative changes from one day to next (fall rate) | 48.42 | 38.35 |  |
| RA4: CV, mean of negative changes from one day to next (fall rate) | 300.72 | 281.68 |  |
| 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 | 0.16 | 0.14 |  |
| RA7: Median of difference in log of flows over two consecutive days of falling | 0.10 | 0.08 |  |
| RA8: Number of flow reversals from one day to the next | 95.00 | 92.21 |  |
| RA9: CV, number of flow reversals from one day to the next | 19.78 | 20.83 |  |

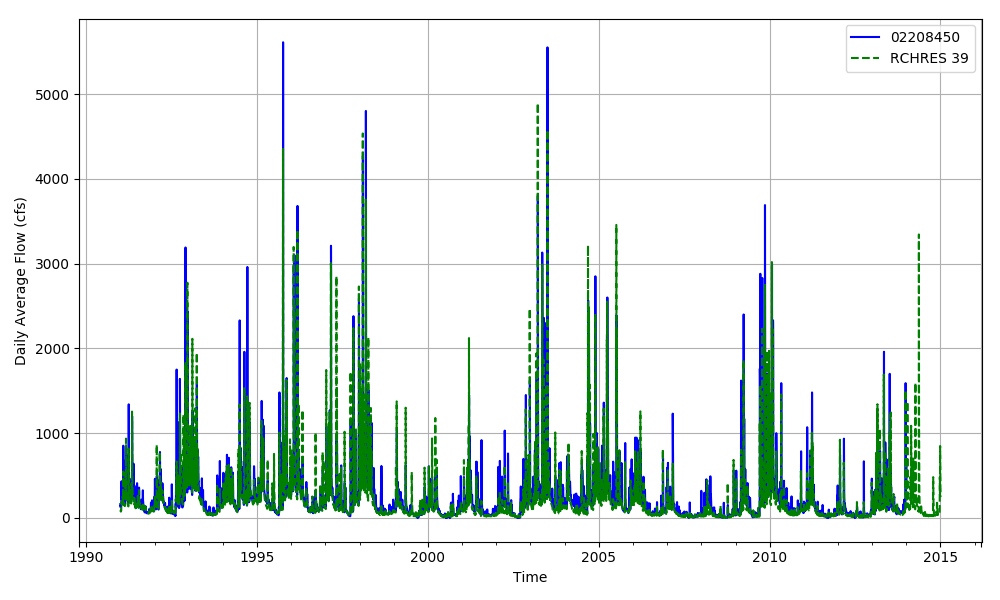


Figure 03070103-37: Daily flow for HSFP reach 39 and USGS station 02208450.

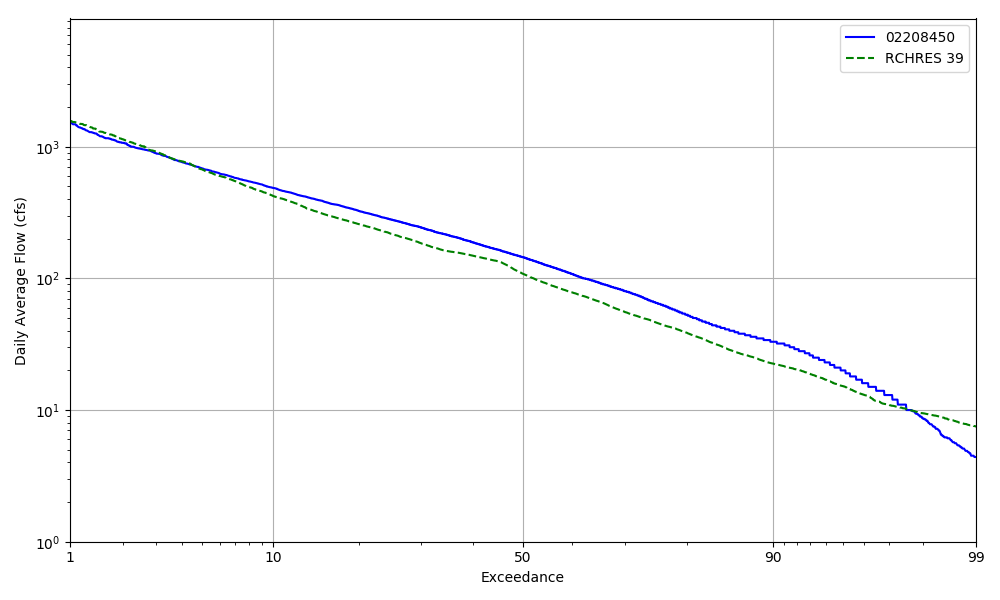


Figure 03070103-38: Daily exceedance for HSFP reach 39 and USGS station 02208450.

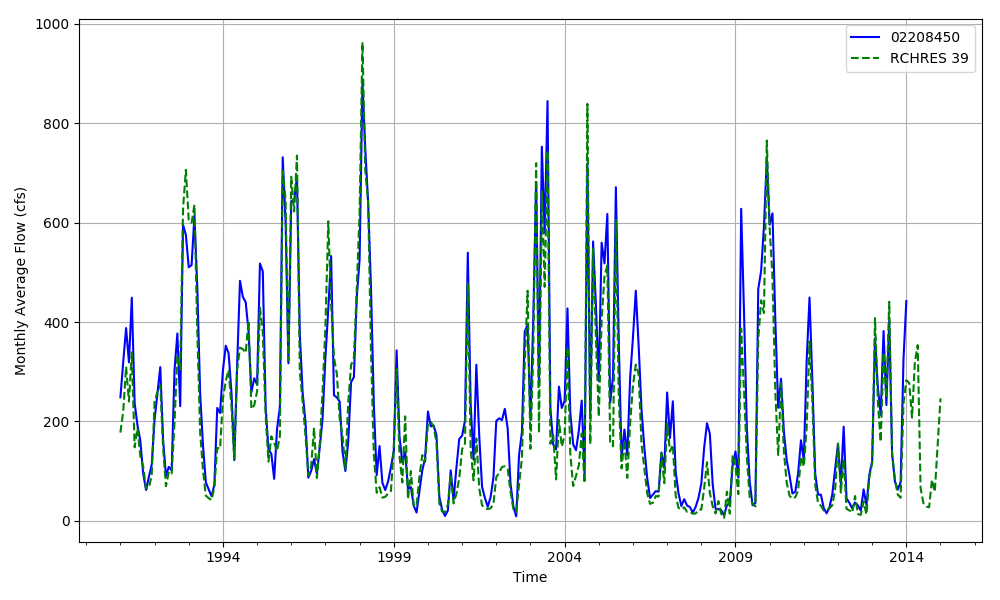


Figure 03070103-39: Monthly flow for HSFP reach 39 and USGS station 02208450.