Supplementary Materials

|  |  |  |
| --- | --- | --- |
| USGS Station ID Dataset 1 | Latitude | Longitude |
| 02296750 Peace River at sr 70 at Arcadia, FL | 27.22056 | 81.87639 |
| 02293987 Peace Creek drainage canal near Wahneta, FL | 27.92444 | 81.72694 |
| 02294650 Peace River at sr 60 at Bartow, FL | 27.90194 | 81.8175 |
| 02294781 Peace River near Homeland, FL | 27.82417 | 81.80222 |
| 02294898 Peace River at fort Meade, FL | 27.75111 | 81.78222 |
| 02295013 Bowlegs Creek near fort Meade, FL | 27.69972 | 81.69556 |
| 02295420 Payne Creek near Bowling Green, FL | 27.62028 | 81.82583 |
| 02295637 Peace River at us 17 at Zolfo Springs, FL | 27.50417 | 81.80111 |
| 02297100 Joshua Creek at Nocatee, FL | 27.16639 | 81.87972 |
| 02296500 Charlie Creek near Gardner, FL | 27.37472 | 81.79667 |
| 02298123 Prairie Creek near fort Ogden, FL | 27.05167 | 81.78472 |
| 02297310 Horse Creek at sr 72 near Arcadia, FL | 27.19917 | 81.98861 |
| 02298202 Shell Creek near Punta Gorda, FL | 26.98444 | 81.93583 |
| 02297460 Peace River at Harbour Heights, FL | 26.98722 | 81.99444 |
| USGS Station ID Dataset 1 | Latitude | Longitude |
| 301001089442600 Rigolets at hwy 90 near Slidell, la | 30.16694 | 89.74056 |
| 02481270 Back Bay of Biloxi near Biloxi, MS | 30.41556 | 89.30100 |
| 301849088350000 Mississippi Sound at USGS Round Island Light, MS | 30.30806 | 88.58389 |
| 301104089253400 Mississippi Sound at USGS st Joseph Island Light | 30.19083 | 89.42222 |
| 300722089150100 Mississippi Sound near Grand Pass | 30.12278 | 89.25028 |
| 302318088512600 Biloxi Bay at Point Cadet Harbor at Biloxi, MS | 30.38833 | 88.85722 |
| 07374527 Northeast Bay Gardene near Point-a-la-Hache, LA | 29.58575 | 89.60597 |
| 02480212 Pascagoula River at mi 1 at Pascagoula, MS | 30.36778 | 88.56306 |
| 02480285 West Pascagoula River at hwy 90 at Gautier, MS | 30.38269 | 88.60844 |
| 02492600 Pearl River at Pearl River, LA | 30.38500 | 89.73667 |
| 073745257 Crooked B. NW of L. Cuatro Caballo near Delacroix | 29.70806 | 89.71944 |
| 02481510 Wolf River near Landon, MS | 30.48361 | 89.27444 |
| 07375500 Tangipahoa River at Robert, LA | 30.50639 | 90.36167 |
| 07374525 Mississippi River at Belle Chasse, LA | 29.85694 | 89.97778 |
| 02492110 East Pearl River at Wilson, MS | 30.57167 | 89.80611 |
| 07374000 Mississippi River at Baton Rouge, LA | 30.44567 | 91.19156 |
| 07375175 Bogue Falaya River at Boston St. at Covington, LA | 30.47639 | 90.08944 |
| 07374581 Bayou Liberty near Slidell, LA | 30.30111 | 89.83056 |
| 07289000 USACE Mississippi River at Vicksburg, MS | 32.31464 | 90.90584 |
| 02378300 Magnolia River at us 98 near Foley, AL | 30.40639 | 87.73694 |
| 07374370 USACE Bonnet Carre Spillway | 29.99861 | 90.44306 |

**Table 5.** United States Geological Survey (USGS) stations identification number (ID) and name. USACE: United States Corps of Engineers operated station. NAD27 coordinate reference system.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Target (unit) | Lead time | | Input | 100% | 50% | 20 | 10 | -10% | -20% | -50% | -100% |
| Q(m3s-1) | t+1 | | Q+GH | 7.829 | 4.374 | 1.884 | 0.966 | -1.011 | -2.077 | -5.672 | -1.011 |
|  |  | | SM | 1.056 | 0.575 | 0.242 | 0.123 | -0.127 | -0.258 | -0.677 | -0.127 |
|  |  | | r | 0.793 | 0.425 | 0.178 | 0.091 | -0.093 | -0.190 | -0.476 | -0.093 |
|  |  | | rh | -0.076 | -0.040 | -0.015 | -0.007 | 0.007 | -0.015 | 0.040 | 0.007 |
|  |  | | P | 0.135 | 0.059 | 0.023 | 0.011 | -0.011 | -0.024 | -0.066 | -0.011 |
|  |  | | Sr | -0.519 | -0.258 | -0.100 | -0.049 | 0.048 | 0.094 | 0.219 | 0.048 |
|  |  | | T | -0.649 | -0.333 | -0.134 | -0.067 | 0.067 | 0.134 | 0.339 | 0.067 |
|  |  | | u | -0.635 | -0.317 | -0.126 | -0.063 | 0.061 | 0.120 | 0.286 | 0.061 |
|  |  | | v | -0.394 | -0.192 | -0.071 | -0.036 | 0.036 | 0.072 | 0.183 | 0.036 |
|  | t+3 | | Q+GH | 8.904 | 4.733 | 1.933 | 0.954 | -1.082 | -2.138 | -5.417 | -10.664 |
|  |  | | SM | 4.513 | 1.189 | 0.870 | 0.409 | -0.504 | -0.951 | -1.367 | -4.125 |
|  |  | | r | -1.071 | 1.883 | -0.276 | -0.162 | 0.065 | 0.182 | -1.683 | 1.090 |
|  |  | | rh | -0.339 | -0.541 | -0.112 | -0.081 | -0.020 | 0.007 | 0.509 | 0.196 |
|  |  | | P | -0.534 | -0.047 | -0.156 | -0.102 | 0.001 | 0.052 | -0.104 | 0.495 |
|  |  | | Sr | -1.950 | -0.578 | -0.490 | -0.273 | 0.180 | 0.420 | 0.424 | 2.700 |
|  |  | | T | -1.728 | -1.560 | -0.399 | -0.226 | 0.127 | 0.311 | 1.680 | 1.844 |
|  |  | | u | -1.040 | -0.501 | -0.259 | -0.155 | 0.055 | 0.159 | 0.305 | 0.948 |
|  |  | | v | 2.379 | -0.503 | 0.402 | 0.173 | -0.262 | -0.465 | 0.294 | -1.578 |
|  | t+7 | | Q+GH | 5.161 | 2.733 | 1.061 | 0.465 | -0.793 | -1.450 | -3.502 | -6.841 |
|  |  | | SM | 2.785 | 1.353 | 0.458 | 0.153 | -0.463 | -0.775 | -1.720 | -3.321 |
|  |  | | r | 8.526 | 4.110 | 1.504 | 0.660 | -0.929 | -1.660 | -3.471 | -4.892 |
|  |  | | rh | -0.897 | -0.532 | -0.307 | -0.230 | -0.074 | 0.006 | 0.241 | 0.640 |
|  |  | | P | -0.290 | -0.203 | -0.171 | -0.162 | -0.148 | -0.146 | -0.194 | -0.359 |
|  |  | | Sr | -1.198 | -0.671 | -0.356 | -0.257 | -0.049 | 0.057 | 0.374 | 0.881 |
|  |  | | T | -4.324 | -2.444 | -1.112 | -0.638 | 0.342 | 0.849 | 2.407 | 5.103 |
|  |  | | u | -2.626 | -1.473 | -0.684 | -0.418 | 0.111 | 0.376 | 1.128 | 2.070 |
|  |  | | v | -1.145 | -0.643 | -0.343 | -0.244 | -0.065 | 0.021 | 0.267 | 0.537 |
|  | t+14 | | Q+GH | 4.050 | 1.981 | 0.624 | 0.155 | -0.805 | -1.290 | -2.755 | -5.105 |
|  |  | | SM | 1.828 | 0.770 | 0.118 | -0.101 | -0.543 | -0.765 | -1.432 | -2.547 |
|  |  | | r | 12.336 | 5.981 | 2.116 | 0.875 | -1.433 | -2.477 | -5.120 | -7.230 |
|  |  | | rh | -0.512 | -0.419 | -0.358 | -0.339 | -0.303 | -0.283 | -0.226 | -0.021 |
|  |  | | P | -0.251 | -0.247 | -0.281 | -0.300 | -0.346 | -0.370 | -0.456 | -0.746 |
|  |  | | Sr | -1.968 | -1.183 | -0.672 | -0.496 | -0.142 | 0.034 | 0.580 | 1.284 |
|  |  | | T | -6.789 | -4.246 | -2.027 | -1.193 | 0.569 | 1.487 | 4.296 | 8.470 |
|  |  | | u | -4.047 | -2.407 | -1.218 | -0.790 | 0.175 | 0.688 | 2.228 | 4.453 |
|  |  | | v | -0.639 | -0.449 | -0.367 | -0.349 | -0.303 | -0.300 | -0.283 | -0.344 |
| GH(m) | t+1 | | Q+GH | 0.087 | 0.050 | 0.022 | 0.011 | -0.014 | -0.028 | -0.083 | -0.241 |
|  |  | | SM | 0.021 | 0.010 | 0.004 | 0.002 | -0.003 | -0.005 | -0.013 | -0.026 |
|  |  | | r | 0.007 | 0.004 | 0.001 | 0.000 | -0.002 | -0.003 | -0.007 | -0.013 |
|  |  | | rh | 0.006 | 0.002 | 0.000 | 0.000 | -0.001 | -0.002 | -0.003 | -0.005 |
|  |  | | P | -0.003 | -0.002 | -0.001 | -0.001 | 0.000 | 0.000 | 0.001 | 0.001 |
|  |  | | Sr | -0.011 | -0.006 | -0.003 | -0.002 | 0.000 | 0.001 | 0.003 | 0.006 |
|  |  | | T | -0.006 | -0.004 | -0.002 | -0.001 | 0.000 | 0.001 | 0.003 | 0.007 |
|  |  | | u | -0.014 | -0.008 | -0.003 | -0.002 | 0.001 | 0.002 | 0.005 | 0.007 |
|  |  | | v | -0.002 | -0.002 | -0.001 | -0.001 | 0.000 | 0.000 | 0.001 | 0.003 |
|  | t+3 | | Q+GH | 0.157 | 0.083 | 0.034 | 0.016 | -0.023 | -0.045 | -0.120 | -0.276 |
|  |  | | SM | 0.050 | 0.023 | 0.008 | 0.003 | -0.008 | -0.014 | -0.032 | -0.062 |
|  |  | | r | 0.047 | 0.024 | 0.008 | 0.003 | -0.008 | -0.014 | -0.028 | -0.037 |
|  |  | | rh | 0.002 | -0.002 | -0.003 | -0.003 | -0.003 | -0.003 | -0.003 | 0.000 |
|  |  | | P | -0.006 | -0.007 | -0.004 | -0.003 | -0.002 | -0.002 | -0.001 | 0.001 |
|  |  | | Sr | -0.017 | -0.011 | -0.006 | -0.004 | -0.001 | 0.000 | 0.003 | 0.011 |
|  |  | | T | -0.035 | -0.022 | -0.010 | -0.007 | 0.001 | 0.005 | 0.016 | 0.037 |
|  |  | | u | -0.024 | -0.015 | -0.007 | -0.005 | -0.001 | 0.001 | 0.005 | 0.012 |
|  |  | | v | -0.026 | -0.015 | -0.008 | -0.005 | -0.001 | 0.001 | 0.007 | 0.014 |
|  | t+7 | | Q+GH | 0.079 | 0.043 | 0.017 | 0.008 | -0.013 | -0.024 | -0.064 | -0.151 |
|  |  | | SM | 0.060 | 0.031 | 0.012 | 0.005 | -0.009 | -0.016 | -0.040 | -0.081 |
|  |  | | r | 0.132 | 0.068 | 0.026 | 0.012 | -0.016 | -0.030 | -0.069 | -0.106 |
|  |  | | rh | -0.001 | -0.001 | -0.002 | -0.002 | -0.002 | -0.002 | -0.003 | -0.004 |
|  |  | | P | -0.022 | -0.012 | -0.006 | -0.004 | 0.000 | 0.002 | 0.008 | 0.015 |
|  |  | | Sr | -0.014 | -0.008 | -0.005 | -0.003 | -0.001 | 0.001 | 0.006 | 0.016 |
|  |  | | T | -0.079 | -0.042 | -0.018 | -0.010 | 0.006 | 0.014 | 0.039 | 0.079 |
|  |  | | u | -0.040 | -0.022 | -0.010 | -0.006 | 0.002 | 0.005 | 0.016 | 0.029 |
|  |  | | v | -0.020 | -0.010 | -0.005 | -0.004 | -0.001 | 0.000 | 0.004 | 0.007 |
|  | t+14 | | Q+GH | 0.039 | 0.025 | 0.014 | 0.009 | -0.001 | -0.007 | -0.028 | -0.070 |
|  |  | | SM | 0.041 | 0.024 | 0.012 | 0.008 | 0.000 | -0.004 | -0.018 | -0.041 |
|  |  | | r | 0.189 | 0.106 | 0.047 | 0.025 | -0.018 | -0.039 | -0.102 | -0.170 |
|  |  | | rh | 0.003 | 0.005 | 0.005 | 0.004 | 0.003 | 0.003 | 0.001 | -0.005 |
|  |  | | P | -0.028 | -0.014 | -0.003 | 0.000 | 0.008 | 0.012 | 0.023 | 0.039 |
|  |  | | Sr | -0.025 | -0.009 | -0.001 | 0.002 | 0.006 | 0.008 | 0.013 | 0.022 |
|  |  | | T | -0.098 | -0.051 | -0.019 | -0.007 | 0.016 | 0.027 | 0.059 | 0.105 |
|  |  | | u | -0.056 | -0.029 | -0.010 | -0.003 | 0.011 | 0.018 | 0.039 | 0.071 |
|  |  | | v | -0.023 | -0.008 | -0.001 | 0.002 | 0.006 | 0.007 | 0.012 | 0.014 |
| T(C) | t+1 | S+Q+GH | | 0.054 | 0.025 | -0.002 | -0.013 | -0.038 | -0.053 | -0.105 | -0.226 |
|  |  | r | | 0.111 | 0.034 | -0.004 | -0.015 | -0.034 | -0.041 | -0.059 | -0.060 |
|  |  | u | | -0.458 | -0.243 | -0.111 | -0.067 | 0.017 | 0.057 | 0.162 | 0.242 |
|  |  | v | | -0.162 | -0.095 | -0.054 | -0.039 | -0.010 | 0.006 | 0.056 | 0.156 |
|  |  | P | | -0.303 | -0.178 | -0.089 | -0.057 | 0.009 | 0.043 | 0.147 | 0.307 |
|  |  | T | | -0.339 | -0.220 | -0.113 | -0.070 | 0.025 | 0.079 | 0.240 | 0.343 |
|  | t+3 | S+Q+GH | | 0.260 | 0.130 | 0.048 | 0.019 | -0.039 | -0.069 | -0.162 | -0.330 |
|  |  | r | | 0.166 | 0.080 | 0.027 | 0.008 | -0.027 | -0.043 | -0.087 | -0.108 |
|  |  | u | | -0.467 | -0.237 | -0.099 | -0.054 | 0.035 | 0.077 | 0.192 | 0.306 |
|  |  | v | | -0.299 | -0.171 | -0.079 | -0.045 | 0.027 | 0.067 | 0.189 | 0.386 |
|  |  | P | | -0.267 | -0.149 | -0.068 | -0.039 | 0.020 | 0.051 | 0.146 | 0.306 |
|  |  | T | | -0.508 | -0.300 | -0.138 | -0.076 | 0.061 | 0.137 | 0.355 | 0.409 |
|  | t+7 | S+Q+GH | | 0.221 | 0.105 | 0.034 | 0.010 | -0.038 | -0.062 | -0.134 | -0.258 |
|  |  | r | | 0.366 | 0.189 | 0.069 | 0.027 | -0.054 | -0.094 | -0.205 | -0.283 |
|  |  | u | | -0.070 | -0.049 | -0.028 | -0.021 | -0.003 | 0.009 | 0.050 | 0.125 |
|  |  | v | | -0.271 | -0.169 | -0.083 | -0.049 | 0.025 | 0.066 | 0.195 | 0.424 |
|  |  | P | | -0.164 | -0.105 | -0.054 | -0.034 | 0.008 | 0.031 | 0.107 | 0.247 |
|  |  | T | | -0.712 | -0.390 | -0.178 | -0.098 | 0.076 | 0.166 | 0.396 | 0.428 |
|  | t+14 | S+Q+GH | | 0.147 | 0.067 | 0.019 | 0.003 | -0.030 | -0.046 | -0.094 | -0.176 |
|  |  | r | | 0.305 | 0.156 | 0.057 | 0.021 | -0.043 | -0.074 | -0.159 | -0.232 |
|  |  | u | | 0.197 | 0.103 | 0.034 | 0.010 | -0.035 | -0.055 | -0.106 | -0.146 |
|  |  | v | | -0.251 | -0.154 | -0.074 | -0.045 | 0.022 | 0.060 | 0.195 | 0.446 |
|  |  | P | | -0.093 | -0.069 | -0.041 | -0.028 | 0.003 | 0.021 | 0.084 | 0.208 |
|  |  | T | | -0.639 | -0.318 | -0.136 | -0.075 | 0.047 | 0.103 | 0.216 | 0.076 |
| S(ppt) | t+1 | S+Q+GH | | -0.345 | -0.231 | -0.112 | -0.060 | 0.069 | 0.148 | 0.479 | 1.591 |
|  |  | r | | 0.036 | -0.005 | -0.006 | -0.003 | 0.006 | 0.012 | 0.032 | 0.048 |
|  |  | u | | 1.175 | 0.554 | 0.207 | 0.101 | -0.093 | -0.179 | -0.390 | -0.590 |
|  |  | v | | 0.151 | 0.026 | 0.002 | 0.000 | 0.003 | 0.007 | 0.023 | 0.033 |
|  |  | P | | 0.237 | 0.107 | 0.040 | 0.020 | -0.017 | -0.033 | -0.074 | -0.107 |
|  |  | T | | 0.233 | 0.111 | 0.043 | 0.022 | -0.020 | -0.039 | -0.090 | -0.139 |
|  | t+3 | S+Q+GH | | -0.467 | -0.295 | -0.140 | -0.076 | 0.075 | 0.165 | 0.516 | 1.539 |
|  |  | r | | 0.095 | 0.020 | 0.000 | -0.003 | -0.005 | -0.003 | 0.015 | 0.059 |
|  |  | u | | 1.129 | 0.556 | 0.213 | 0.102 | -0.108 | -0.206 | -0.454 | -0.667 |
|  |  | v | | 0.151 | 0.041 | 0.007 | 0.000 | -0.009 | -0.011 | -0.014 | -0.030 |
|  |  | P | | 0.178 | 0.075 | 0.024 | 0.009 | -0.018 | -0.030 | -0.061 | -0.089 |
|  |  | T | | 0.358 | 0.173 | 0.065 | 0.030 | -0.039 | -0.071 | -0.155 | -0.233 |
|  | t+7 | S+Q+GH | | -0.520 | -0.332 | -0.168 | -0.101 | 0.056 | 0.148 | 0.501 | 1.445 |
|  |  | r | | 0.183 | 0.059 | 0.002 | -0.014 | -0.037 | -0.045 | -0.049 | -0.012 |
|  |  | u | | 0.912 | 0.447 | 0.162 | 0.068 | -0.120 | -0.211 | -0.456 | -0.654 |
|  |  | v | | 0.222 | 0.067 | 0.004 | -0.013 | -0.038 | -0.048 | -0.066 | -0.078 |
|  |  | P | | 0.162 | 0.050 | 0.000 | -0.014 | -0.038 | -0.048 | -0.068 | -0.071 |
|  |  | T | | 0.382 | 0.170 | 0.049 | 0.010 | -0.062 | -0.095 | -0.179 | -0.260 |
|  | t+14 | S+Q+GH | | -0.471 | -0.287 | -0.134 | -0.074 | 0.064 | 0.143 | 0.431 | 1.115 |
|  |  | r | | 0.175 | 0.068 | 0.016 | 0.003 | -0.016 | -0.021 | -0.019 | 0.037 |
|  |  | u | | 0.649 | 0.327 | 0.127 | 0.060 | -0.075 | -0.140 | -0.319 | -0.436 |
|  |  | v | | 0.141 | 0.043 | 0.007 | -0.001 | -0.013 | -0.017 | -0.020 | -0.003 |
|  |  | P | | 0.197 | 0.080 | 0.024 | 0.007 | -0.022 | -0.035 | -0.068 | -0.101 |
|  |  | T | | 0.398 | 0.197 | 0.073 | 0.032 | -0.046 | -0.083 | -0.181 | -0.302 |

**Table 6.** Average output errors for all response variables and lead times. T: time; Q: discharge; GH: gage height; SM: soil moisture; r: rainfall; rh: relative humidity; P: pressure; Sr: solar radiation; T: temperature; u,v: horizonal and vertical components of the wind speed, S: salinity, ppt: parts per thousand.