Article

Characterizing Density Flow Regimes of Three Rivers with Different Physicochemical Properties in a Run-of-the-River Reservoir

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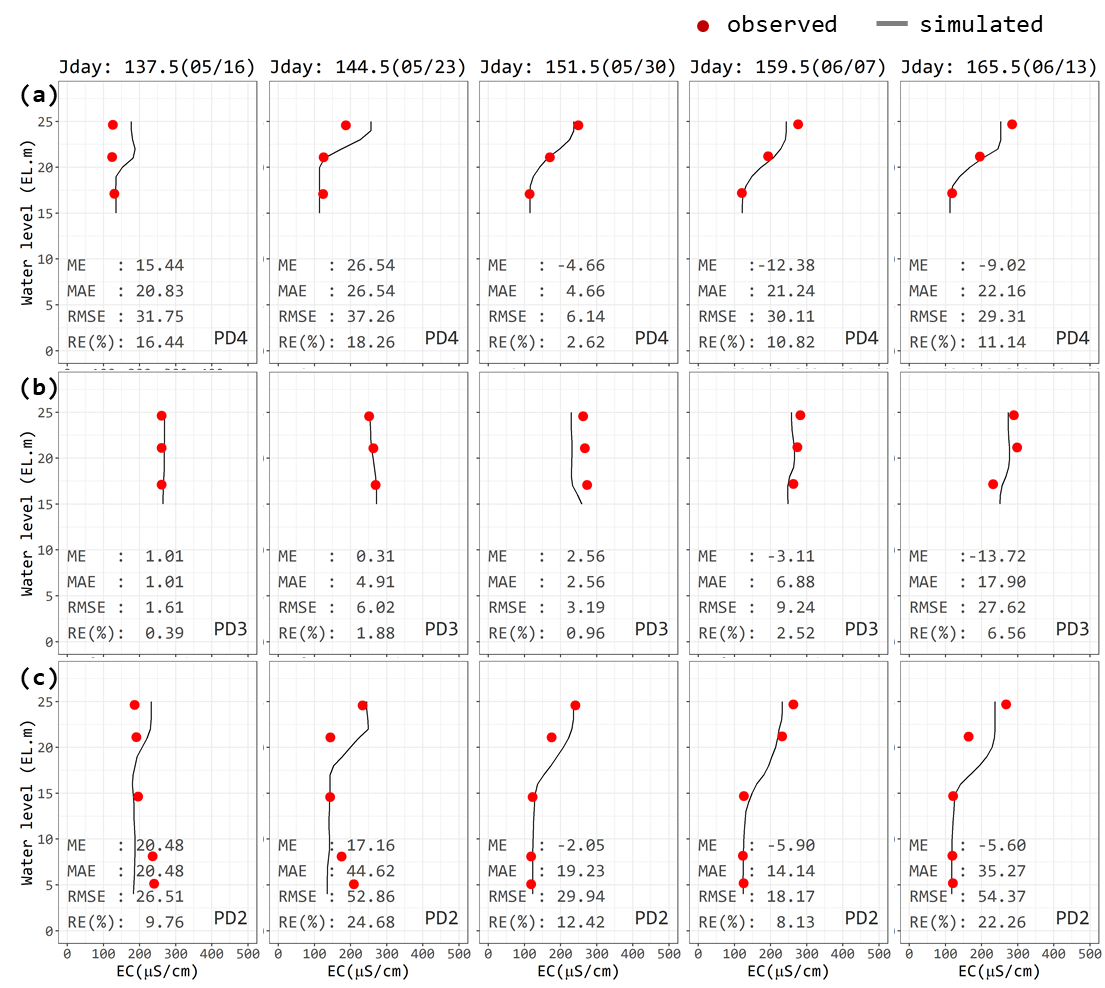
**Supplementary Materials:**



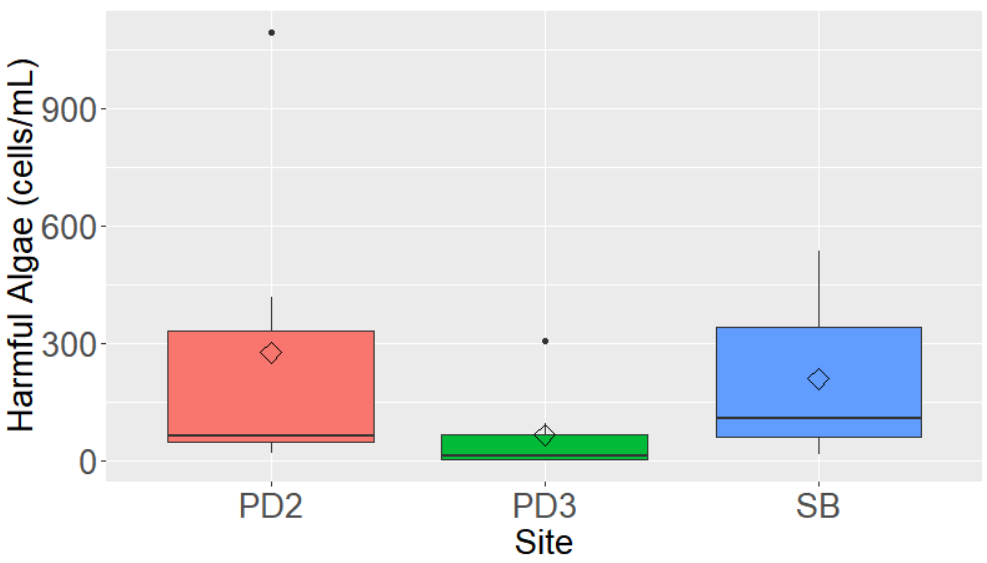
**Figure S1.** Comparison of observed (red) and simulated (blue) values of vertical flow velocity at (a) PC1, (b) PC2, and (c) PC3. Negative and positive signs indicate that flow is toward downstream (PDD) and upstream (UP). Jday and parentheses are the Julian day of year 2016 and month/day (format: mm/dd).



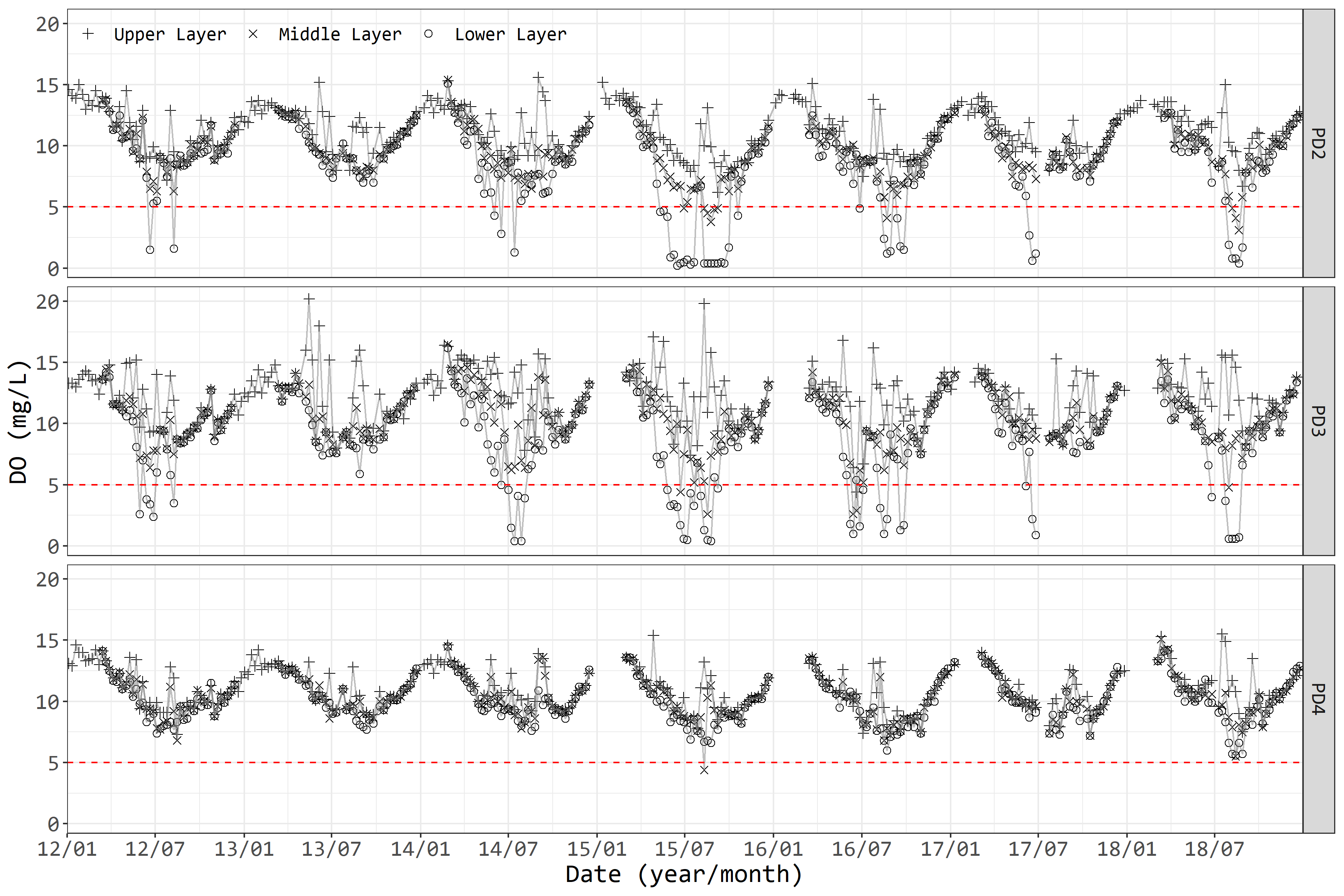
**Figure S2.** Comparison of observed (red) and simulated(blue) values of vertical water temperature at (a) PC1, (b) PC2, and (c) PC3. Jday and parentheses are the Julian day of year 2016 and month/day (format: mm/dd).



**Figure S3.** Comparison of observed (red) and simulated (blue) values of vertical electrical conductivity at (a) PD4, (b) PD3, and (c) PD2. Jday and parentheses are the Julian day of year 2016 and month/day (format: mm/dd).



**Figure S4.** Box plots showing the cell density of harmful algae (*Microcystis* sp., *Anabaena* sp., *Oscillatoria* sp., *Aphanizomenon* sp.) observed at site PD2, PD3, and SB from 2012 to 2018.



**Figure S5.** Temporal variations of dissolved oxygen observed by depths at site PD2, PD3, and PD4 from 2012 to 2018 (Upper layer at PD2, PD3, and PD4 is 0.5 m in depth, Middle Layer at PD2 is 10.0 m in depth, Middle Layer at PD3 and PD4 is 4.0 m in depth, Lower Layer at PD2 is 20.0 m in depth, Lower Layer at PD3 and PD4 is 8.0 m in depth, Dashed line means the level of dissolved oxygen 5 mg/L)

**Table S1.** Variations of simulated flow velocity, water temperature, water age and electrical conductivity with depths at PD2. The values are averaged during Julian day 122 to 152 (May 2016) and 153 to 182 (June 2016), respectively.

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Period | Depth (m) | | | | | | | | | | |
| 0 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| Flow velocity (cm/s) | | | | | | | | | | | |
| May (122–152) | 6.0 | 5.5 | 6.2 | 8.3 | 8.8 | 8.6 | 7.7 | 6.7 | 5.5 | 3.5 | 1.7 |
| June (153–182) | 0.9 | 0.6 | 1.3 | 4.1 | 7.4 | 7.9 | 7.4 | 6.6 | 5.5 | 3.4 | 1.3 |
| Water Temperature (℃) | | | | | | | | | | | |
| May (122–152) | 20.0 | 19.8 | 19.1 | 18.2 | 17.5 | 17.1 | 16.9 | 16.8 | 16.7 | 16.6 | 16.5 |
| June (153–182) | 25.7 | 25.6 | 24.3 | 22.5 | 20.8 | 19.6 | 19.0 | 18.8 | 18.7 | 18.6 | 18.4 |
| Water age (days) | | | | | | | | | | | |
| May (122–152) | 7.0 | 7.0 | 6.4 | 5.6 | 5.3 | 5.2 | 5.3 | 5.3 | 5.4 | 5.6 | 6.0 |
| June (153–182) | 19.2 | 19.1 | 16.3 | 12.7 | 10.0 | 8.2 | 7.5 | 7.2 | 7.2 | 7.4 | 8.1 |
| Electrical conductivity (μS/cm) | | | | | | | | | | | |
| May (122–152) | 242 | 241 | 230 | 207 | 187 | 176 | 171 | 169 | 168 | 168 | 168 |
| June (153–182) | 246 | 245 | 239 | 218 | 180 | 151 | 140 | 135 | 134 | 133 | 131 |

**Table S2.** Variations of simulated flow velocity, water temperature, water age and electrical conductivity with depths at the stations. The values are averaged during Julian day 122 to 152 (May 2016) and 153 to 182 (June 2016), respectively.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Period | Depth  (m) | Flow velocity (cm/s) | | | | | | | | Water Temperature (℃) | | | | | | | |
| DS | SB | PD4 | GS | PD1 | PD3 | GAC6 | PD5 | DS | SB | PD4 | GS | PD1 | PD3 | GAC6 | PD5 |
| May  (122–152) | 0 | 8.0 | 5.1 | 3.6 | 18.6 | 12.3 | 10.2 | 2.2 | 2.4 | 16.5 | 18.9 | 19.7 | 19.6 | 19.8 | 19.7 | 19.6 | 20.1 |
| 2 | 8.5 | 5.1 | 2.0 | 17.0 | 12.0 | 9.7 | 1.3 | 0.9 | 16.4 | 18.4 | 19.4 | 18.7 | 19.1 | 19.5 | 19.1 | 19.8 |
| 4 | 9.2 | 9.8 | 6.2 | 14.9 | 11.8 | 9.7 | 0.6 | 1.5 | 16.3 | 17.1 | 18.3 | 17.1 | 17.5 | 18.5 | 18.6 | 18.8 |
| 6 | 9.1 | 7.6 | 9.0 | 8.6 | 8.3 | 8.9 | - | - | 16.2 | 16.6 | 17.0 | 15.8 | 16.4 | 17.3 | - | - |
| 8 | 7.0 | - | 7.9 | 3.4 | 4.0 | 4.8 | - | - | 16.2 | - | 16.6 | 15.6 | 15.8 | 16.6 | - | - |
| 10 | - | - | 6.4 | - | - | 1.8 | - | - | - | - | 16.5 | - | - | 16.3 | - | - |
| June  (153–182) | 0 | 5.3 | 5.8 | 4.4 | 8.0 | 2.5 | 2.5 | 0.8 | 1.9 | 18.0 | 25.7 | 25.7 | 23.2 | 24.3 | 25.1 | 25.2 | 25.6 |
| 2 | 7.0 | 2.9 | 2.3 | 6.9 | 4.4 | 3.0 | 0.7 | 0.6 | 17.7 | 25.5 | 25.5 | 22.6 | 23.9 | 24.9 | 24.9 | 25.4 |
| 4 | 8.9 | 10.2 | 3.3 | 5.8 | 6.6 | 5.9 | 0.4 | 1.3 | 17.5 | 21.8 | 24.0 | 21.3 | 22.6 | 23.7 | 24.5 | 24.5 |
| 6 | 9.1 | 12.6 | 10.5 | 2.8 | 4.7 | 5.2 | - | - | 17.3 | 18.2 | 20.7 | 20.5 | 21.6 | 22.0 | - | - |
| 8 | 6.6 | - | 12.1 | 1.0 | 1.8 | 1.0 | - | - | 17.2 | - | 18.4 | 20.3 | 21.2 | 20.1 | - | - |
| 10 | - | - | 9.6 | - | - | 0.2 | - | - | - | - | 18.2 | - | - | 18.6 | - | - |
|  |  | Water age (days) | | | | | | | | Electrical conductivity (μS/cm) | | | | | | | |
| May  (122–152) | 0 | 0.8 | 5.3 | 6.4 | 0.8 | 1.9 | 3.5 | 2.3 | 6.7 | 123 | 146 | 196 | 258 | 257 | 257 | 281 | 263 |
| 2 | 0.7 | 4.5 | 6.4 | 0.8 | 1.9 | 3.5 | 2.2 | 7.0 | 123 | 141 | 183 | 257 | 257 | 257 | 281 | 258 |
| 4 | 0.7 | 2.8 | 5.3 | 0.9 | 2.0 | 3.4 | 2.3 | 6.9 | 123 | 128 | 146 | 257 | 257 | 258 | 280 | 252 |
| 6 | 0.7 | 2.4 | 3.8 | 1.1 | 2.3 | 3.7 | - | - | 123 | 125 | 130 | 257 | 257 | 259 | - | - |
| 8 | 0.8 | - | 3.7 | 1.1 | 2.7 | 4.4 | - | - | 123 | - | 129 | 257 | 258 | 261 | - | - |
| 10 | - | - | 3.8 | - | - | 5.1 | - | - | - | - | 130 | - | - | 264 | - | - |
| June  (153–182) | 0 | 1.3 | 17.5 | 15.9 | 1.8 | 5.3 | 9.3 | 4.8 | 14.2 | 122 | 236 | 256 | 280 | 279 | 275 | 398 | 302 |
| 2 | 1.0 | 16.9 | 15.9 | 1.9 | 4.8 | 8.8 | 4.3 | 15.1 | 122 | 231 | 253 | 280 | 279 | 275 | 400 | 290 |
| 4 | 0.8 | 10.2 | 14.9 | 2.1 | 4.1 | 7.5 | 4.1 | 16.7 | 122 | 174 | 216 | 280 | 280 | 276 | 402 | 251 |
| 6 | 0.8 | 3.3 | 8.9 | 2.4 | 4.6 | 8.1 | - | - | 122 | 127 | 158 | 280 | 279 | 274 | - | - |
| 8 | 0.9 | - | 4.6 | 2.6 | 5.7 | 14.0 | - | - | 122 | - | 128 | 280 | 275 | 246 | - | - |
| 10 | - | - | 4.4 | - | - | 17.9 | - | - | - | - | 126 | - | - | 218 | - | - |