

DECLINATION AND TIME EQUATION TABLE (JANUARY-AUGUST)

| DAY | <i>J</i> | $\delta^\circ$ | $E_t$ (min) | <i>J</i> | $\delta^\circ$ | $E_t$ (min) | <i>J</i> | $\delta^\circ$ | $E_t$ (min) | <i>J</i> | $\delta^\circ$ | $E_t$ (min) |
|-----|----------|----------------|-------------|----------|----------------|-------------|----------|----------------|-------------|----------|----------------|-------------|
| 1   | 1        | -23.06         | -2.90       | 60       | -7.88          | -12.91      | 121      | 14.83          | 3.02        | 182      | 23.18          | -3.46       |
| 2   | 2        | -22.98         | -3.35       | 61       | -7.50          | -12.73      | 122      | 15.13          | 3.15        | 183      | 23.11          | -3.66       |
| 3   | 3        | -22.89         | -3.79       | 62       | -7.12          | -12.54      | 123      | 15.43          | 3.27        | 184      | 23.04          | -3.86       |
| 4   | 4        | -22.80         | -4.23       | 63       | -6.73          | -12.35      | 124      | 15.73          | 3.38        | 185      | 22.96          | -4.05       |
| 5   | 5        | -22.70         | -4.67       | 64       | -6.35          | -12.14      | 125      | 16.02          | 3.48        | 186      | 22.88          | -4.24       |
| 6   | 6        | -22.59         | -5.09       | 65       | -5.96          | -11.92      | 126      | 16.31          | 3.57        | 187      | 22.78          | -4.42       |
| 7   | 7        | -22.47         | -5.52       | 66       | -5.57          | -11.70      | 127      | 16.59          | 3.65        | 188      | 22.69          | -4.60       |
| 8   | 8        | -22.35         | -5.93       | 67       | -5.19          | -11.47      | 128      | 16.87          | 3.72        | 189      | 22.58          | -4.77       |
| 9   | 9        | -22.21         | -6.34       | 68       | -4.79          | -11.23      | 129      | 17.14          | 3.78        | 190      | 22.47          | -4.93       |
| 10  | 10       | -22.07         | -6.74       | 69       | -4.40          | -10.98      | 130      | 17.41          | 3.83        | 191      | 22.35          | -5.09       |
| 11  | 11       | -21.93         | -7.14       | 70       | -4.01          | -10.72      | 131      | 17.67          | 3.87        | 192      | 22.23          | -5.24       |
| 12  | 12       | -21.77         | -7.52       | 71       | -3.62          | -10.46      | 132      | 17.93          | 3.90        | 193      | 22.09          | -5.39       |
| 13  | 13       | -21.61         | -7.90       | 72       | -3.23          | -10.19      | 133      | 18.18          | 3.92        | 194      | 21.96          | -5.53       |
| 14  | 14       | -21.45         | -8.27       | 73       | -2.83          | -9.92       | 134      | 18.43          | 3.94        | 195      | 21.81          | -5.66       |
| 15  | 15       | -21.27         | -8.63       | 74       | -2.44          | -9.64       | 135      | 18.67          | 3.94        | 196      | 21.66          | -5.79       |
| 16  | 16       | -21.09         | -8.99       | 75       | -2.04          | -9.36       | 136      | 18.91          | 3.93        | 197      | 21.51          | -5.90       |
| 17  | 17       | -20.90         | -9.33       | 76       | -1.65          | -9.07       | 137      | 19.14          | 3.91        | 198      | 21.35          | -6.01       |
| 18  | 18       | -20.71         | -9.66       | 77       | -1.25          | -8.77       | 138      | 19.37          | 3.88        | 199      | 21.18          | -6.11       |
| 19  | 19       | -20.51         | -9.99       | 78       | -0.86          | -8.47       | 139      | 19.59          | 3.85        | 200      | 21.00          | -6.20       |
| 20  | 20       | -20.30         | -10.30      | 79       | -0.46          | -8.17       | 140      | 19.81          | 3.80        | 201      | 20.82          | -6.28       |
| 21  | 21       | -20.09         | -10.60      | 80       | -0.07          | -7.86       | 141      | 20.02          | 3.74        | 202      | 20.64          | -6.35       |
| 22  | 22       | -19.87         | -10.89      | 81       | 0.33           | -7.55       | 142      | 20.23          | 3.68        | 203      | 20.44          | -6.42       |
| 23  | 23       | -19.64         | -11.18      | 82       | 0.72           | -7.24       | 143      | 20.43          | 3.61        | 204      | 20.25          | -6.47       |
| 24  | 24       | -19.41         | -11.45      | 83       | 1.12           | -6.93       | 144      | 20.62          | 3.52        | 205      | 20.04          | -6.52       |
| 25  | 25       | -19.17         | -11.70      | 84       | 1.51           | -6.61       | 145      | 20.81          | 3.43        | 206      | 19.84          | -6.55       |
| 26  | 26       | -18.92         | -11.95      | 85       | 1.90           | -6.29       | 146      | 20.99          | 3.33        | 207      | 19.62          | -6.58       |
| 27  | 27       | -18.67         | -12.19      | 86       | 2.30           | -5.97       | 147      | 21.16          | 3.23        | 208      | 19.40          | -6.59       |
| 28  | 28       | -18.42         | -12.41      | 87       | 2.69           | -5.66       | 148      | 21.33          | 3.11        | 209      | 19.18          | -6.60       |
| 29  | 29       | -18.15         | -12.62      | 88       | 3.08           | -5.34       | 149      | 21.50          | 2.99        | 210      | 18.95          | -6.59       |
| 30  | 30       | -17.89         | -12.82      | 89       | 3.47           | -5.02       | 150      | 21.65          | 2.86        | 211      | 18.71          | -6.57       |
| 31  | 31       | -17.61         | -13.00      | 90       | 3.86           | -4.70       | 151      | 21.80          | 2.72        | 212      | 18.47          | -6.55       |
| 1   | 32       | -17.34         | -13.18      | 91       | 4.24           | -4.38       | 152      | 21.95          | 2.58        | 213      | 18.22          | -6.51       |
| 2   | 33       | -17.05         | -13.34      | 92       | 4.63           | -4.06       | 153      | 22.09          | 2.42        | 214      | 17.97          | -6.46       |
| 3   | 34       | -16.76         | -13.49      | 93       | 5.01           | -3.75       | 154      | 22.22          | 2.27        | 215      | 17.72          | -6.41       |
| 4   | 35       | -16.47         | -13.62      | 94       | 5.40           | -3.44       | 155      | 22.34          | 2.10        | 216      | 17.46          | -6.34       |
| 5   | 36       | -16.17         | -13.75      | 95       | 5.78           | -3.13       | 156      | 22.46          | 1.93        | 217      | 17.19          | -6.26       |
| 6   | 37       | -15.87         | -13.86      | 96       | 6.16           | -2.82       | 157      | 22.58          | 1.76        | 218      | 16.92          | -6.17       |
| 7   | 38       | -15.56         | -13.95      | 97       | 6.53           | -2.51       | 158      | 22.68          | 1.58        | 219      | 16.65          | -6.07       |
| 8   | 39       | -15.25         | -14.04      | 98       | 6.91           | -2.21       | 159      | 22.78          | 1.39        | 220      | 16.37          | -5.96       |
| 9   | 40       | -14.93         | -14.11      | 99       | 7.28           | -1.92       | 160      | 22.87          | 1.20        | 221      | 16.09          | -5.83       |
| 10  | 41       | -14.61         | -14.16      | 100      | 7.66           | -1.62       | 161      | 22.96          | 1.01        | 222      | 15.80          | -5.70       |
| 11  | 42       | -14.29         | -14.21      | 101      | 8.03           | -1.34       | 162      | 23.04          | 0.81        | 223      | 15.51          | -5.56       |
| 12  | 43       | -13.96         | -14.24      | 102      | 8.39           | -1.05       | 163      | 23.11          | 0.60        | 224      | 15.21          | -5.40       |
| 13  | 44       | -13.63         | -14.26      | 103      | 8.76           | -0.78       | 164      | 23.18          | 0.40        | 225      | 14.91          | -5.24       |
| 14  | 45       | -13.29         | -14.27      | 104      | 9.12           | -0.50       | 165      | 23.23          | 0.19        | 226      | 14.61          | -5.07       |
| 15  | 46       | -12.95         | -14.26      | 105      | 9.48           | -0.24       | 166      | 23.29          | -0.02       | 227      | 14.30          | -4.88       |
| 16  | 47       | -12.61         | -14.24      | 106      | 9.84           | 0.02        | 167      | 23.33          | -0.24       | 228      | 13.99          | -4.69       |
| 17  | 48       | -12.26         | -14.21      | 107      | 10.19          | 0.28        | 168      | 23.37          | -0.45       | 229      | 13.67          | -4.48       |
| 18  | 49       | -11.91         | -14.17      | 108      | 10.55          | 0.52        | 169      | 23.40          | -0.67       | 230      | 13.36          | -4.27       |
| 19  | 50       | -11.56         | -14.11      | 109      | 10.89          | 0.76        | 170      | 23.42          | -0.89       | 231      | 13.03          | -4.05       |
| 20  | 51       | -11.20         | -14.04      | 110      | 11.24          | 1.00        | 171      | 23.44          | -1.11       | 232      | 12.71          | -3.82       |
| 21  | 52       | -10.84         | -13.96      | 111      | 11.58          | 1.22        | 172      | 23.45          | -1.32       | 233      | 12.38          | -3.57       |
| 22  | 53       | -10.48         | -13.87      | 112      | 11.92          | 1.44        | 173      | 23.46          | -1.54       | 234      | 12.05          | -3.32       |
| 23  | 54       | -10.12         | -13.76      | 113      | 12.26          | 1.65        | 174      | 23.45          | -1.76       | 235      | 11.71          | -3.06       |
| 24  | 55       | -9.75          | -13.65      | 114      | 12.60          | 1.85        | 175      | 23.44          | -1.98       | 236      | 11.38          | -2.80       |
| 25  | 56       | -9.38          | -13.52      | 115      | 12.93          | 2.04        | 176      | 23.42          | -2.20       | 237      | 11.03          | -2.52       |
| 26  | 57       | -9.01          | -13.39      | 116      | 13.25          | 2.23        | 177      | 23.40          | -2.42       | 238      | 10.69          | -2.24       |
| 27  | 58       | -8.63          | -13.24      | 117      | 13.57          | 2.40        | 178      | 23.37          | -2.63       | 239      | 10.34          | -1.95       |
| 28  | 59       | -8.26          | -13.08      | 118      | 13.89          | 2.57        | 179      | 23.33          | -2.84       | 240      | 9.99           | -1.65       |
| 29  |          |                |             | 119      | 14.21          | 2.73        | 180      | 23.29          | -3.05       | 241      | 9.64           | -1.34       |
| 30  |          |                |             | 120      | 14.52          | 2.88        | 181      | 23.24          | -3.26       | 242      | 9.29           | -1.03       |
| 31  |          |                |             |          |                |             |          |                |             | 243      | 8.93           | -0.71       |

(Calculations from Spencer formula)

## DECLINATION AND TIME EQUATION TABLE (SEPTEMBER-DECEMBER)

| DAY | J   | $\delta^\circ$ | $E_t$ (min) | J   | $\delta^\circ$ | $E_t$ (min) |
|-----|-----|----------------|-------------|-----|----------------|-------------|
| 1   | 244 | 8.57           | -0.38       | 305 | -14.19         | 16.39       |
| 2   | 245 | 8.21           | -0.05       | 306 | -14.51         | 16.39       |
| 3   | 246 | 7.85           | 0.29        | 307 | -14.83         | 16.37       |
| 4   | 247 | 7.48           | 0.63        | 308 | -15.14         | 16.35       |
| 5   | 248 | 7.11           | 0.98        | 309 | -15.46         | 16.31       |
| 6   | 249 | 6.74           | 1.33        | 310 | -15.76         | 16.25       |
| 7   | 250 | 6.37           | 1.69        | 311 | -16.06         | 16.18       |
| 8   | 251 | 6.00           | 2.05        | 312 | -16.36         | 16.10       |
| 9   | 252 | 5.62           | 2.41        | 313 | -16.65         | 16.01       |
| 10  | 253 | 5.25           | 2.78        | 314 | -16.94         | 15.90       |
| 11  | 254 | 4.87           | 3.15        | 315 | -17.22         | 15.77       |
| 12  | 255 | 4.49           | 3.52        | 316 | -17.50         | 15.64       |
| 13  | 256 | 4.11           | 3.89        | 317 | -17.77         | 15.49       |
| 14  | 257 | 3.73           | 4.27        | 318 | -18.04         | 15.33       |
| 15  | 258 | 3.34           | 4.64        | 319 | -18.30         | 15.15       |
| 16  | 259 | 2.96           | 5.02        | 320 | -18.56         | 14.96       |
| 17  | 260 | 2.57           | 5.40        | 321 | -18.81         | 14.76       |
| 18  | 261 | 2.19           | 5.77        | 322 | -19.06         | 14.55       |
| 19  | 262 | 1.80           | 6.15        | 323 | -19.30         | 14.32       |
| 20  | 263 | 1.41           | 6.52        | 324 | -19.53         | 14.08       |
| 21  | 264 | 1.03           | 6.90        | 325 | -19.76         | 13.83       |
| 22  | 265 | 0.64           | 7.27        | 326 | -19.98         | 13.57       |
| 23  | 266 | 0.25           | 7.64        | 327 | -20.20         | 13.30       |
| 24  | 267 | -0.14          | 8.01        | 328 | -20.41         | 13.01       |
| 25  | 268 | -0.53          | 8.37        | 329 | -20.61         | 12.71       |
| 26  | 269 | -0.92          | 8.73        | 330 | -20.81         | 12.41       |
| 27  | 270 | -1.31          | 9.09        | 331 | -21.00         | 12.09       |
| 28  | 271 | -1.70          | 9.44        | 332 | -21.18         | 11.76       |
| 29  | 272 | -2.09          | 9.79        | 333 | -21.36         | 11.42       |
| 30  | 273 | -2.48          | 10.13       | 334 | -21.53         | 11.07       |
| 1   | 274 | -2.87          | 10.47       | 335 | -21.69         | 10.72       |
| 2   | 275 | -3.25          | 10.80       | 336 | -21.85         | 10.35       |
| 3   | 276 | -3.64          | 11.13       | 337 | -22.00         | 9.98        |
| 4   | 277 | -4.03          | 11.44       | 338 | -22.14         | 9.59        |
| 5   | 278 | -4.42          | 11.76       | 339 | -22.27         | 9.20        |
| 6   | 279 | -4.80          | 12.06       | 340 | -22.40         | 8.80        |
| 7   | 280 | -5.19          | 12.36       | 341 | -22.52         | 8.40        |
| 8   | 281 | -5.57          | 12.65       | 342 | -22.64         | 7.98        |
| 9   | 282 | -5.95          | 12.93       | 343 | -22.74         | 7.56        |
| 10  | 283 | -6.33          | 13.20       | 344 | -22.84         | 7.14        |
| 11  | 284 | -6.71          | 13.46       | 345 | -22.93         | 6.71        |
| 12  | 285 | -7.09          | 13.71       | 346 | -23.01         | 6.27        |
| 13  | 286 | -7.47          | 13.95       | 347 | -23.09         | 5.83        |
| 14  | 287 | -7.84          | 14.19       | 348 | -23.16         | 5.38        |
| 15  | 288 | -8.22          | 14.41       | 349 | -23.22         | 4.93        |
| 16  | 289 | -8.59          | 14.62       | 350 | -23.27         | 4.48        |
| 17  | 290 | -8.96          | 14.82       | 351 | -23.32         | 4.02        |
| 18  | 291 | -9.33          | 15.01       | 352 | -23.35         | 3.56        |
| 19  | 292 | -9.69          | 15.19       | 353 | -23.38         | 3.10        |
| 20  | 293 | -10.06         | 15.36       | 354 | -23.41         | 2.64        |
| 21  | 294 | -10.42         | 15.51       | 355 | -23.42         | 2.17        |
| 22  | 295 | -10.77         | 15.66       | 356 | -23.43         | 1.71        |
| 23  | 296 | -11.13         | 15.79       | 357 | -23.42         | 1.24        |
| 24  | 297 | -11.48         | 15.91       | 358 | -23.41         | 0.78        |
| 25  | 298 | -11.83         | 16.01       | 359 | -23.40         | 0.31        |
| 26  | 299 | -12.18         | 16.11       | 360 | -23.37         | -0.16       |
| 27  | 300 | -12.52         | 16.19       | 361 | -23.34         | -0.62       |
| 28  | 301 | -12.86         | 16.25       | 362 | -23.30         | -1.08       |
| 29  | 302 | -13.20         | 16.31       | 363 | -23.25         | -1.54       |
| 30  | 303 | -13.53         | 16.35       | 364 | -23.19         | -2.00       |
| 31  | 304 | -13.86         | 16.37       | 365 | -23.13         | -2.45       |

The value of J expressed in the table corresponds to the agenda number within an ordinary year. If the year is leap, the day J = 60 will correspond to February 29 instead of March 1, and from that date a unit must be added to the value of J. For example, on August 31 of a leap year has J = 244, on December 5 of a leap year it has J = 340.

*El valor de J expresado en la tabla corresponde al número de orden del día dentro de un año ordinario. Si el año es bisiesto el día J = 60 corresponderá al 29 de febrero en lugar de al 1 de marzo, y a partir de dicha fecha deberá sumarse una unidad al valor de J. Por ejemplo, el día 31 de agosto de un año bisiesto tiene J = 244, el día 5 de diciembre de un año bisiesto tiene J = 340.*

$$\phi = 90^\circ + (\pm \delta) - \alpha$$

SUN CORRECTIONS:  
SEMI DIAMETER (SD)  
From 06 to 10° high = 0.15°  
From 10 to 20° high = 0.20°  
From 20 to 40° high = 0.23°  
More than 40° high = 0.25°  
Remember: Lower Limb, ADD.  
Upper Limb, SUBTRACT.

(Calculations from Spencer formula)