

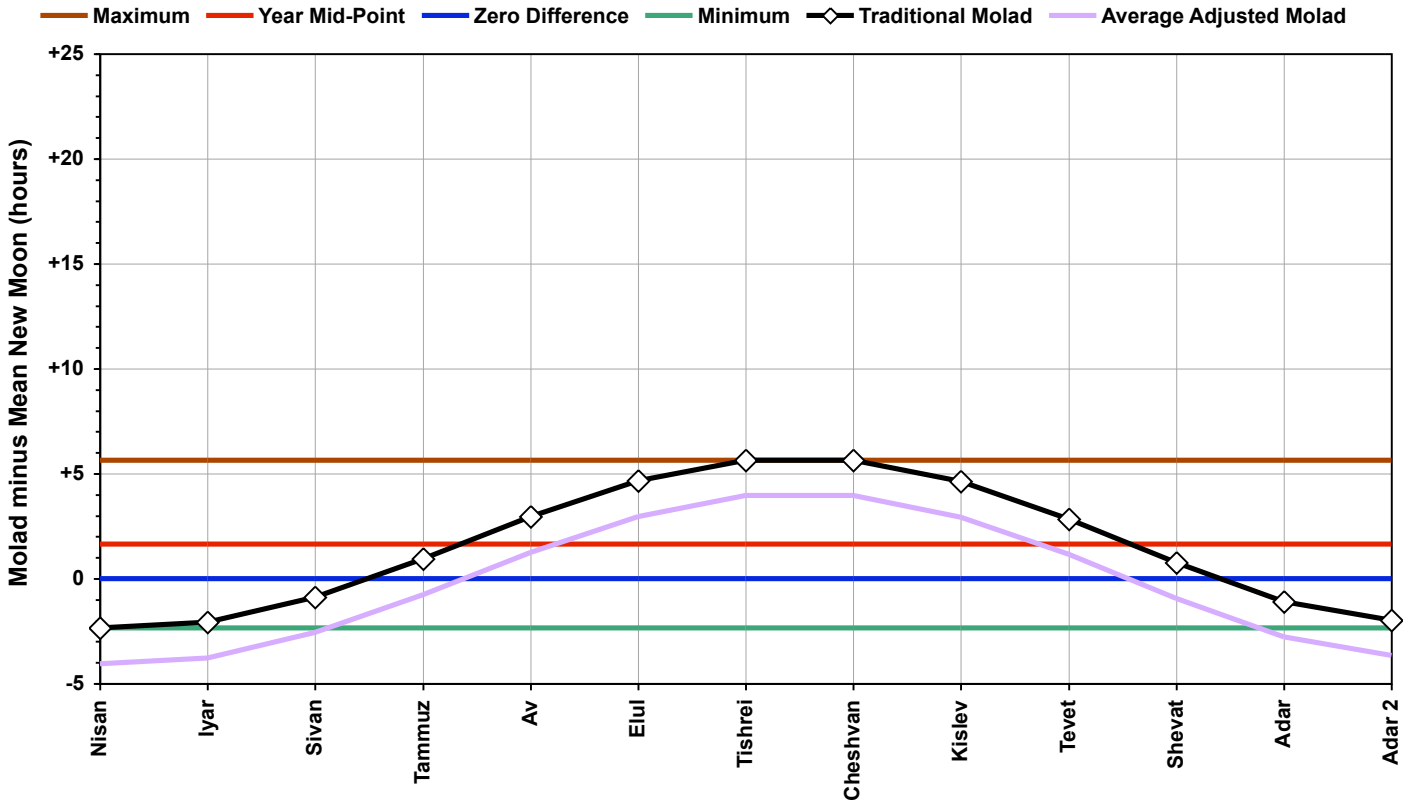
Molad minus Mean New Moon

Hebrew Year: **5765**

Optional: Molad refers to halfway between Ur, Babylon and Jerusalem, Israel (+23 minutes to Moon time)

Average Adjust (hours): **-2.08**

| | | | | | | | | | | | | | |
|-----------------|--------------|--------|-----------------------|--------------|-------------------|--------|----------------------|----------|-----------------------------|--------------|--------|-------|--------|
| Lunation: | 71298 | 71299 | 71300 | 71301 | 71302 | 71303 | 71291 | 71292 | 71293 | 71294 | 71295 | 71296 | 71297 |
| Month Number: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Month Name: | Nisan | Iyar | Sivan | Tammuz | Av | Elul | Tishrei | Cheshvan | Kislev | Tevet | Shevat | Adar | Adar 2 |
| Minutes Apart: | -141.3 | -124.9 | -52.8 | +56.7 | +177.0 | +279.5 | +338.7 | +338.9 | +278.1 | +170.7 | +45.0 | -65.3 | -118.5 |
| Hours Apart: | -2.35 | -2.08 | -0.88 | +0.94 | +2.95 | +4.66 | +5.65 | +5.65 | +4.63 | +2.85 | +0.75 | -1.09 | -1.98 |
| Maximum: | +5.65 | | Minimum: -2.35 | | Span: 8.00 | | Middle: +1.65 | | Average: +1.52 hours | | | | |
| Average Adjust: | -4.0 | -3.8 | -2.6 | -0.7 | +1.3 | +3.0 | +4.0 | +4.0 | +2.9 | +1.2 | -0.9 | -2.8 | -3.7 |



by Dr. Irv Bromberg, University of Toronto, revised 8 Shevat 5765 <<http://individual.utoronto.ca/kalendis/>>.

Lunations are shorter when Earth is moving slowest near aphelion (furthest from Sun), then the Molad falls behind.

Aphelion is near the point where the up-going "Molad minus Mean New Moon" curve crosses the **red mid-point line**.

Lunations are longer when Earth is moving fastest near perihelion (closest to Sun), giving the Molad a chance to "catch up".

Perihelion is near the point where the down-going "Molad minus Mean New Moon" curve crosses the **red mid-point line**.

In the era of Hillel II the traditional Molad interval was almost exactly equal to the actual Mean Synodic Month.

Moladot before Hillel II back-calculate later than the Mean New Moon because at that time the Mean Synodic Month was longer than the Molad.

Future Moladot will drift progressively later at an accelerating rate because the Mean Synodic Month is less than the Molad, and getting shorter.

Perihelion moves relative to the equinoxes at the rate of 1.72 degrees per century, with a period of 20930 years, moving 1 day later per 58 years.

In our time, Earth reaches perihelion around January 3rd-4th (mid Tevet) and aphelion around July 4th (mid Tammuz).

Variations in the duration of lunation are becoming less extreme as the Earth orbital eccentricity decreases.

Year 5765 Eccentricity = 1.67%

Over the range of years shown here the minimum to maximum span decreases as the years advance, because the Earth orbital eccentricity is decreasing.

In the era of Hillel II (4119, or 330–365 CE) the curve was almost symmetrical with respect to the **blue zero difference line**. If the "Molad refers to halfway between Ur and Jerusalem" checkbox is marked, then the year 4119 curve is perfectly centered above and below the zero difference line and balanced on both sides of Tishrei, with the Molad of both Tammuz and Tevet within a few minutes of the zero difference line. This arrangement was probably intentional.

Ur, the origin of the Chaldeans, is 46 solar minutes ahead of Jerusalem. Cities near the meridian between Ur to Baghdad were major Jewish centers in 4119.

The **average Molad adjustment shown in lavender** is symmetrically aligned at the **blue zero difference line**, allowing a shift to the right with time and allows the span to increase or decrease as the Earth orbital eccentricity increases or decreases. It corrects for the progressive shortening of the Mean Synodic Month.

Whether the traditional molad refers to Jerusalem or Babylon or in-between, this adjustment intentionally resets it to Jerusalem Mean Solar Time.

Subtracting month-specific values (see "Minutes Apart" cells above) resets all Moladot to the **blue zero difference line** for all years shown.

See the web site given above for details concerning the arithmetic of the proposed Molad adjustments (average or month-specific).

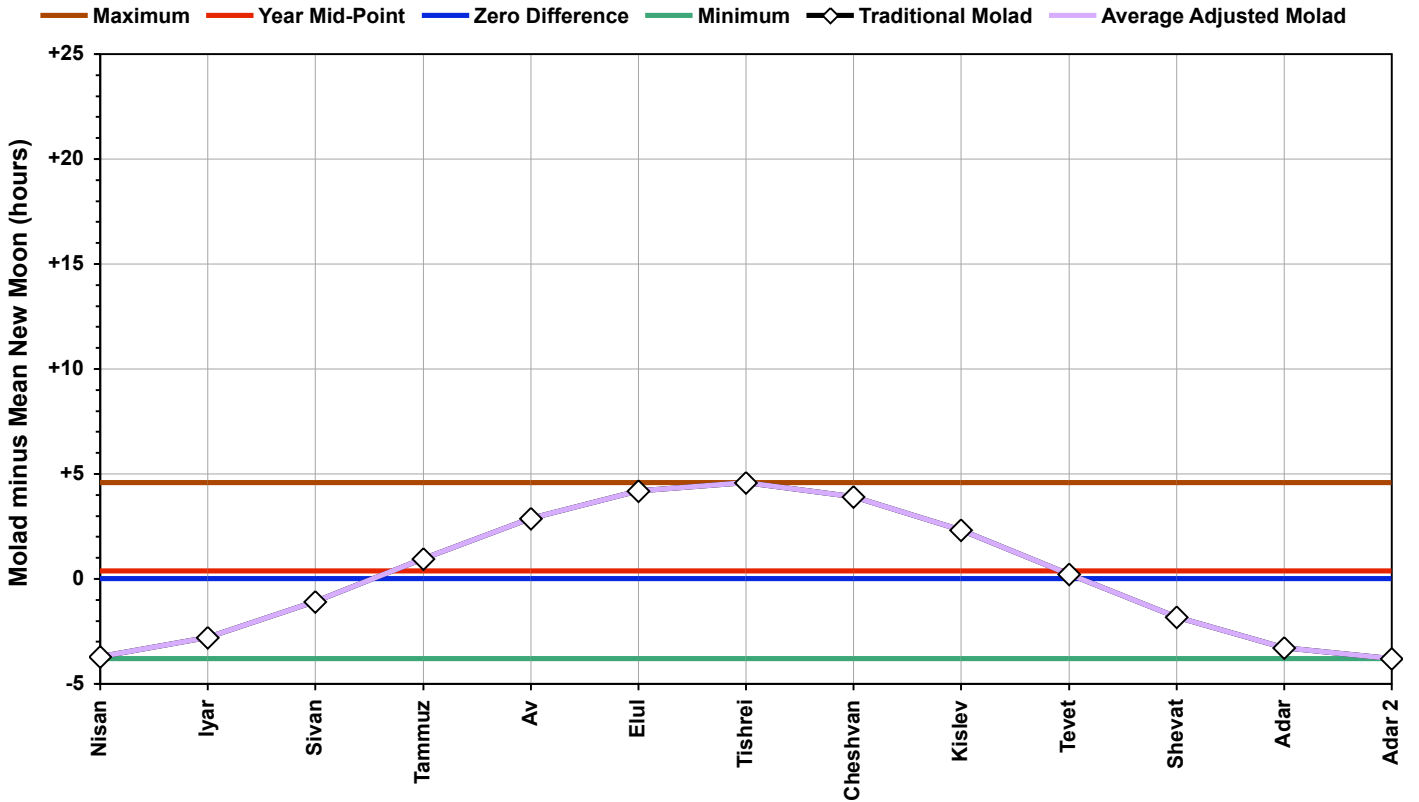
Molad minus Mean New Moon

Hebrew Year: **4119**

Optional: Molad refers to halfway between Ur, Babylon and Jerusalem, Israel (+23 minutes to Moon time)

Average Adjust (hours): **0.00**

| | | | | | | | | | | | | | |
|-----------------|--------------|--------|-------|--------------|--------|--------|-------------|----------|--------|--------------|--------|--------|--------|
| Lunation: | 50939 | 50940 | 50941 | 50942 | 50943 | 50944 | 50933 | 50934 | 50935 | 50936 | 50937 | 50938 | 50939 |
| Month Number: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Month Name: | Nisan | Iyar | Sivan | Tammuz | Av | Elul | Tishrei | Cheshvan | Kislev | Tevet | Shevat | Adar | Adar 2 |
| Minutes Apart: | -223.4 | -168.4 | -66.7 | +56.3 | +171.3 | +250.5 | +273.8 | +233.6 | +138.5 | +12.6 | -110.6 | -198.4 | -228.1 |
| Hours Apart: | -3.72 | -2.81 | -1.11 | +0.94 | +2.85 | +4.18 | +4.56 | +3.89 | +2.31 | +0.21 | -1.84 | -3.31 | -3.80 |
| Maximum: | +4.56 | | | | | | | | | | | | |
| Minimum: | | | | | | | | | | | | | |
| Span: | | | | | | | 8.37 | | | | | | |
| Middle: | | | | | | | | | | | | | |
| Average: | | | | | | | | | | | | | |
| Average Adjust: | -3.7 | -2.8 | -1.1 | +0.9 | +2.9 | +4.2 | +4.6 | +3.9 | +2.3 | +0.2 | -1.8 | -3.3 | -3.8 |



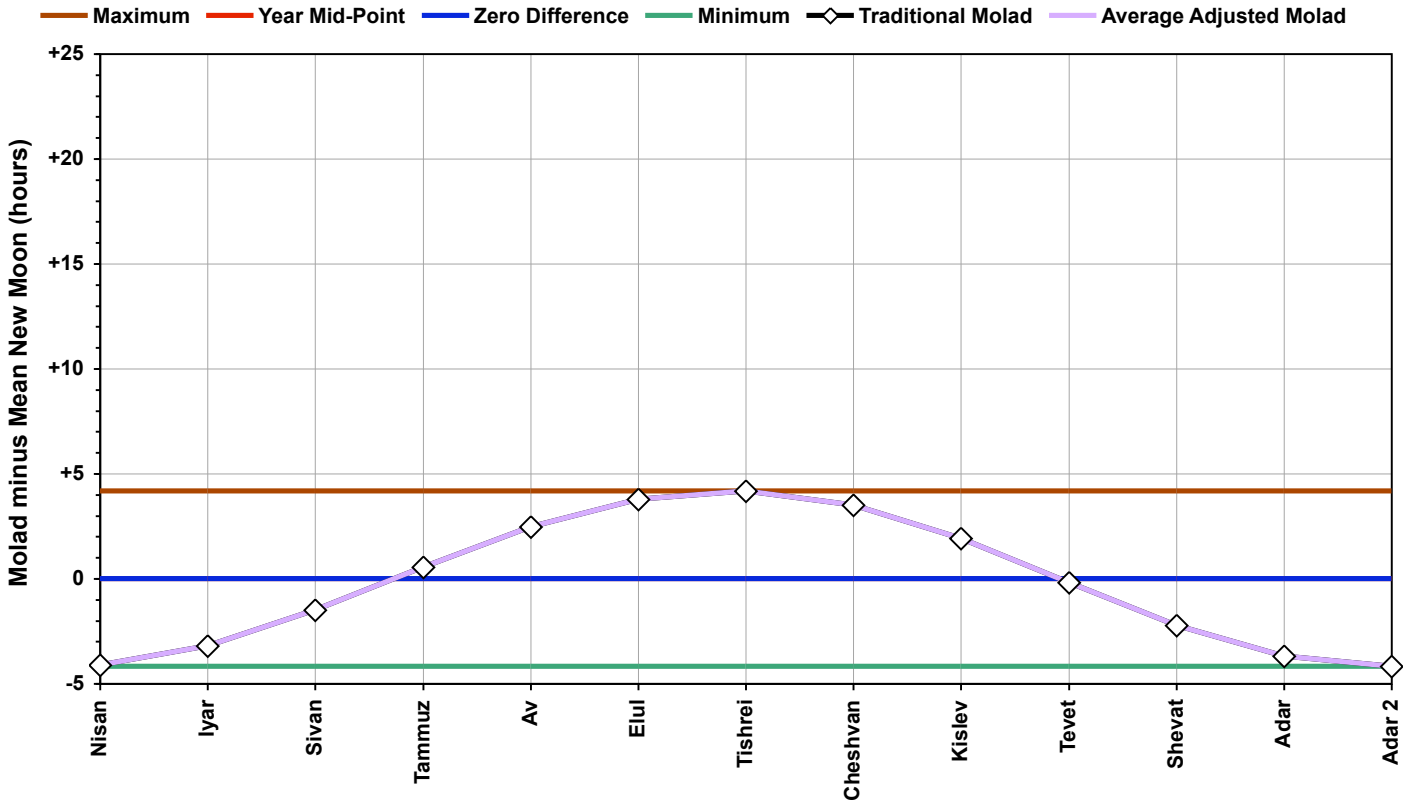
Molad minus Mean New Moon

Hebrew Year: **4119**

Optional: Molad refers to halfway between Ur, Babylon and Jerusalem, Israel (+23 minutes to Moon time)

Average Adjust (hours): **-0.38**

| | | | | | | | | | | | | | |
|-----------------|--------------|--------|----------|--------------|--------|--------|-------------|----------|--------------|--------------|----------|--------------|--------|
| Lunation: | 50939 | 50940 | 50941 | 50942 | 50943 | 50944 | 50933 | 50934 | 50935 | 50936 | 50937 | 50938 | 50939 |
| Month Number: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Month Name: | Nisan | Iyar | Sivan | Tammuz | Av | Elul | Tishrei | Cheshvan | Kislev | Tevet | Shevat | Adar | Adar 2 |
| Minutes Apart: | -246.4 | -191.4 | -89.7 | +33.3 | +148.3 | +227.5 | +250.8 | +210.6 | +115.5 | -10.4 | -133.6 | -221.4 | -251.1 |
| Hours Apart: | -4.11 | -3.19 | -1.50 | +0.55 | +2.47 | +3.79 | +4.18 | +3.51 | +1.93 | -0.17 | -2.23 | -3.69 | -4.19 |
| Maximum: | +4.18 | | Minimum: | -4.19 | | Span: | 8.37 | Middle: | -0.00 | | Average: | -0.20 | hours |
| Average Adjust: | -4.1 | -3.2 | -1.5 | +0.6 | +2.5 | +3.8 | +4.2 | +3.5 | +1.9 | -0.2 | -2.2 | -3.7 | -4.2 |



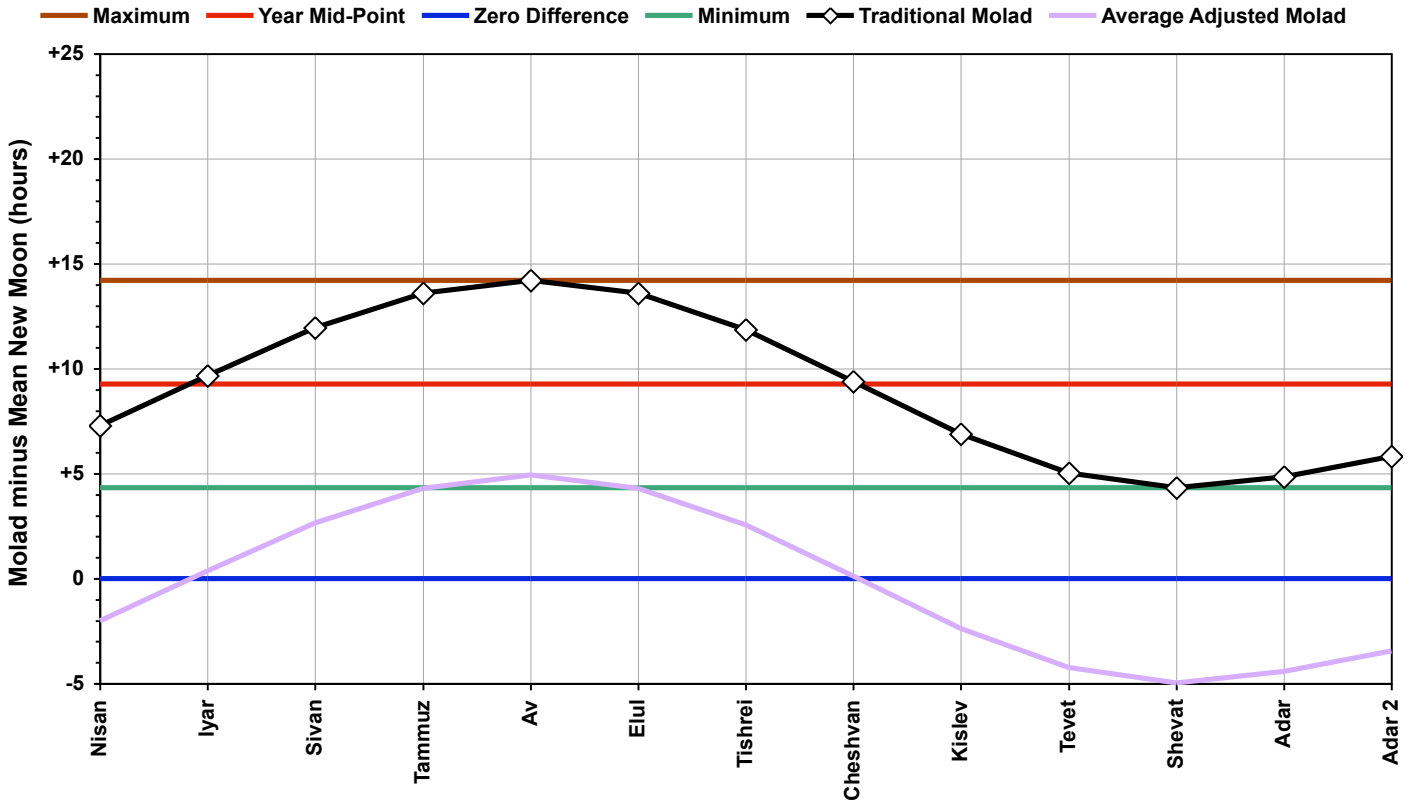
Molad minus Mean New Moon

Hebrew Year: 1

Optional: Molad refers to halfway between Ur, Babylon and Jerusalem, Israel (+23 minutes to Moon time)

Average Adjust (hours): -9.66

| | | | | | | | | | | | | | |
|-----------------|--------|--------|----------------|--------|------------|--------|---------------|----------|----------------------|--------|--------|--------|--------|
| Lunation: | 6 | 7 | 8 | 9 | 10 | 11 | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Month Number: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Month Name: | Nisan | Iyar | Sivan | Tammuz | Av | Elul | Tishrei | Cheshvan | Kislev | Tevet | Shevat | Adar | Adar 2 |
| Minutes Apart: | +436.6 | +579.4 | +716.2 | +815.4 | +852.5 | +815.6 | +711.3 | +563.9 | +413.7 | +302.4 | +258.9 | +291.5 | +349.7 |
| Hours Apart: | +7.28 | +9.66 | +11.94 | +13.59 | +14.21 | +13.59 | +11.86 | +9.40 | +6.89 | +5.04 | +4.31 | +4.86 | +5.83 |
| Maximum: | +14.21 | | Minimum: +4.31 | | Span: 9.89 | | Middle: +9.26 | | Average: +9.11 hours | | | | |
| Average Adjust: | -2.0 | +0.4 | +2.7 | +4.3 | +4.9 | +4.3 | +2.6 | +0.1 | -2.4 | -4.2 | -5.0 | -4.4 | -3.5 |



Molad minus Mean New Moon

Hebrew Year: 10000

Optional: Molad refers to halfway between Ur, Babylon and Jerusalem, Israel (+23 minutes to Moon time)

Average Adjust (hours): -20.62

| | | | | | | | | | | | | | |
|-----------------|---------------|---------|--------|---------------|---------|---------|---------|-------------|---------|---------------|---------|---------|---------|
| Lunation: | 123678 | 123679 | 123680 | 123681 | 123682 | 123683 | 123671 | 123672 | 123673 | 123674 | 123675 | 123676 | 123677 |
| Month Number: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
| Month Name: | Nisan | Iyar | Sivan | Tammuz | Av | Elul | Tishrei | Cheshvan | Kislev | Tevet | Shevat | Adar | Adar 2 |
| Minutes Apart: | +1122.2 | +1029.2 | +985.1 | +999.0 | +1065.2 | +1166.7 | +1279.0 | +1376.8 | +1435.9 | +1440.1 | +1385.6 | +1284.6 | +1201.4 |
| Hours Apart: | +18.70 | +17.15 | +16.42 | +16.65 | +17.75 | +19.44 | +21.32 | +22.95 | +23.93 | +24.00 | +23.09 | +21.41 | +20.02 |
| Maximum: | +24.00 | | | | | | | | | | | | |
| Minimum: | | | | | | | | | | | | | |
| Span: | | | | | | | | 7.58 | | | | | |
| Middle: | | | | | | | | | | | | | |
| Average: | | | | | | | | | | | | | |
| Average Adjust: | -1.5 | -3.1 | -3.8 | -3.6 | -2.5 | -0.8 | +1.1 | +2.7 | +3.7 | +3.8 | +2.9 | +1.2 | -0.2 |

