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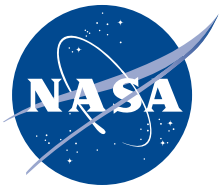

On the Relationship Between Solar Wind Speed, Earthward-Directed Coronal Mass Ejections, Geomagnetic Activity, and the Sunspot Cycle Using 12-Month Moving Averages

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June 2008

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LIST OF ACRONYMS AND SYMBOLS

AU	astronomical unit
CME	coronal mass ejection
IMF	interplanetary magnetic field
IP	interplanetary
LASCO	the Large Angle and Spectrometric Coronagraph experiment
LP	long period
mma	monthly moving average
nT	nano Tesla
SOHO	Solar and Heliospheric Observatory
SP	short period
TP	Technical Publication

NOMENCLATURE

aa	the *aa* geomagnetic index
aa_I	the residual or following recurrent component of *aa*
aa_Im	the minimum value of the 12-mo moving average of aa_I
aa_IM	the maximum value of the 12-mo moving average of aa_I
aa_Im'	a specific geomagnetic index
aam	the minimum value of the 12-mo moving average of *aa*
aam^*	the minimum value of *aa* in the vicinity of *Rm*
aam'	a specific geomagnetic index
aaM	the maximum value of the 12-mo moving average of *aa*
aaM^*	the maximum value of *aa* during the decline of a sunspot cycle
aa_R	the leading sporadic component of *aa*
ASC	the ascent duration in months
Ap	a specific geomagnetic index
Ci	a specific geomagnetic index
cl	confidence level
$E(aam)$	the epoch of occurrence of *aam*
$E(aam^*)$	the epoch of occurrence of aam^*
$E(aaM)$	the epoch of occurrence of *aaM*
$E(aaM^*)$	the epoch of occurrence of aaM^*
$E(aa_Im)$	the epoch of occurrence of aa_Im

NOMENCLATURE (Continued)

$E(aa_I M)$	the epoch of occurrence of $aa_I M$
$E(N_{H+PH}m)$	the epoch of occurrence of $N_{H+PH}m$
$E(N_{H+PH}M)$	the epoch of occurrence of $N_{H+PH}M$
$E(Rm)$	the epoch of occurrence of Rm
$E(RM)$	the epoch of occurrence of RM
$E(vm)$	the epoch of occurrence of vm
$E(vM)$	the epoch of occurrence of vM
n	number
N_{CME}	the number of coronal mass ejection events
N_{H+PH}	the number of halo and partial halo events
$N_{H+PH}m$	the minimum value of the 12-mo moving average of N_{H+PH}
$N_{H+PH}M$	the maximum value of the 12-mo moving average of N_{H+PH}
P	probability
PER	period in months
r	coefficient of correlation
r^2	coefficient of determination
R	sunspot number
Rm	the minimum value of the 12-mo moving average of R
RM	the maximum value of the 12-mo moving average of R
$Rmax$	the maximum sunspot amplitude
se	standard error of estimate

NOMENCLATURE (Continued)

$t(1)$	the time in months between $E(RM)$ and $E(aaM^*)$
$t(2)$	the time in months between $E(aaM^*)$ and the following cycle's $E(Rm)$
$t(3)$	the time in months between $E(aaM^*)$ cycle n and $E(aaM^*)$ cycle $n+1$
$t(4)$	the time in months between $E(aaM^*)$ cycle n and $E(aam^*)$ cycle $n+1$
$t(5)$	time in months between $E(RM)$ cycle n and $E(aam^*)$ cycle $n+1$
$t(6)$	the time in months between $E(Rm)$ and $E(aam^*)$
$t(7)$	the time in months between $E(aam^*)$ and $E(RM)$
$t(8)$	the time between $E(aam^*)$ cycle n and $E(aam^*)$ cycle $n+1$
v	the solar wind speed (velocity)
vm	the minimum value of the 12-mo moving average of v
vM	the maximum value of the 12-mo moving average of v
x	the independent variable
y	the dependent variable (the regression equation)

TECHNICAL PUBLICATION

ON THE RELATIONSHIP BETWEEN SOLAR WIND SPEED, EARTHWARD-DIRECTED CORONAL MASS EJECTIONS, GEOMAGNETIC ACTIVITY, AND THE SUNSPOT CYCLE USING 12-MONTH MOVING AVERAGES

1. INTRODUCTION

About 30 years ago, on the basis of the *Ci* index, N.P. Chirkov[1] suggested that the solar wind velocity and geomagnetic activity were both correlated with solar activity. In particular, Chirkov found that the geomagnetic activity maximum lagged about 1.5–2 yr behind the solar activity maximum in odd-numbered cycles and 2–5 yr in even-numbered cycles, attributing the increased geomagnetic activity during the declining portion of a solar cycle to the presence of coronal holes, the source for recurrent, high-speed, solar wind streams.[2–4] Furthermore, Chirkov noted that the range of variations in geomagnetic activity was greater in even-numbered cycles rather than in odd-numbered cycles (as evinced by the ratio of maximum to minimum values in geomagnetic activity), and he went on to predict that cycle 21 should have its maximum in solar wind velocity in 1980–1982, and cycle 22 should have its maximum in 1995–1996 and should be single-peaked.

To describe the late-occurring geomagnetic peak in solar cycles, Feynman[5] suggested decomposing the *aa* geomagnetic index into two specific components—the leading sporadic component (that portion associated directly with solar activity, as described using sunspot number, denoted here as aa_R) and the residual or following recurrent component (that portion that remains, having removed the sporadic component, denoted here as aa_I, which equals $aa–aa_R$). Soon thereafter, Sargent[6] developed a simple index based on half-day values of the *aa* index to describe the following recurrent component, calling it the 27-day recurrence index, where higher values of the index indicate the presence of both high-speed streams and coronal holes, and lower values indicate the lack of both high-speed streams and coronal holes. Sargent went on to state, on the basis of describing sunspot cycles using 12-mo moving averages of monthly mean sunspot number, that the onset of recurrent activity is generally abrupt and that the termination of recurrent activity is almost as abrupt as at onset, but occurs about 1 yr into the new cycle, and that during odd-numbered cycles the recurrent state lasts about 1.5–3 yr, while lasting about 3–5 yr during even-numbered cycles.

Russell and Mulligan[7] suggested that the long-term variation of geomagnetic activity might be caused by a long-term variation in the solar wind velocity, the solar wind density, or the interplanetary magnetic field (IMF). Gazis et al.[8] found a correlation ($r = 0.8$) between solar wind speed and the *Ap* geomagnetic index (when the coverage was greater than or equal to 85%). Crooker and McAllister,[9] Watari and Watanabe,[10] and Richardson, Cliver, and Cane[11] found that coronal mass ejections (CMEs) also contribute to the overall geomagnetic activity during the solar cycle.

Rangarajan and Barreto[12] examined long-term variations in the solar wind velocity and IMF intensity, noting that solar wind speed maximizes about 22 mo after solar maximum and minimizes about a year after solar minimum, with no apparent relationship existing between the amplitude of sunspot number *R* and solar wind speed *v*. Richardson, Cane, and Cliver[13] showed that high-speed streams account for about two-thirds of the long-term *aa* averages at solar minimum, while at solar maximum, structures associated with transients account for about half of the long-term *aa* averages.

In this Technical Publication (TP), the relationship between solar wind speed, geomagnetic activity (the *aa* index), and the solar cycle is reexamined using 12-mo moving averages, where the solar wind speed is determined using the Omni merged 1-hr 1 AU interplanetary (IP) data <http://cdaweb.gsfc.nasa.gov/>. This study, the second in a two-part study, expands upon our previous study using annual averages.[14] Also examined is the relationship between earthward-directed CMEs and the solar wind speed and geomagnetic/solar cycle, where the earthward-directed CMEs are the halo and partial halo events extracted from the SOHO/LASCO CME catalog, <http://cdaw.gsfc.nasa.gov/CME_list/>.

2. RESULTS AND DISCUSSION

2.1 Behavioral Characteristics During Cycle 23 (1996–2006)

Figure 1 displays the variations of (a) sunspot number R, (b) the *aa* geomagnetic index, (c) the number of halo and partial halo CMEs N_{H+PH}, and (d) solar wind speed v in km s^{-1} for the interval January 1996–December 2006, essentially covering all of sunspot cycle 23. For R, *aa*, and v, plotted are the monthly means (the thin jagged lines) and the 12-mo moving averages (the thick smoothed lines), and for N_{H+PH}, plotted are the observed monthly counts (the thin jagged line) and the 12-mo moving average counts (the thick smoothed line). For each parameter, the minimum and maximum values and their dates of occurrence are identified. Thus, based on the 12-mo moving averages, $Rm = 8.0$ (May 1996), $RM = 120.8$ (April 2000), $aam = 15.8$ (September/October 1997), $aaM = 38.0$ (August 2003), $N_{H+PH}m \leq 1.3$ (on or before July 1996), $N_{H+PH}M = 18.0$ (November 2000), $vm = 376.4$ km s^{-1} (October 1997) and $vM = 547.1$ km s^{-1} (August 2003).

Halo and partial halo events are those earthward-directed CMEs as determined using the C2-telescope of the Large Angle and Spectrometric Coronagraph (LASCO) onboard the Solar and Heliospheric Observatory (SOHO). Of the 11,618 events listed in the SOHO/LASCO CME catalog (1996–2006), 393 events were described as halo CMEs and 811 events were described as being possibly partial halo CMEs; one infers at least 1,204 possible earthward-directed CMEs (or about 10.4% of all cataloged CMEs). For the interval 1996–2006, coverage averaged 86.3%; one infers that the corrected numbers might be as much as 15.9% higher. Table 3 in the appendix lists the monthly counts of each grouping of CMEs, the cumulative downtime in minutes for LASCO, and the percent coverage for each month January 1996–December 2006 and annually 1996–2006.

Solar wind speeds are based on the average minimum and maximum daily solar wind speeds for each month (liken to the computation of mean temperature on Earth <http://climate.arm.ac.uk/calibrated.html>). As an example, on January 1, 1996, solar wind speeds were recorded for each hour of the day, having a maximum of 423 km s^{-1} and a minimum of 387 km s^{-1}, thereby inferring an average of the extremes of 405 km s^{-1}. Observations are available for each day of the month, covering 704 hr (94.6% coverage). The average of the daily maximum-minimum averages, weighted according to the number of hours of daily observation, was 427.0 km s^{-1}, and this value represents the weighted-average solar wind speed for January 1996 that is plotted in figure 1. Table 4 in the appendix lists the monthly weighted solar wind speed in km s^{-1}, and the cumulative hours of observation and the percent coverage for each month January 1964–July 2007 and annually 1996–2006.

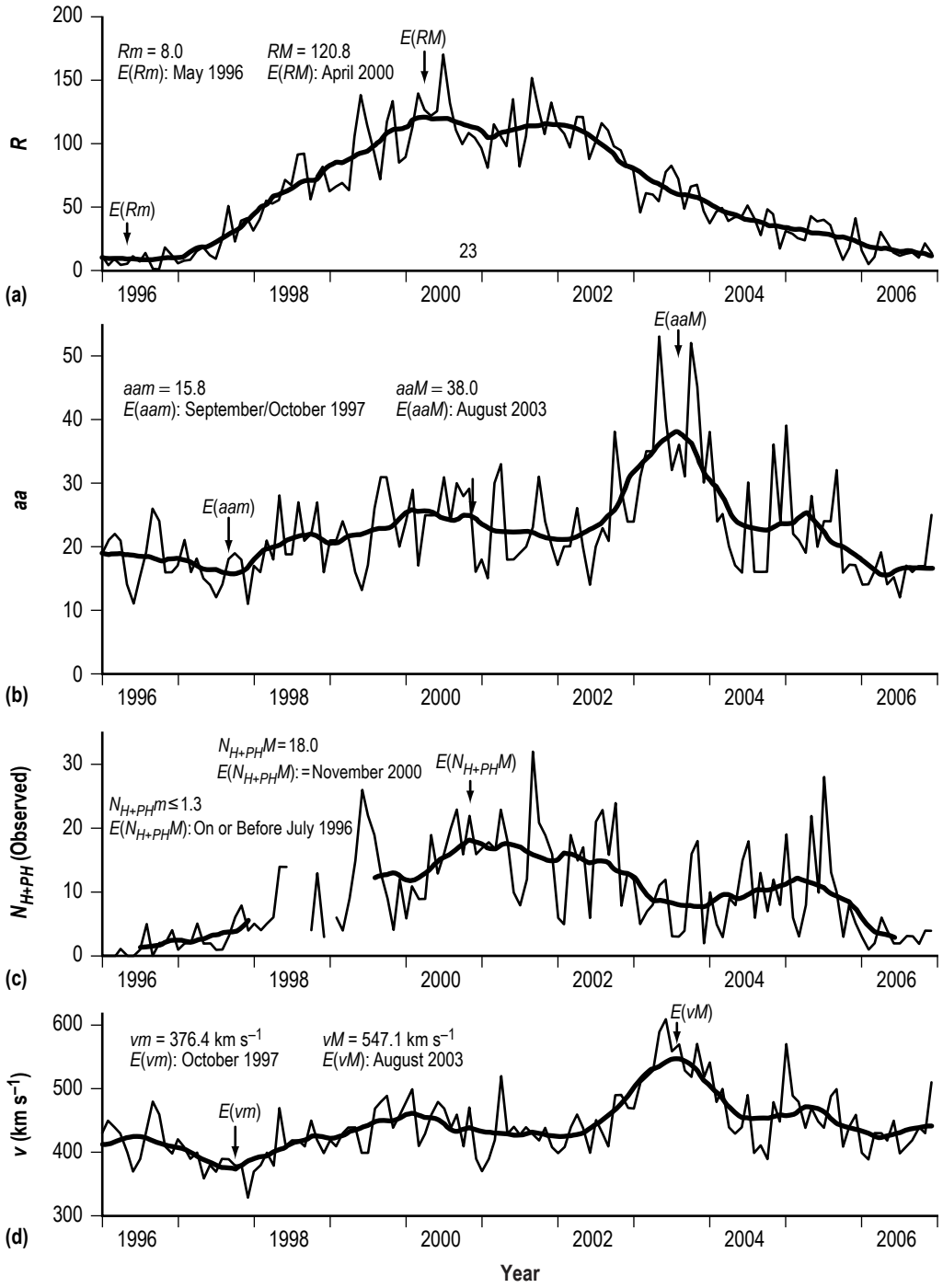

Figure 1. Variation of sunspot number R (panel (a)), the *aa* geomagnetic index (panel (b)), the number of halo and partial halo CMEs N_{H+PH} (panel (c)) and solar wind speed v in km s^{-1} (panel (d)) for the interval January 1996–December 2006. See text for details.

Plainly, for cycle 23, an odd-numbered cycle, the maximum of geomagnetic activity (*aaM*) follows maximum sunspot amplitude (*RM*) by 40 mo (3.3 yr), coinciding with the maximum in solar wind speed (*vM*) and not the maximum in earthward-directed CMEs ($N_{H+PH}M$). Such a finding is in contrast to that noted earlier by Chirkov, whose previous studies suggested that odd-numbered cycles had geomagnetic peaks about 1.5–2 yr after sunspot maximum. The observed *aaM* is the highest ever recorded and the ratio of *aaM* to *aam* is 2.4, indicating a 140% increase in geomagnetic activity from *aam* to *aaM*. Recall also that Chirkov previously had noted that odd-numbered cycles had a smaller range of variation (maximum to minimum) as compared to even-numbered cycles, typically 60–80%. Clearly, the variation observed in cycle 23 has been much more robust and is in stark contrast to that described by Chirkov. The simultaneous peaking of *aaM* and *vM* some 40 mo after *Rmax* is also in contrast to that reported by Rangarajan and Barreto, who stated that solar wind speed maximizes about 22 mo after solar maximum.

Figure 2 shows the variation of the residual or following recurrent component aa_I for the same time interval (January 1996–December 2006), where the aa_I component is determined as $aa - aa_R$ (the leading sporadic component). The thin line represents the monthly mean value of aa_I, and the thick line is its 12-mo moving average. The value of aa_Im equals 8.3 (September–October 1997), occurring some 16–17 mo after *Rm* and occurring simultaneously with *aam* and *vm*, and the value of aa_IM equals 28.9 (August 2003), occurring simultaneously with *aaM* and *vM*. The ratio aa_IM to aa_Im measures about 3.5. Table 5 in the appendix lists the monthly mean and 12-mo moving averages for *R*, *aa*, and aa_I for July 1868–present and lists the ratio aa_I/aa. (Monthly values of *aa* prior to 1957 were adjusted by adding 3 nT to the observed value, in order to compensate for movements of the magnetometers used in determination of the monthly *aa* value.[15,16] The value of $aa_I = aa - aa_R$, where $aa_R = 6.3 + 0.0462\ R$, based on the scatter plot of monthly mean adjusted *aa* values versus *R* for the interval January 1868–the present, this line being established by the *aa* and *R* points for February 1880 and June 1999. It should be noted that a stronger relationship between monthly mean adjusted *aa* and *R* would result if a different binning technique were employed.[17])

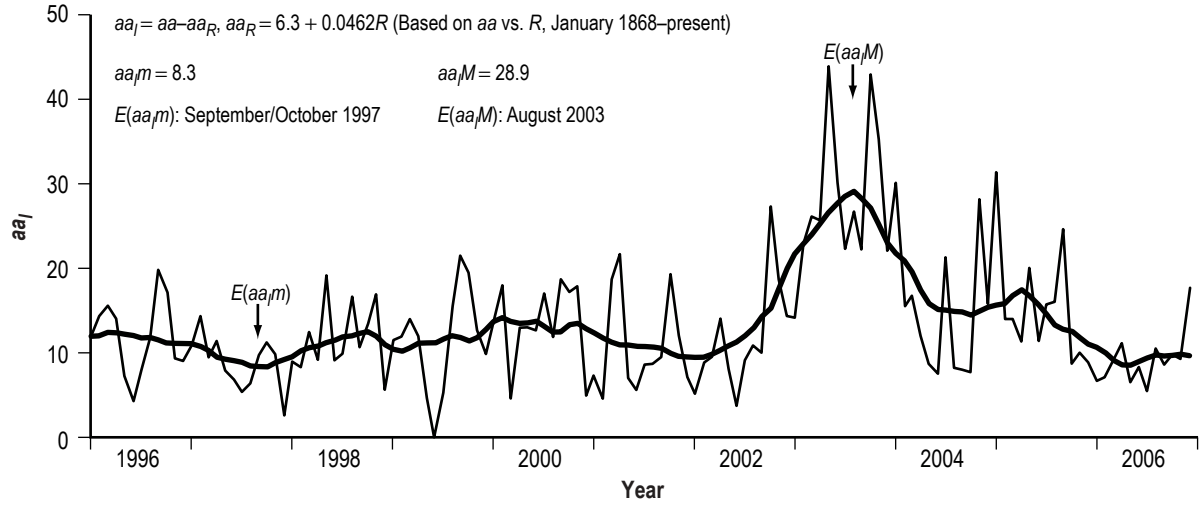

Figure 2. Variation of the residual or following recurrent component aa_I for the interval January 1996–December 2006.

Figure 3 depicts the ratio aa_I/aa (using the 12-mo moving averages) for the interval January 1996–December 2006. For cycle 23, this ratio always exceeded 45%, having a minimum (45%) near the end of 2001 and a maximum (76%) in mid 2003 (concurrent with aa_IM). Thus, for cycle 23, the residual or following recurrent component contributed nearly half or more to the overall *aa* value (with only 13 mo having a ratio less than 0.50), and accounted for two-thirds to three-fourths of the overall *aa* value between 2003 and 2005. Hence, it is inferred that high-speed streams have been the major cause of the increased geomagnetic activity, especially during the interval 2003–2005.

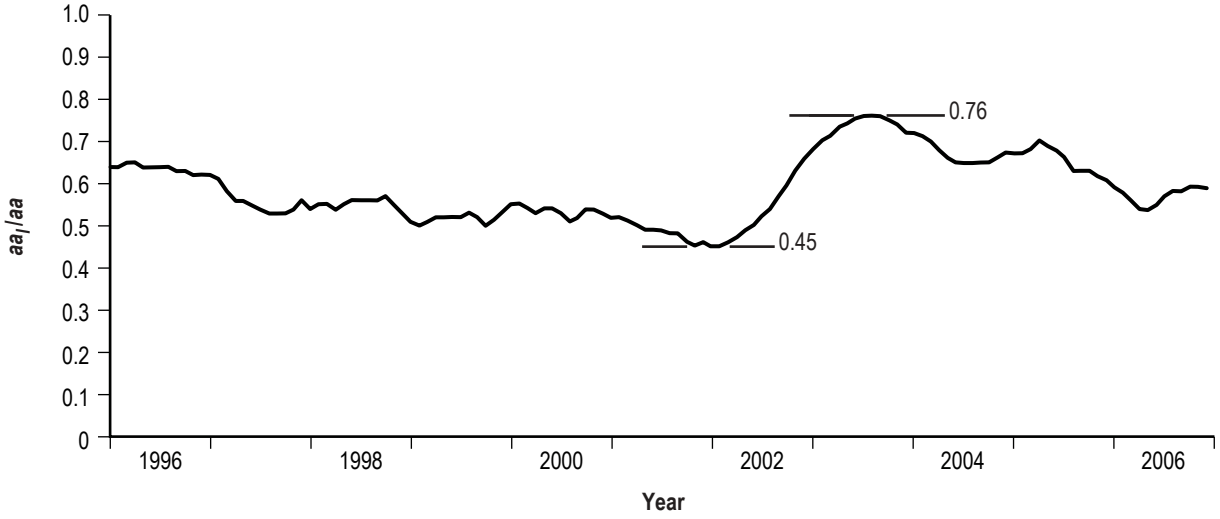

Figure 3. The ratio aa_I/aa (using the 12-mo moving averages) for the interval January 1996–December 2006.

Figure 4 displays the scatter plot of the monthly values/counts for N_{H+PH} versus R for the interval January 1996–December 2006, except July–September 1998 and January 1999, when no observations were reported by SOHO/LASCO. Plainly, as sunspot activity increases (or decreases), the number of earthward-directed CMEs increases (or decreases). The line passing through the scatter points is the inferred regression, having $r = 0.679$ and $se = 5.4$. Hence, nearly half (46%) of the variance in the observed counts of N_{H+PH} can be explained by the variation in the monthly mean value of R alone. Interestingly, for the 12 mo having $R<10$, N_{H+PH} spanned 0–3, averaging about one earthward-directed CME per month (four of the months had no halo/partial halo CMEs, four had one halo/partial halo CME, three had two halo/partial halo CMEs, and one had three halo/partial halo CMEs). Thus, even near sunspot minimum, earthward-directed CMEs can still occur (two-thirds of the time). For the 29 months having $R>100$, N_{H+PH} spanned 4–32, averaging about 16 earthward-directed CMEs per month.

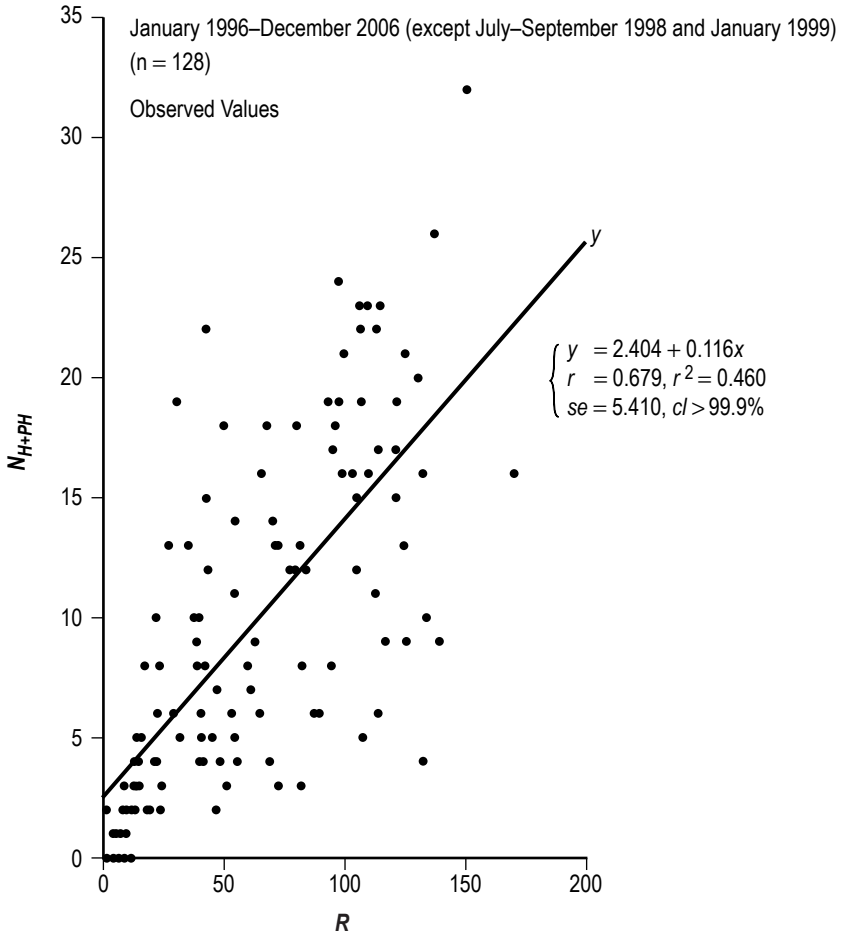

Figure 4. Scatter plot of N_{H+PH} versus R (January 1996–December 2006).

Obviously, a comparison of 12-mo moving averages for the various parameters plotted in figures 1 and 2 should reveal close associations between aa_I, aa, and v and between N_{H+PH} and R. Table 1 shows the results of correlation analysis. Indeed, the results are highly significant statistically. The inferred regression between v and aa_I is given by $v = 344.4 + 7.335\ aa_I$, having $r = 0.931$ (inferring that nearly 87% of the variance in v can be explained simply by the variation in aa_I alone, or vice versa). Almost as strong is the inferred regression between v and aa; that is, the combined sporadic and recurrent components. Its inferred relationship is given by $v = 294.1 + 6.599\ aa$, having $r = 0.916$ (inferring that about 84% of the variance in v can be simply explained by the variation in aa alone, or vice versa). The inferred regression between N_{H+PH} and R is given by $3.4 + 0.107\ R$, having $r = 0.870$ (inferring that more than 75% of the variance in N_{H+PH} can be simply explained by the variation in R alone, or vice versa). The inferred regressions between N_{H+PH} and aa, v, or aa_I are considerably weaker and can only explain, respectively, about 11, 4, and 3% of the variance, or vice versa. The inferred regression between v and R can only explain about 3% of the variance, or vice versa. Thus, solar wind speed is strongly associated with the aa geomagnetic index, particularly the following recurrent component aa_I, and the number of earthward-directed CMEs is strongly associated with sunspot number R.

Table 1. Correlative results based on smoothed values (1996–2006).

Regression	*r*	*se*	*cl*	*n*
$aa_I = -5.9 + 0.857\ aa$	0.938	1.6	>>99.9	132
$v = 344.4 + 7.335\ aa_I$	0.931	13.5	>>99.9	132
$v = 294.1 + 6.599\ aa$	0.916	15.1	>>99.9	132
$N(H+PH) = 3.4 + 0.107\ R$	0.870	2.5	>>99.9	101
$N(H+PH) = 3.3 + 0.302\ aa$	0.336	4.7	>99.9	101
$N(H+PH) = -1.2 + 0.026\ v$	0.205	4.7	>95	101
$v = 431.9 + 0.176\ R$	0.184	36.8	>95	132
$N(H+PH) = 6.1 + 0.411\ aa_I$	0.177	11.9	<95	101

Figure 5 compares the variation of 12-mo moving averages of (a) *aa*, (b) *v* and (c) percent coverage of solar wind observations for the interval 1964–2006. Identified in the figure are the occurrences of *Rm* and *RM* for cycles 20–23. As previously noted, the inferred regression between *v* and *aa* is extremely well correlated for the interval 1996–2006. For the entire interval 1964–2006, the inferred regression, while remaining quite strong, is observed to be slightly weaker (*r* is reduced from 0.916 to 0.734 and *se* increased from 15.1 to 24.0), obviously due to the poor coverage of solar wind speed prior to 1995. Even so, there is extremely close correlation between the parameters, with the general behavior of bumps and dips occurring simultaneously in both data sets. (Because of the strong correlation between aa_I and *aa*, a similar plot (not shown) is found comparing *v* and aa_I.)

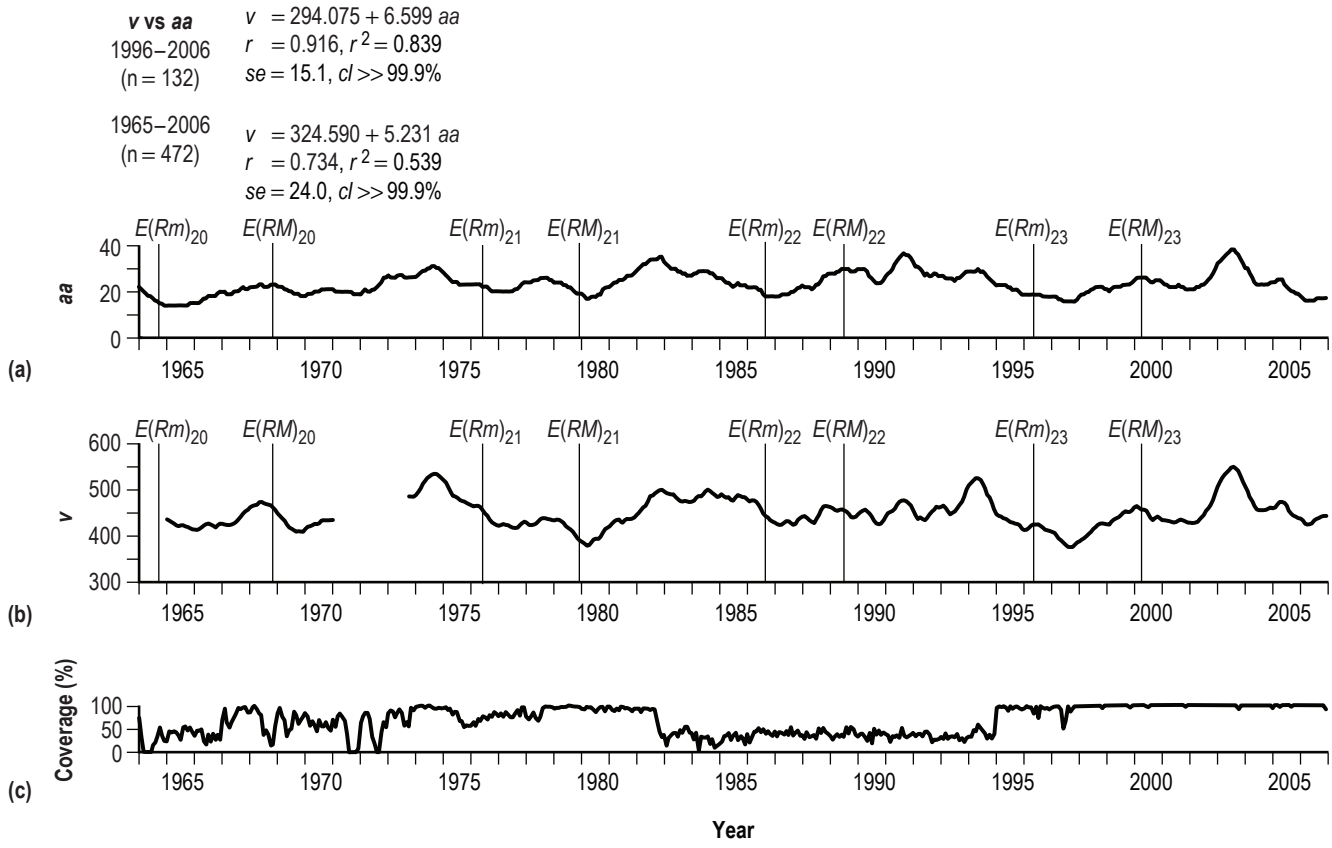

Figure 5. Variation of (a) *aa*, (b) *v*, and (c) coverage for the interval January 1964–December 2006.

2.2 Cyclic and Predictive Aspects of the Sunspot/Geomagnetic Record (1868–2006)

Figures 6–12 display the 12-mo moving averages of the adjusted-*aa* index for the entire interval July 1868–December 2006, where values (see table 5 in the appendix) of the *aa*-index prior to 1957 have been increased by 3 nT to account for changes in the repositioning of the magnetometers used for the determination of the *aa*-index value.[15–16] In each chart the occurrences and values of *Rm*, *RM*, *aam*, and *aaM* (and occasional alternate values *aam′* and *aaM′*) are easily identified. In figure 6, for instance, for cycle 11 (panel (a)), its *aam* could not be determined, probably being ≤21.6 and occurring before July 1868. Its *aaM* (panel (b)) measured 27.4, occurring in August 1872, some 2 yr after *RM*. Cycle 12 had its *aam* (9.7) in January 1879 (panel (b)), following *Rm* by 1 mo. In contrast to cycle 11, cycle 12's *aaM* (26.8) (panel (c)) occurred 15 mo prior to its *RM*, although a slightly smaller *aaM′* (23.7) occurred in August 1886, some 32 mo after *RM*. Similar behavior occurred in cycle 13 (fig. 7). All other cycles had their *aaM* after *RM*, without exception. Generally speaking, *aam* almost always has occurred in the vicinity of *Rm*, with only one exception—cycle 21, which had its *aam* (17.2) in April 1980, very near its *RM* (December 1979) (see fig. 10(b) and 11(a)). A slightly larger *aam′* (19.6) occurred in December 1976/January 1977 near *Rm* (June 1976)). Cycle 23 (fig. 11 (b) and 12)) had its *aam* (15.8) in September/October 1997, some 16–17 mo after *Rm* (May 1996), and its *aaM* (38.0), the highest on record, in August 2003, some 40 mo after *RM* (April 2000). A smaller secondary peak (25.3) is seen in April 2005. (The lowest value that has been seen to date during the decline of cycle 23 is 14.9 in July 2007, but this value surely will be eclipsed in time, because *Rm* for cycle 24 has not yet occurred.[18] The 12-mo moving average for *R* continues to decrease with time, measuring 5.9 in September 2007.)

From figures 6–12, one can construct table 2, which gives observed values for a number of parameters, including *Rm*, *RM*, *aam**, and *aaM** (and their occurrence dates), where *aam** is the minimum *aa* value in the vicinity of sunspot minimum and *aaM** is the maximum *aa* value between sunspot maximum and succeeding sunspot minimum. Also given are a number of timing signatures (in months), determined from the occurrence dates, including *ASC*, *PER*, and *t*(1)–*t*(8), defined according to the note at the bottom of the table.

Table 2. Selected parametric values (cycles 11–23).

Cycle	*Rm*	*E*(*Rm*)	*RM*	*E*(*RM*)	*aam**	*E*(*aam**)	*aaM**	*E*(*aaM**)	*ASC*	*PER*	*t*(1)	*t*(2)	*t*(3)	*t*(4)	*t*(5)	*t*(6)	*t*(7)	*t*(8)
11	5.2	03-1867	140.5	08-1870	–	–	27.4	08-1872	41	141	24	76	168	77	101	–	–	–
12	2.2	12-1878	74.6	12-1883	9.7	01-1879	23.7	08-1886	60	135	32	43	94	48	80	1	59	139
13	5.0	03-1890	87.9	01-1894	13.6	08-1890	23.9	06-1894	46	142	5	91	199	87	92	5	41	133
14	2.6	01-1902	64.2	02-1906	8.9	09-1901	22.2	01-1911	49	139	59	31	95	32	91	–4	53	144
15	1.5	08-1913	105.4	08-1917	11.2	09-1913	27.4	12-1918	48	120	16	56	137	70	86	1	47	133
16	5.6	08-1923	78.1	04-1928	12.4	10-1924	32.0	05-1930	56	121	25	40	161	49	74	14	42	116
17	3.4	09-1933	119.2	04-1937	16.2	06-1934	29.5	10-1943	43	125	78	4	98	18	96	9	34	130
18	7.7	02-1944	151.8	05-1947	19.3	04-1945	34.7	12-1951	39	122	55	28	102	40	95	14	25	120
19	3.4	04-1954	201.3	03-1958	19.9	04-1955	32.7	06-1960	47	126	27	52	171	60	87	12	35	122
20	9.6	10-1964	110.6	11-1968	13.8	06-1965	30.8	09-1974	49	140	70	21	99	28	98	8	41	139
21	12.2	06-1976	164.5	12-1979	19.6	01-1977	34.6	12-1982	42	123	36	45	105	49	85	7	35	120
22	12.3	09-1986	158.5	07-1989	17.5	01-1987	36.7	09-1991	34	116	26	56	143	73	99	4	30	129
23	8.0	05-1996	120.8	04-2000	15.8	10-1997	38.0	08-2003	47	–	40	–	–	–	–	17	30	–

Note: *aam** is the minimum value of *aa* in the vicinity of *E*(*Rm*). Cycle 21 actually had a later occurring *aam* = 17.2 at 04-1980. *aaM** is the maximum value of *aa* between *E*(*RM*) for cycle *n* and *E*(*Rm*) for cycle *n*+1. Cycle 12 and 13 actually had higher *aaM* values before *E*(*RM*) equal to 26.8 at 09-1882 and 27.1 at 07-1892, respectively. The *aam** value for cycle 14 is the last occurrence of 8.9; the same value was observed at 12-1900, 05- and 08-1901. The *aam** value for cycle 15 is the last occurrence of 11.2; the same value was observed was observed at 08-1913. The *aam** value for cycle 16 is the last occurrence of 12.4; the same value was observed at 09-1924. The *aaM** value for cycle 16 is the last occurrence of 32.0; the same value was observed at 04-1930. The *aam** value for cycle 20 is the last occurrence of 13.8; the same value was observed at 05-1965. The *aam** value for cycle 21 is the last occurrence of 19.6; the same value was observed at 12-1976. The *aam** value for cycle 22 is the last occurrence of 17.5; the same value was observed at 12-1986. The *aam** value for cycle 23 is the last occurrence of 15.8; the same value was observed at 09-1997. The lowest value of *aa* observed during the decline of cycle 23 is 15.5 at 04-2006. *ASC* is the ascent duration in months from *E*(*Rm*) to *E*(*RM*). *PER* is the cycle duration or period (in mo) between *E*(*Rm*) cycle n and *E*(*Rm*) cycle *n*+1. The *PER* for cycle 23 is presently unknown, but will be longer than 131 mo (*R* = 9.9 at 04-2007). *t*(1) is the time in months between *E*(*RM*) and *E*(*aaM**). *t*(2) is the time in months between *E*(*aaM**) and the following cycle's *E*(*Rm*). *t*(3) is the time in months between *E*(*aaM**) cycle *n* and *E*(*aaM**) cycle *n*+1. *t*(4) is the time in months between *E*(*aaM**) cycle *n* and *E*(*aam**) cycle *n*+1. *t*(5) is the time in months between *E*(*RM*) cycle *n* and *E*(*aam**) cycle *n*+1. *t*(6) is the time in months between *E*(*Rm*) and *E*(*aam**). *t*(7) is the time in months between *E*(*aam**) and *E*(*RM*). *t*(8) is the time between *E*(*aam**) cycle *n* and *E*(*aam**) cycle *n*+1. For cycle 23, *t*(8) is presently unknown, but will be longer than 114 months.

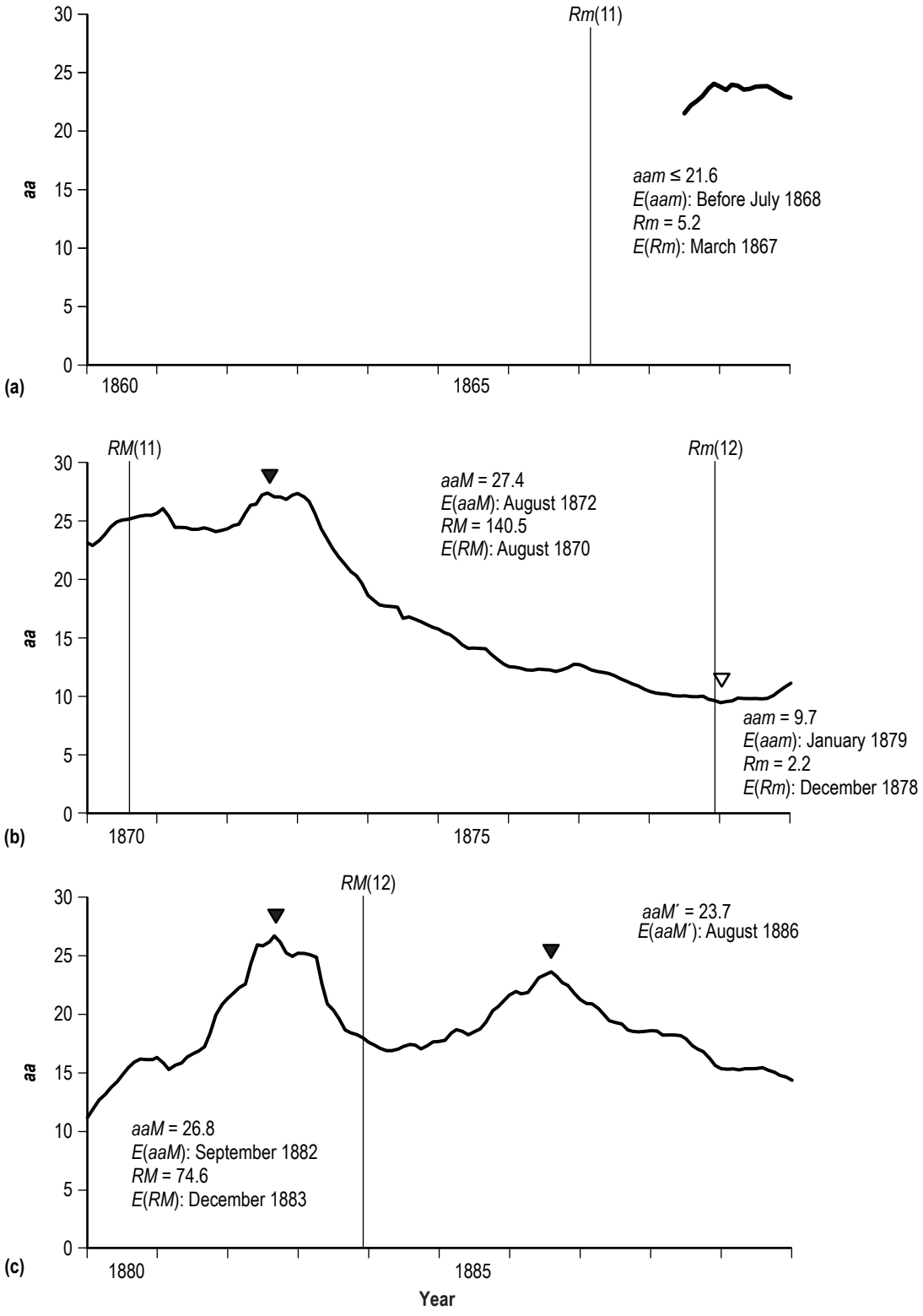

Figure 6. Variation of *aa* for the interval July 1868–January 1890: (a) Cycle 11 *aam*; (b) cycle 12 *aam*; (c) cycle 12 *aaM*.

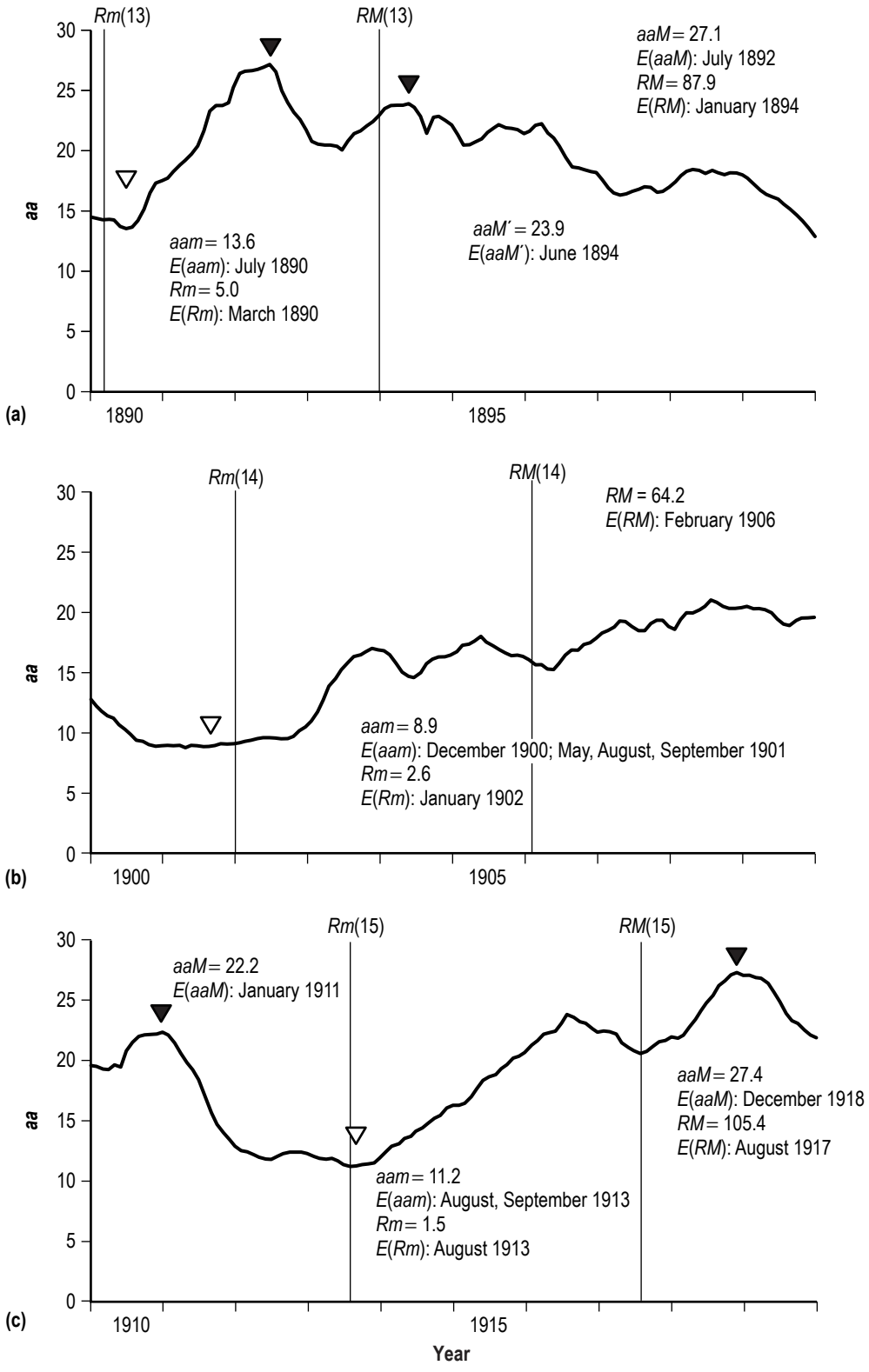

Figure 7. Variation of *aa* for the interval January 1890–January 1920: (a) Cycle 13 *aam*; (b) cycle 14 *aam*; (c) cycle 15 *aam* and *aaM*.

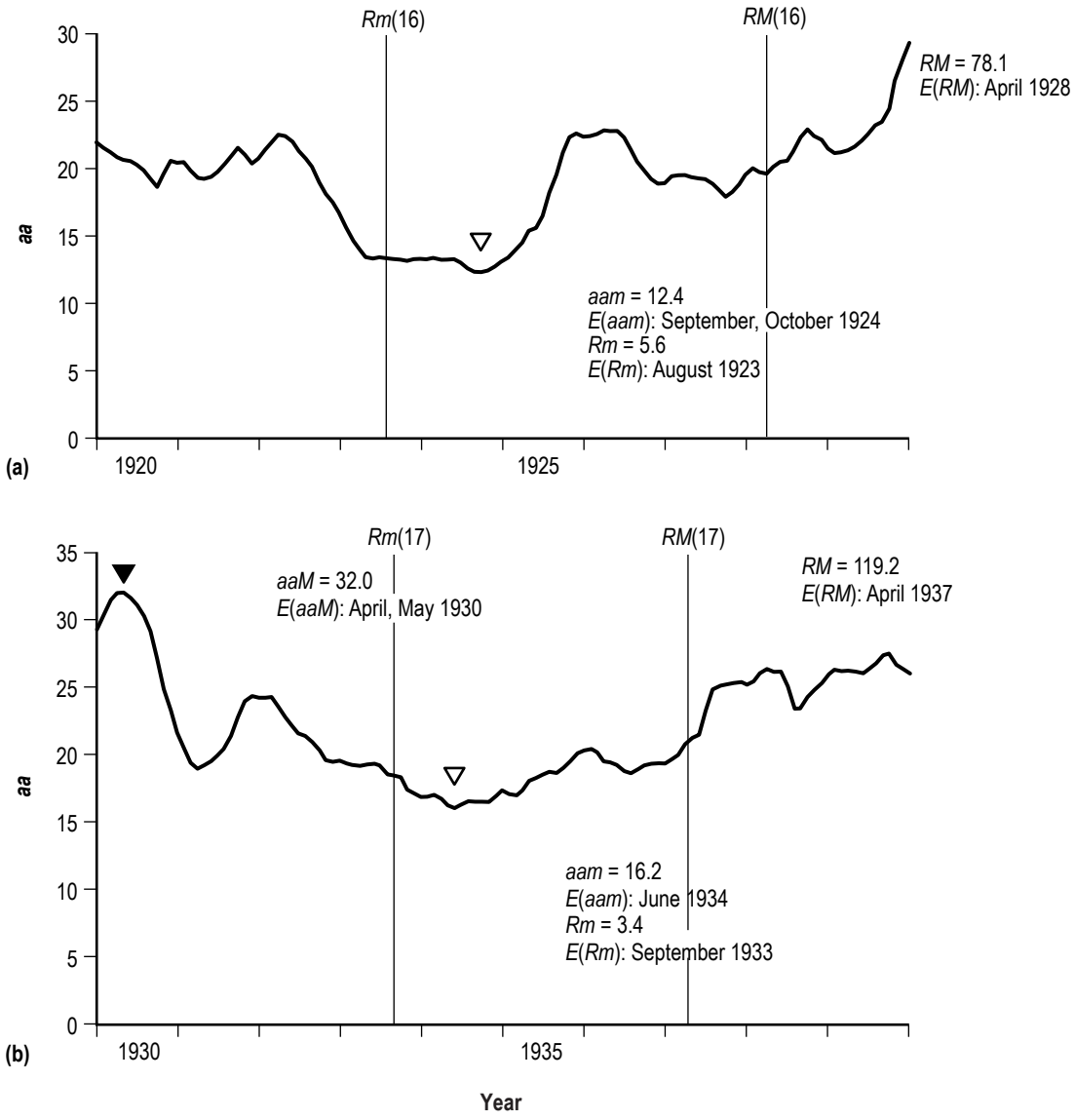

Figure 8. Variation of *aa* for the interval January 1920–January 1940: (a) Cycle 16 *aam*; (b) cycle 17 *aam*.

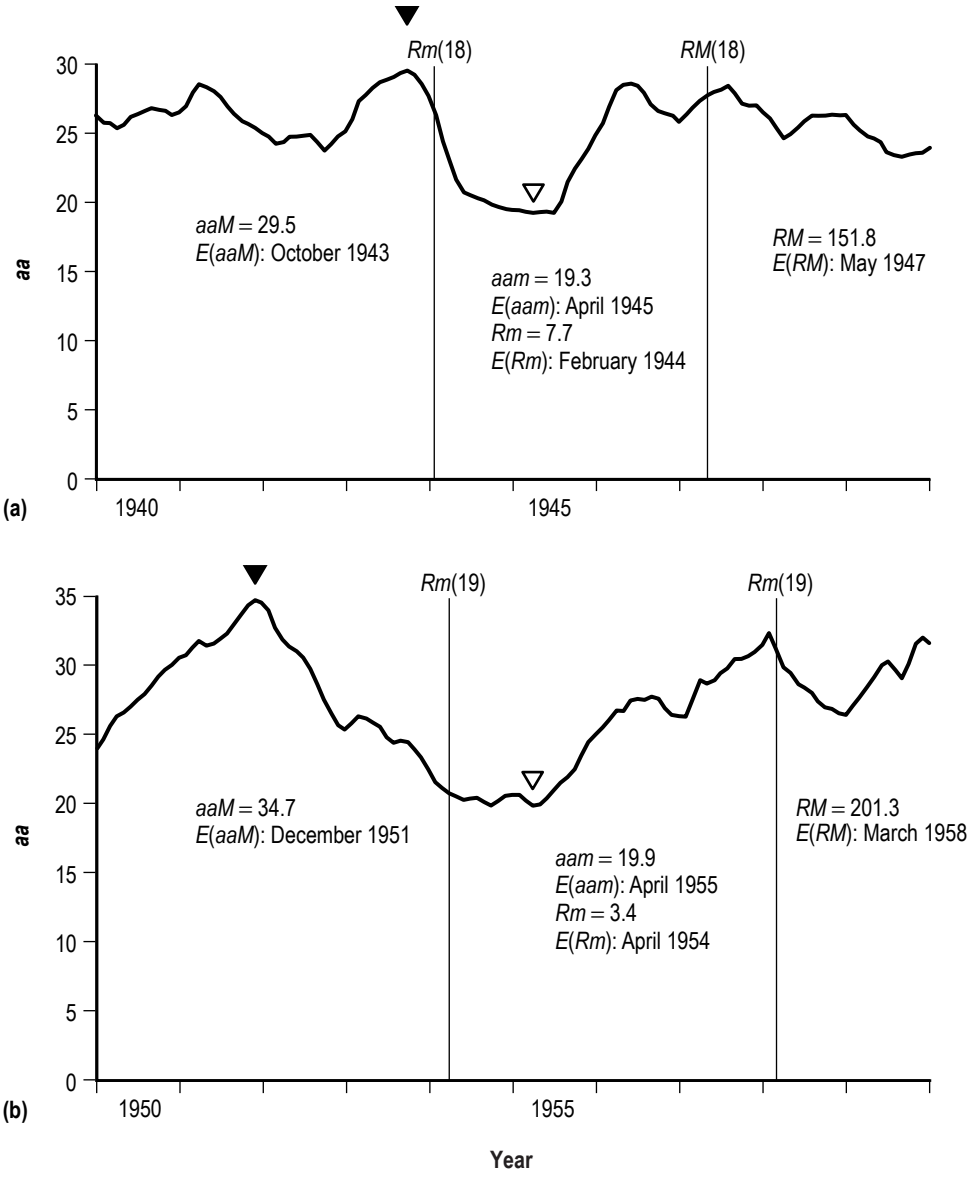

Figure 9. Variation of *aa* for the interval January 1940–January 1960: (a) Cycle 18 *aam*; (b) cycle 19 *aam*.

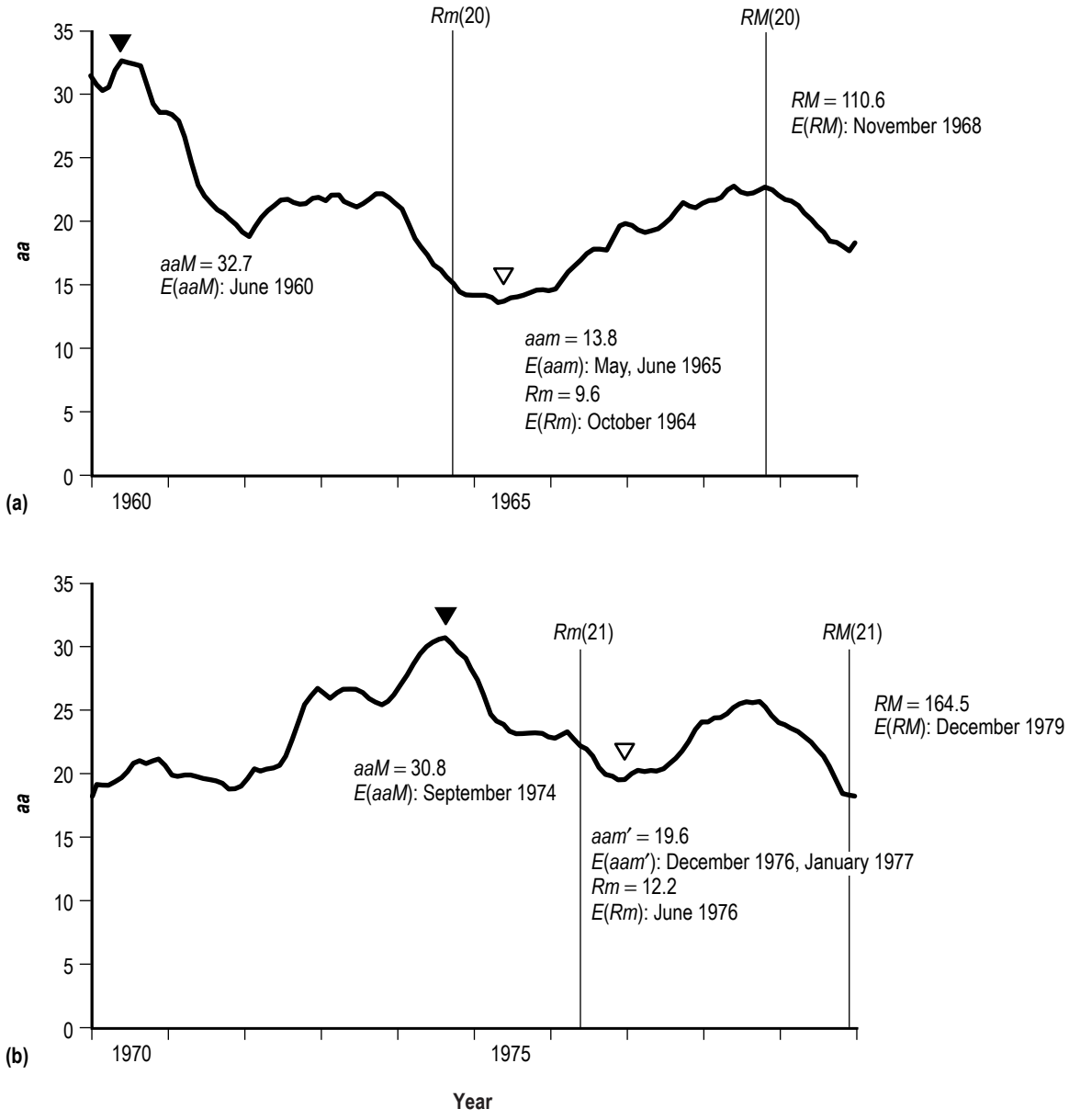

Figure 10. Variation of *aa* for the interval January 1960–January 1980: (a) Cycle 20 *aam*; (b) cycle 21 *aam′*.

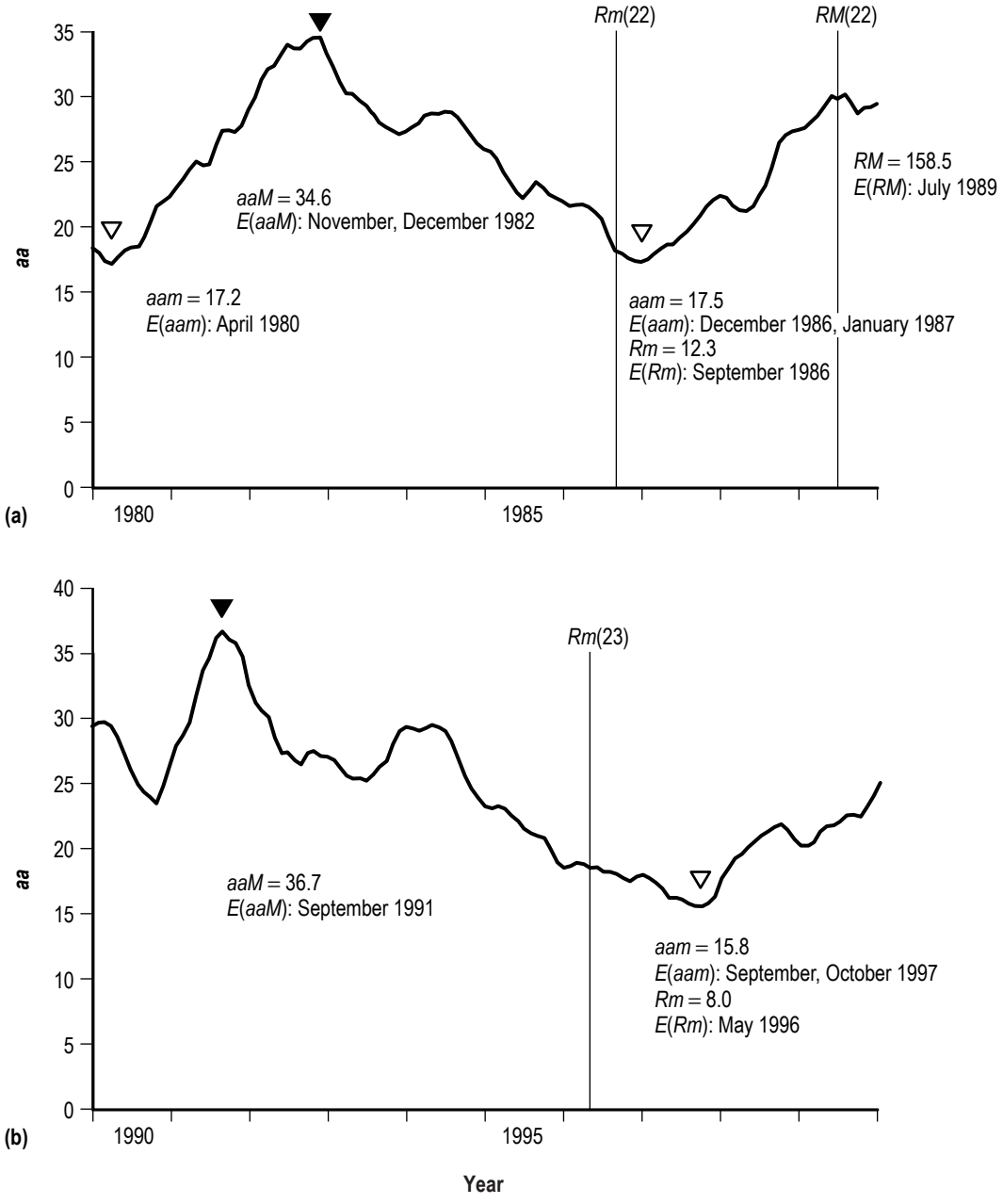

Figure 11. Variation of *aa* for the interval January 1980–January 2000: (a) Cycle 22 *aam*; (b) cycle 23 *aam*.

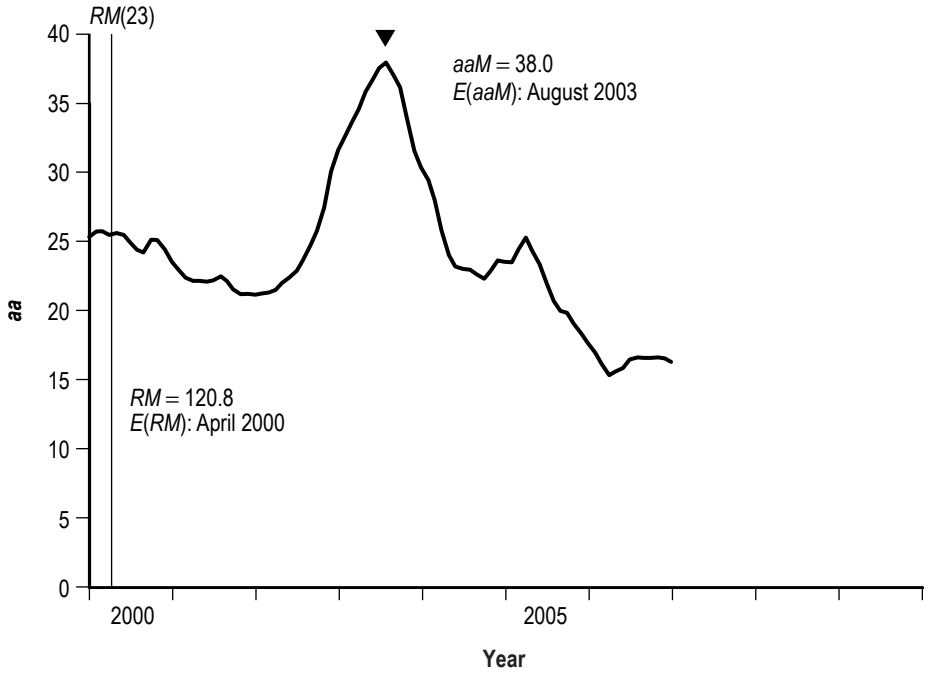

Figure 12. Variation of *aa* for the interval January 2000–January 2007.

Figures 13 and 14 provide a visual depiction of the parametric and timing values given for cycles 11–23 in table 2. For each of the parameters and timing signatures (except for *PER*), the median is given, as well as the means and standard deviations (in parentheses) for selected groupings of cycles (cycles 11–16, 17–23, and 11–23 and even- and odd-numbered cycles). Thus, for *Rm* and *RM*, their medians are, respectively, 5.2 and 119.2, and cycles of late (cycles 17–23) have had both higher *Rm* (8.1) and *RM* (146.7), on average, as compared to earlier cycles (3.7 and 91.8, cycles 11–16). Also, odd-numbered cycles have averaged 5.5 and 134.2 for *Rm* and *RM*, respectively, as compared to 6.7 and 106.3 for even-numbered cycles. Because of the Waldmeier effect,[19–23] a similar inverse behavior is seen in *ASC*; namely, cycles of late (cycles 17–23), on average, have risen from minimum to maximum amplitude more quickly (43 mo) than earlier cycles (50 mo, cycles 11–16). *ASC* for odd-numbered cycles has averaged 44.9 mo, as compared to 47.8 mo for even-numbered cycles. The differences in means[24] for the various groupings are not statistically important for *RM* or *ASC*, and runs testing[25] suggests that their values are distributed randomly. However, for *Rm*, although runs testing suggests a random distribution for it, the difference in means is statistically important for cycles of late as compared to earlier cycles, and linear correlation analysis suggests a statistically important increase in *Rm* with time, such that $Rm\ (24)_{90} = 10.8 \pm 4.7$, inferring only a 5% probability that cycle 24's *Rm* will exceed 15.5 or be smaller than 6.1. (Through September 2007, the 12-mo moving average of *R* equals 5.9, inferring that the occurrence of *Rm* is most imminent.)

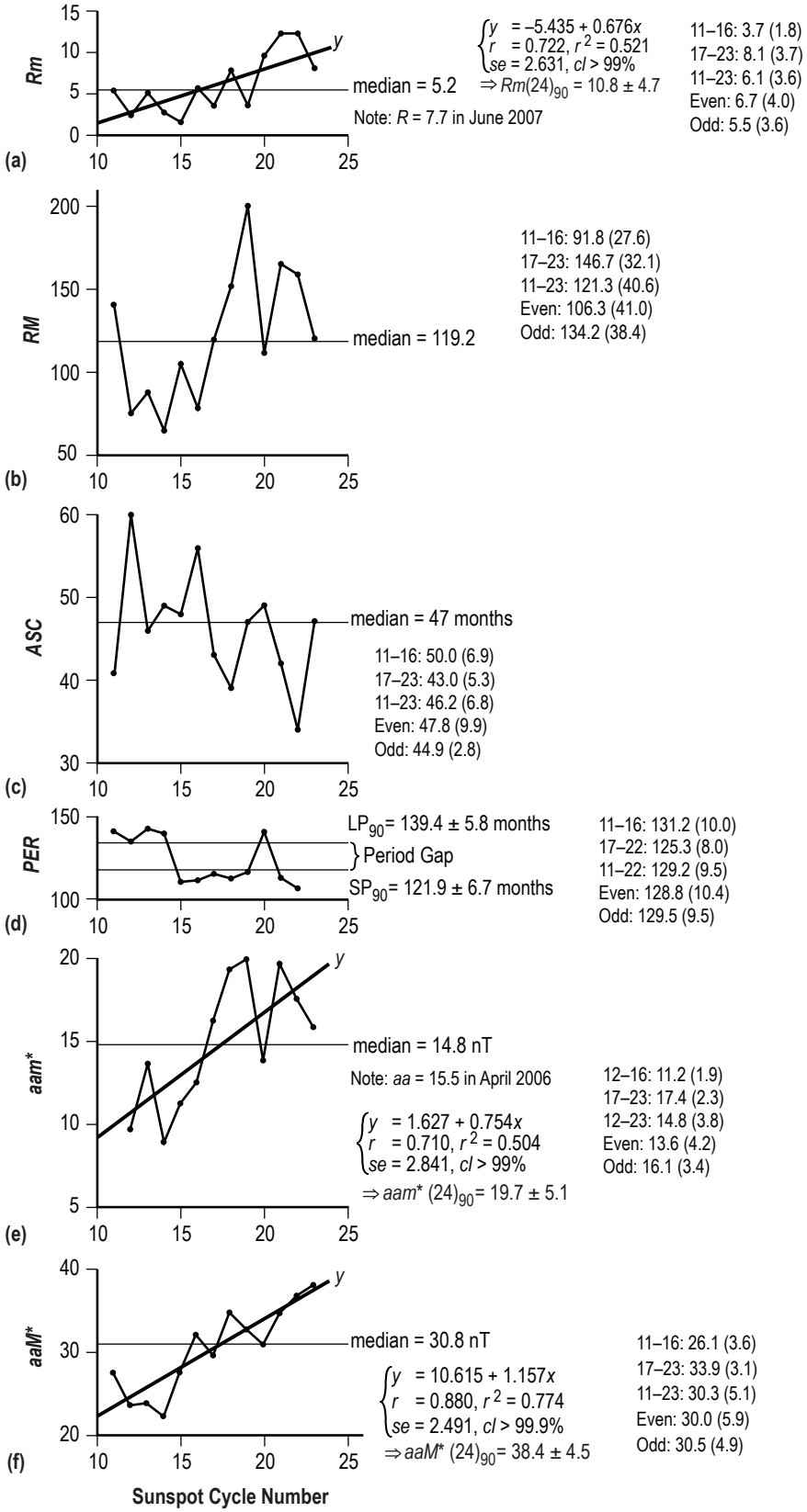

Figure 13. Variation of selected parametric values for cycles 11–23: (a) *Rm*; (b) *RM*; (c) *ASC*; (d) *PER*; (e) *aam**; (f) *aaM**. See text for details.

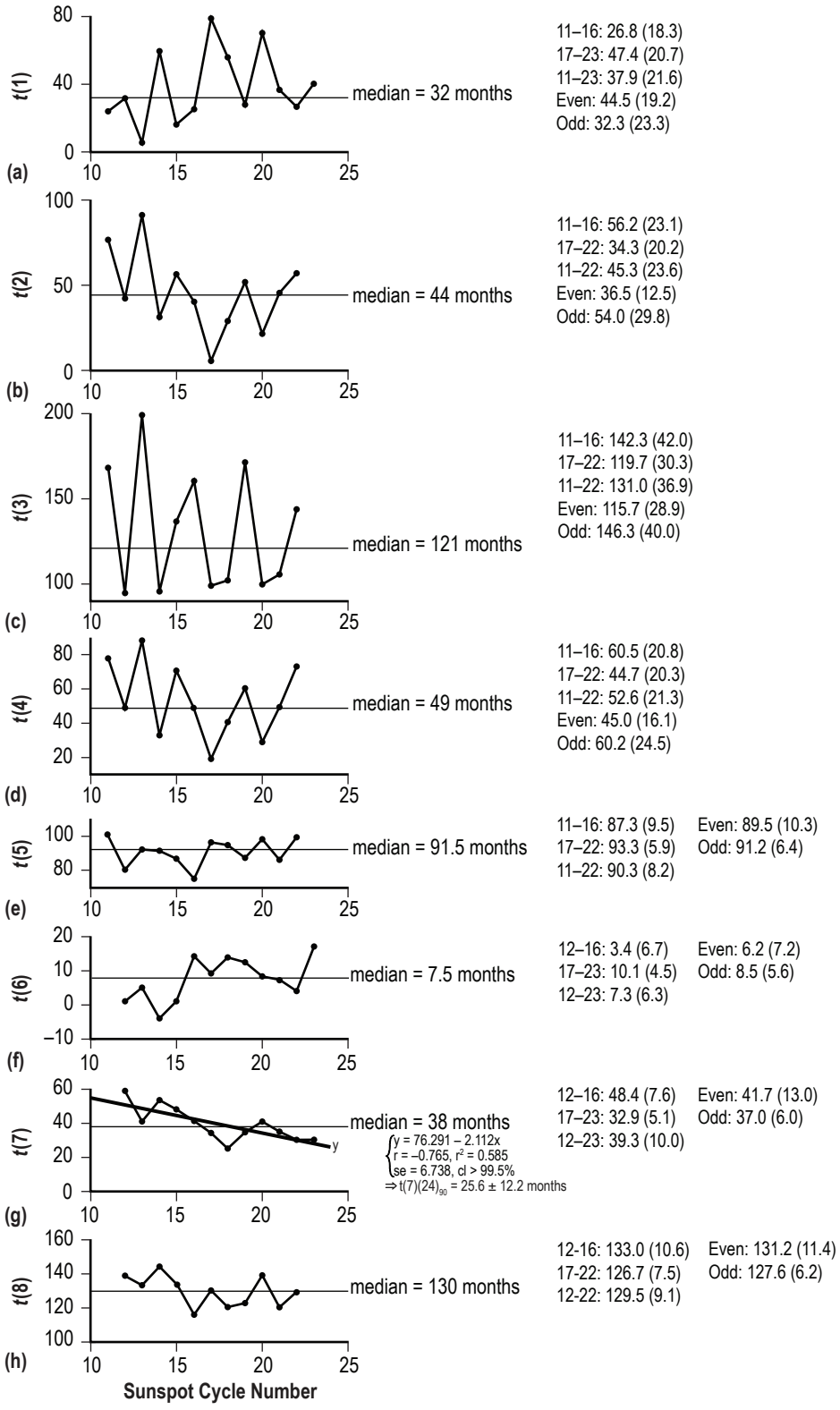

Figure 14. Variation of selected timing signature values for cycles 11–23: (a)–(h) are $t(1)$–$t(8)$. See text for details.

For *PER*, on the basis of the 12-mo moving average, cycles appear to be distributed into long-period (LP) cycles, having a cycle duration exceeding 134 mo, and short-period (SP) cycles, having a cycle duration less than 127 mo, with only a 5% probability that an LP cycle will have a cycle duration as short as 133 mo and an SP cycle will have a cycle duration as long as 129 mo. The *PER* for cycle 23, although presently unknown, will be longer than 134 mo, thus making it an LP cycle. Through September 2007, cycle 23 has already persisted 136 mo, and through December 2007, there has yet to be an occurrence of a high-latitude, new-cycle spot. Moreover, the number of spotless days has dramatically increased,[18,26,27] especially in September, October, and November 2007, these being characteristics indicating the nearness of cycle minimum. While there is no real difference in averages for *PER* between even- and odd-numbered cycles, *PER* for cycles of late has averaged 6 mo shorter in duration as compared to the earlier cycles. (Note added in proof: A high-latitude, new-cycle spot was finally reported in January 2008, and a second high-latitude, new-cycle spot was reported in April 2008.)

For *aam** and *aaM*,* cycles of late have averaged 17.4 and 33.9, respectively, as compared to 11.2 and 26.1 for the earlier cycles, and the difference in means is found to be statistically important for both *aam** and *aaM**. Furthermore, linear regression analysis yields statistically important regressions for both *aam** and *aaM** as well, so one can infer only a 5% probability that cycle 24's *aam** will be smaller than 14.6 or larger than 24.8, and only a 5% probability that cycle 24's *aaM** will be smaller than 33.9 or larger than 42.9. (The lowest value of the 12-mo moving average of *aa* during the decline of cycle 23 is 14.9 in July 2007.)

Concerning the timing signatures (fig. 14), on average, the times in months between *RM* and *aaM** ($t(1)$) are 47.4 and 26.8 mo for cycles 17–23 and 11–16, respectively, and 44.5 and 32.3 mo for even- and odd-numbered cycles, respectively. The times in months between *aaM** and *Rm* ($t(2)$) are 34.3 and 56.2 mo for cycles 17–23 and 11–16, respectively, and 36.5 and 54.0 mo for even- and odd-numbered cycles, respectively. The times in months between *aaM** (cycle n) and *aaM** (cycle n+1) ($t(3)$) are 119.7 and 142.3 mo for cycles 17–23 and 11–16, respectively, and 115.7 and 146.3 mo for even- and odd-numbered cycles, respectively. The times in months between *aaM** (cycle n) and *aam** (cycle n+1) ($t(4)$) are 44.7 and 60.5 mo for cycles 17–23 and 11–16, respectively, and 45.0 and 60.2 months for even- and odd-numbered cycles, respectively. The times in months between *RM* (cycle n) and *aam** (cycle n+1) ($t(5)$) are 93.3 and 87.3 mo for cycles 17–23 and 11–16, respectively, and 89.5 and 91.2 mo for even- and odd-numbered cycles, respectively. The times in months between *Rm* and *aam** ($t(6)$) are 10.1 and 3.4 mo for cycles 17–23 and 11–16, respectively, and 6.2 and 8.5 mo for even- and odd-numbered cycles, respectively. The times in months between *aam** and *RM* ($t(7)$) are 32.9 and 48.4 mo for cycles 17–23 and 11–16, respectively, and 41.7 and 37.0 mo for even- and odd-numbered cycles, respectively. The times in months between *aam** (cycle n) and *aam** (cycle n+1) ($t(8)$) are 126.7 and 133.0 mo for cycles 17–23 and 11–16, respectively, and 131.2 and 127.6 mo for even- and odd-numbered cycles, respectively. Of the various timing signatures, the only statistically important difference in means is the one for $t(7)$, the time between *aam** and *RM*, comparing cycles of late with earlier cycles. Linear correlation analysis of $t(7)$ suggests a statistically important decrease with time of $t(7)$, such that $t(7)_{90} = 25.6 \pm 12.2$ mo for cycle 24, inferring only a 5% probability that *RM* will follow cycle 24's *aam** by more than about 38 mo or less than about 13 mo.

From figure 13, statistically important upward trends are strongly suggested for *Rm*, *aam**, and *aaM**. It should be mentioned that a marginally significant upward trend is hinted for *RM* as

well. Thus, scatter plots of *Rm* and *RM* against *aam** and *aaM** might suggest correlated behavior. Figure 15 depicts the scatter plots of *Rm* (cycle *n*+1) and *RM* (cycle *n*+1) versus *aaM** (cycle *n*) (panels (a) and (b), respectively) and *Rm* and *RM* versus *aam** (same cycle) (panels (c) and (d), respectively). The inferred regression between *RM* and *aam** is the strongest, although the ones between *RM* (cycle *n*+1) and *aaM** (cycle *n*) and *Rm* and *aam** (same cycle) are also statistically important. The one between *Rm* (cycle *n*+1) and *aaM** (cycle *n*) is of marginal statistical importance only. In each panel the results of Fisher's exact test for 2×2 contingency tables[28] are given, where *P* represents the probability of obtaining the observed result or one more suggestive of a departure from independence, and the results of linear correlation analysis are given, where *y* is the inferred regression equation. The little arrow in the left panels shows cycle 23's *aaM** value (38.0), this value having occurred in August 2003. While *aam** is presently unknown, it will measure ≤14.9 (this value having occurred in July 2007). From the known value of *aaM** for cycle 23, one infers $Rm(24)_{90} = 9.9 \pm 5.9$ and $RM(24)_{90} = 167.9 \pm 60.3$. From the inferred value of *aam** ≤14.9 (≥14.6) for cycle 24, one infers $Rm(24)_{90} \leq 6.2 \pm 5.9$ (≥6.0 ± 5.9) and RM(24)90 ≤ 120.5 ± 30.1 (≥117.5 ± 30.1). Together, this seems to suggest that cycle 24's *Rm* and *RM* will measure about 8.0 ± 4.1 (8.0 ± 3.9) and 129.1 ± 21.45 (127.6 ± 20.0), respectively, based on the overlap of the 90% prediction intervals.

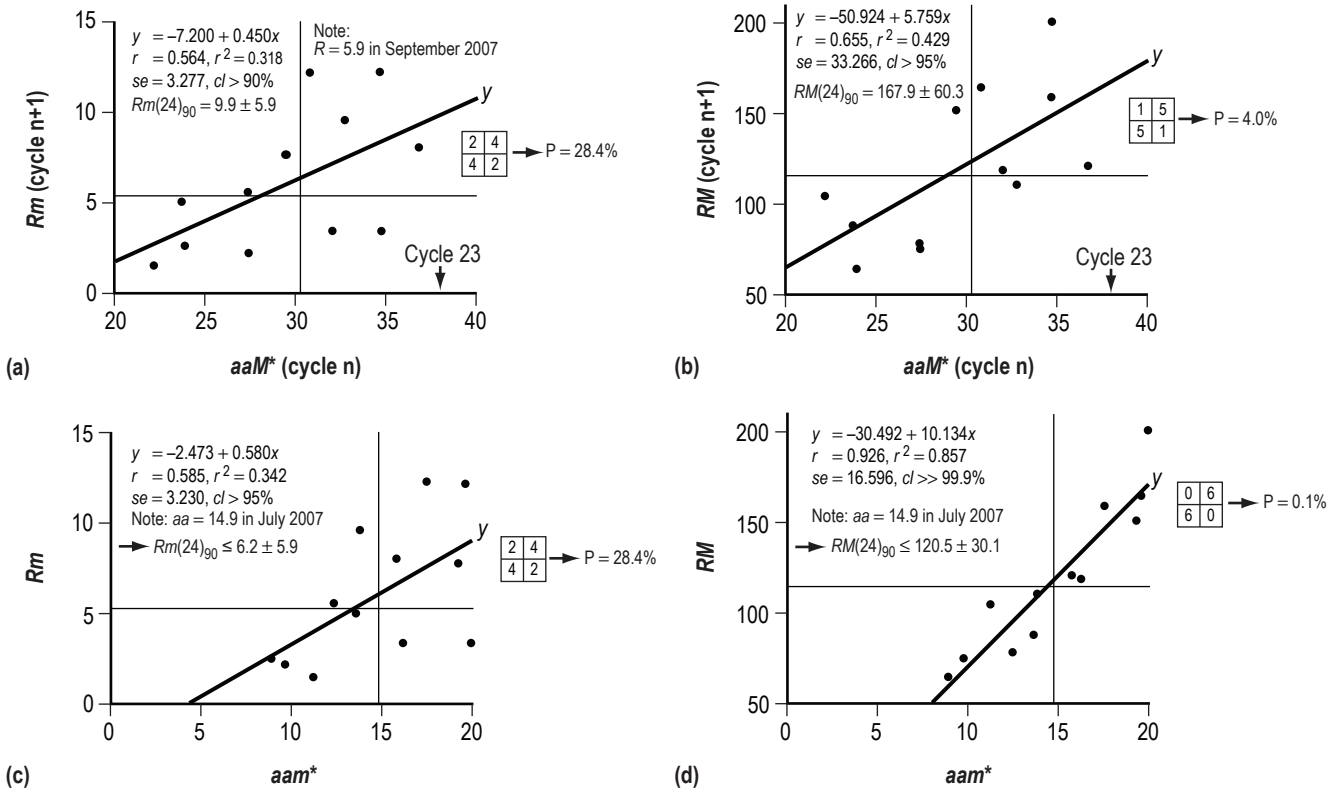

Figure 15. Scatter plots of (a) *Rm* (cycle *n*+1), and (b) *RM* (cycle *n*+1) versus *aaM** (cycle *n*); (c) *Rm,* and (d) *RM* versus *aam**. See text for details.

Figure 16 plots observed values of *RM* versus predicted values of *RM*, based on specific bivariate fits,[29] and also observed values of *Rm* versus predicted values of *Rm*, based on a specific bivariate fit. The lines passing through the data points are the 1:1 lines. For *RM* (Observed, cycle *n*+1) versus the *aaM** (cycle *n*) and *aam** (cycle *n*+1) (panel (a)), *RM* (Predicted) = –38.314 + 0.456 *aaM** + 9.750 *aam**, $r = 0.927$, and $se = 17.4$. Using *aaM**(23) = 38.0 and *aam**(24) ≤14.9 yields $RM(24)_{90}$ ≤124.3 ± 31.9 (or ≥121.4 ± 30.1 based on *aaM** = 38.0 and *aam** ≥14.6), essentially the same as using the single-variate fit between *RM* and *aam** (see fig. 15, panel (d), ≤120.5 ± 30.1 and ≥117.5 ± 30.1, respectively). Hence, there appears to be no meaningful improvement in the prediction of cycle 24's *RM* when using both *aaM** (cycle *n*) and *aam** (cycle *n*+1) as compared to just using *aam** (cycle *n*+1) alone.

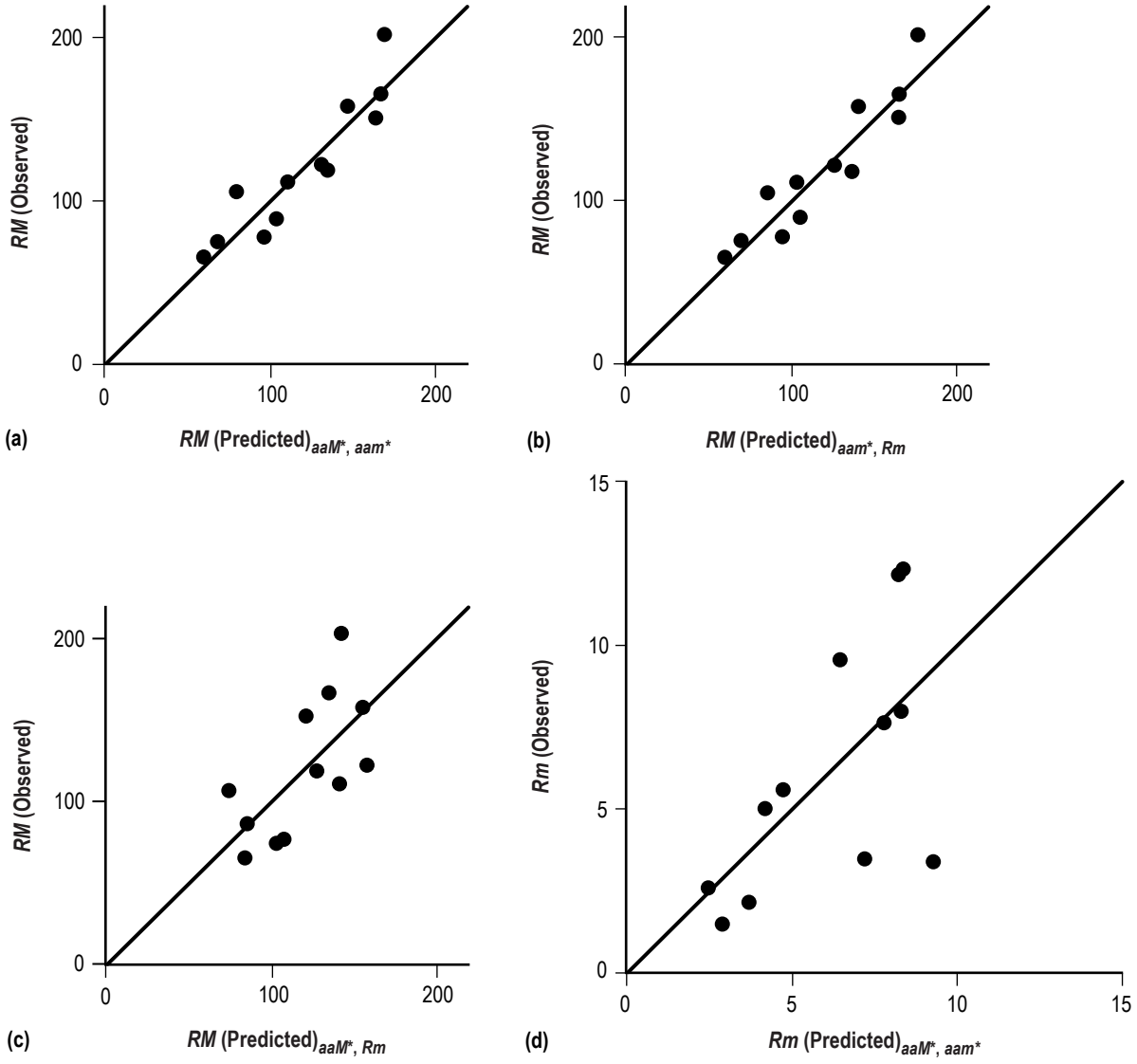

Figure 16. Scatter plots (a)–(c) of observed values of *RM* versus predicted values of *RM*, based on specific bivariate fits, and observed values (d) of *Rm* versus predicted values of *Rm*, based on a specific bivariate fit. See text for details.

Similarly, the bivariate fit for *RM* (cycle *n*+1) based on *aaM** (cycle *n*) and *Rm* (cycle *n*+1) is *RM* (Predicted) = –40.351 + 1.483 *Rm* + 5.096 *aaM**, having $r = 0.664$ and $se = 34.654$. Using *aaM** = 38.0 and *Rm* ≤5.9 yields $RM(24)_{90} \leq 162.0 \pm 62.2$., which is essentially the same as using the single-variate fit between *RM* and *aaM** alone (see fig. 15, panel (b), = 167.9 ± 60.3).

Likewise, the bivariate fit of *RM* based on *Rm* and *aam** (all for the same cycle) is *RM* (Predicted) = –33.854 – 1.354 *Rm* + 10.920 *aam**, having $r = 0.931$ and $se = 16.886$. Using *aam** ≤14.9 and *Rm* ≤5.9 yields $RM(24)_{90} \leq 120.9 \pm 30.6$, which is essentially the same as using the single-variate fit between *RM* and *aam** alone (see fig. 15, panel (d), ≤120.5 ± 30.1). Using *aam** ≥14.6 and *Rm* ≤5.9 yields $RM(24)_{90} \approx 117.6 \pm 30.6$.

The bivariate fit of *Rm* (cycle *n*+1) based on *aaM** (cycle *n*) and *aam** (cycle *n*+1) is *Rm* (Predicted) = –6.709 + 0.247 *aaM** + 0.372 *aam**, having $r = 0.628$ and $se = 3.267$. Using *aaM** = 38.0 and *aam** ≤14.9 yields $Rm(24)_{90} \leq 8.2 \pm 5.9$ (or ≥8.1 ± 5.9, using *aaM** = 38.0 and *aam** ≥14.6), which is essentially the same as using the single-variate fits between *Rm* and *aaM** (see fig. 15, panel (a), 9.9 ± 5.9) or between *Rm* and *aam** (see fig. 15, panel (c), ≤6.2 ± 5.9).

While the bivariate fits have slightly higher coefficients of correlation than the single-variate fits, they do not appear to provide any meaningful increase in precision for the prediction of *Rm* or *RM*. Of the various fits, the one between *RM* and *aam** has provided the greatest predictive ability (essentially, this is Ohl's method).[30] Therefore, since *aam** is destined to be ≤14.9 (and probably ≥14.6), it appears highly likely that cycle 24 will not be as large as previously predicted,[16,31,32] based solely on *aaM**. There appears to be only a 5% chance that cycle 24's *RM* will be greater than 150.6. If *aam** is presumed to be equal to 14.6 (the lowest expected value based on the 90% prediction interval of *aam** versus sunspot cycle number, see fig. 13, panel (e), $aam^*(24)_{90} = 19.7 \pm 5.1$), then $RM(24)_{90} = 117.5 \pm 30.1$, inferring only a 5% chance that *RM* would exceed 147.6.

3. SUMMARY

For cycle 23 (1996–2006), an odd-numbered cycle, the maximum of geomagnetic activity (*aaM*) follows maximum sunspot amplitude (*RM*) by 40 mo (3.3 yr), coinciding with the maximum in solar wind speed (*vM*) and not the maximum in earthward-directed CMEs ($N_{H+PH}M$, the number of halo and partial halo events). Such a finding is in contrast to that noted by Chirkov, whose earlier studies suggested that odd-numbered cycles had geomagnetic peaks about 1.5–2 yr after sunspot maximum. The observed *aaM* is the highest ever recorded, and the ratio of *aaM* to *aam* is 2.4, which indicates a 140% increase in geomagnetic activity from *aam* to *aaM*. This is also in contrast to that found by Chirkov, who previously had noted that odd-numbered cycles had a smaller range of variation (maximum to minimum) as compared to even-numbered cycles, typically 60–80%. The simultaneous peaking of *aaM* and *vM* some 40 mo after *Rmax* also is in contrast to that reported by Rangarajan and Barreto, who stated that solar wind speed maximizes about 22 mo after solar maximum. Correlation analysis suggests strong correlation between *aa* (and aa_I, the following recurrent component) and *v*, having an *r* equal to about 0.92, and between the number of halo and partial halo CMEs and sunspot number, having an *r* equal to about 0.87.

Statistically important rises have occurred between cycles 11 and 23 in *Rm*, *aam**, and *aaM**, such that for cycle 24 the 90% prediction intervals are, respectively, 10.8 ± 4.7, 19.7 ± 5.1, and 38.4 ± 4.5, inferring only a 5% probability that $Rm(24) \leq 6.1$ (*R* measures 5.9 in September 2007), $aam^*(24) \leq 14.6$ (the lowest value of *aa* that has been seen during the decline of cycle 23 measures 14.9 in July 2007) and $aaM^*(24) \leq 33.9$. Of the various timing signatures that were examined, only $t(7)$, the time between $E(aam^*)$ and $E(RM)$, has shown a statistically important downward trend. This suggests $t(7) = 26 \pm 12$ mo for cycle 24 and one infers that once $E(aam^*)$ has been seen (which usually follows $E(Rm)$ by about 7 mo), *RM* should follow within 38 mo, with 95% confidence.

Statistically important correlations are found between $RM(\text{cycle } n+1)$ and $aaM^*(\text{cycle } n)$ and between $RM(\text{cycle } n)$ and $aam^*(\text{cycle } n)$, the latter being the stronger ($r = 0.93$ as compared to $r = 0.66$). Since *aaM** is known for cycle 23 (38.0, August 2003), one estimates $RM(24) = 168 \pm 60$. The value of *aam** likely will be ≤14.9 (the lowest value of *aa* that has been seen thus far during the decline of cycle 23) and very probably ≥14.6 (from above), so that $RM(24)$ likely will be $\geq 117.5 \pm 30.1$. Based on the overlap, $RM(24)$ should measure about 128 ± 20.

APPENDIX

Table 3. SOHO/LASCO/CME counts.

Date (Yr-Mo)	N_{CME}	N_H	N_{PH}	$N_H + N_{PH}$	LASCO Downtime (Minutes)	Coverage (%)
1996-01	6	0	0	0	13,230	70.4
02	6	0	0	0	24,525	41.3
03	18	0	0	0	29,426	34.1
04	18	1	0	1	26,366	39.0
05	14	0	0	0	13,203	70.4
06	8	0	0	0	3,586	91.7
07	23	0	1	1	7,731	82.7
08	18	1	4	5	3,746	91.6
09	19	0	0	0	1,312	97.0
10	19	0	2	2	976	97.8
11	24	1	1	2	8,617	80.1
12	33	1	3	4	2,266	94.9
1997-01	18	1	0	1	4,162	90.7
02	22	1	1	2	240	99.4
03	18	0	2	2	2,882	93.5
04	26	3	2	5	3,250	92.5
05	36	1	1	2	370	99.2
06	34	0	2	2	179	99.6
07	31	1	0	1	913	98.0
08	26	1	0	1	496	98.9
09	44	2	1	3	4,702	89.1
10	40	2	4	6	398	99.1
11	50	4	4	8	3,141	92.7
12	36	1	3	4	3,902	91.3
1998-01	62	4	1	5	1,023	97.7
02	85	1	3	4	667	98.3
03	79	2	3	5	4,100	90.8
04	87	3	3	6	2,047	95.3
05	106	3	11	14	679	98.5
06	118	4	10	14	9,549	77.9
07	-	-	-	-	44,640	0.0
08	-	-	-	-	44,640	0.0
09	-	-	-	-	43,200	0.0
10	34	3	1	4	30,134	32.5
11	79	7	6	13	17,177	60.2
12	57	2	1	3	19,626	56.0

Table 3. SOHO/LASCO/CME counts (Continued).

Date (Yr-Mo)	N_{CME}	N_H	N_{PH}	$N_H + N_{PH}$	LASCO Downtime (Minutes)	Coverage (%)
1999-01	-	-	-	-	44,640	0.0
02	46	0	6	6	19,061	52.7
03	91	0	4	4	6,439	85.6
04	83	1	8	9	2,892	93.3
05	94	3	12	15	3,476	92.2
06	112	13	13	26	5,554	87.1
07	132	3	19	22	1,439	96.8
08	113	0	19	19	9,640	78.4
09	104	1	12	13	7,740	82.1
10	84	1	8	9	8,665	80.6
11	82	0	4	4	12,270	71.6
12	65	5	7	12	9,747	78.2
2000-01	92	3	3	6	8,439	81.1
02	145	8	3	11	441	98.9
03	158	2	7	9	4,774	89.3
04	134	3	6	9	0	100.0
05	153	5	14	19	0	100.0
06	156	3	10	13	0	100.0
07	142	5	11	16	6,015	86.5
08	140	1	19	20	0	100.0
09	138	5	18	23	0	100.0
10	112	6	10	16	5,375	88.0
11	141	12	10	22	5,408	87.5
12	107	5	11	16	2,611	94.2
2001-01	104	6	11	17	7,250	83.8
02	80	5	13	18	3,441	91.5
03	166	7	10	17	0	100.0
04	124	9	14	23	395	99.1
05	128	0	18	18	180	99.6
06	122	3	7	10	4,446	89.7
07	82	0	8	8	7,082	84.1
08	128	5	7	12	3,474	92.2
09	175	6	26	32	398	99.1
10	157	8	13	21	179	99.6
11	95	9	10	19	7,291	83.1
12	136	5	11	16	0	100.0
2002-01	117	5	1	6	4,463	90.0
02	85	2	3	5	9,107	77.4
03	169	7	12	19	208	99.5
04	174	3	12	15	0	100.0
05	151	6	11	17	10	100.0
06	102	1	5	6	6,659	84.6
07	154	9	12	21	479	98.9
08	180	4	19	23	828	98.1
09	167	2	14	16	0	100.0
10	171	6	18	24	3,120	93.0
11	132	3	5	8	0	100.0
12	86	4	9	13	0	100.0

Table 3. SOHO/LASCO/CME counts (Continued).

Date (Yr-Mo)	N_{CME}	N_H	N_{PH}	$N_H + N_{PH}$	LASCO Downtime (Minutes)	Coverage (%)
2003-01	126	0	12	12	275	99.4
02	85	0	5	5	4,647	88.5
03	104	2	5	7	0	100.0
04	153	0	7	7	0	100.0
05	122	5	6	11	899	98.0
06	76	3	9	12	16,949	60.8
07	54	0	3	3	12,165	72.7
08	84	2	1	3	629	98.6
09	78	2	1	3	303	99.3
10	110	4	12	16	4,764	89.3
11	75	12	6	18	277	99.4
12	60	0	2	2	2,844	93.6
2004-01	89	3	7	10	5,277	88.2
02	94	0	5	5	0	100.0
03	94	0	3	3	7,376	83.5
04	88	4	5	9	14,574	66.3
05	126	1	7	8	0	100.0
06	97	1	14	15	7,647	82.3
07	108	8	9	17	228	99.5
08	66	1	5	6	198	99.6
09	57	7	6	13	14,229	67.1
10	103	4	3	7	964	97.8
11	103	7	5	12	776	98.2
12	75	4	4	8	13,631	69.5
2005-01	111	10	9	19	0	100.0
02	93	2	4	6	181	99.6
03	95	0	3	3	5,431	87.8
04	106	2	5	7	385	99.1
05	139	8	14	22	2,251	95.0
06	101	5	5	10	5,525	87.2
07	145	17	11	28	0	100.0
08	122	6	7	13	474	98.9
09	79	7	3	10	3,441	92.0
10	76	1	2	3	265	99.4
11	73	0	8	8	692	98.4
12	105	1	4	5	3,024	93.2
2006-01	102	0	3	3	221	99.5
02	71	1	0	1	1,035	97.4
03	47	0	2	2	9,033	79.8
04	80	1	5	6	183	99.6
05	109	3	1	4	0	100.0
06	81	0	2	2	4,590	89.4
07	125	1	1	2	195	99.6
08	97	3	0	3	8,977	79.9
09	109	0	3	3	17,278	60.0
10	73	1	1	2	4,269	90.4
11	94	1	3	4	6,250	85.5
12	55	3	1	4	7,203	83.9

Table 3. SOHO/LASCO/CME counts (Continued).

Date (Yr-Mo)	N_{CME}	N_H	N_{PH}	$N_H + N_{PH}$	LASCO Downtime (Minutes)	Coverage (%)
1996	206	4	11	15	134,984	74.4
1997	381	17	20	37	24,635	95.3
1998	707	29	39	68	217,482	58.6
1999	1006	27	112	139	131,563	75.0
2000	1618	58	122	180	33,063	93.7
2001	1497	63	147	210	34,136	93.5
2002	1688	52	121	173	24,874	95.3
2003	1127	30	69	99	43,752	91.7
2004	1100	40	73	113	64,900	87.7
2005	1245	59	75	134	21,669	95.9
2006	1043	14	22	36	59,234	88.7

Note: CME means coronal mass ejection. N_{CME} means number of CMEs. N_H means number of halo CMEs. N_{PH} means number of partial halo CMEs

Table 4. Monthly and annual weighted solar wind velocity.

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1964-01	369.0	558	75.0	
02	352.9	228	32.8	
03	–		0.0	
04	–		0.0	
05	–		0.0	
06	–		0.0	
07	517.5	111	14.9	
08	453.6	159	21.4	
09	463.4	237	32.9	
10	459.8	396	53.2	*E*(*Rm*)20
11	430.7	249	34.6	
12	396.0	183	24.6	
1965-01	394.5	180	24.2	
02	451.3	297	44.2	
03	460.0	309	41.5	
04	396.6	327	45.4	
05	407.9	330	44.4	
06	425.3	270	37.5	
07	440.9	198	26.6	
08	440.1	393	52.8	
09	435.8	393	54.6	
10	415.7	360	48.4	
11	373.7	387	53.8	
12	404.7	318	42.7	
1966-01	419.4	270	36.3	
02	439.1	306	45.5	
03	427.7	339	45.6	
04	395.7	351	48.8	
05	364.8	180	24.2	
06	401.8	129	17.9	
07	436.1	287	38.6	
08	429.3	170	22.8	
09	489.7	287	39.9	
10	440.3	198	26.6	
11	426.4	267	37.1	
12	461.2	197	26.5	
1967-01	378.4	515	69.2	
02	423.3	630	93.8	
03	369.9	480	64.5	
04	397.4	375	52.1	
05	447.5	480	64.5	
06	416.5	551	76.5	
07	417.2	607	81.6	
08	439.6	708	95.2	
09	455.9	663	92.1	
10	450.8	711	95.6	
11	438.1	696	96.7	
12	492.3	625	84.0	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1968-01	447.3	639	85.9	
02	467.4	674	96.8	
03	468.5	742	99.7	
04	471.9	671	93.2	
05	471.6	616	82.8	
06	485.3	579	80.4	
07	457.9	281	37.8	
08	479.0	348	46.8	
09	456.1	277	38.5	
10	493.9	111	14.9	
11	498.0	128	17.8	*E*(*RM*)20
12	451.5	423	56.9	
1969-01	439.1	634	85.2	
02	449.5	640	95.2	
03	460.4	566	76.1	
04	417.2	500	69.4	
05	426.6	255	34.3	
06	395.8	339	47.1	
07	365.6	373	50.1	
08	410.6	658	88.4	
09	409.3	573	79.6	
10	396.0	456	61.3	
11	415.7	489	67.9	
12	418.1	569	76.5	
1970-01	384.7	632	84.9	
02	407.8	522	77.7	
03	461.0	426	57.3	
04	428.4	489	67.9	
05	412.9	441	59.3	
06	407.5	321	44.6	
07	468.0	516	69.4	
08	419.0	423	56.9	
09	438.0	405	56.3	
10	419.6	465	62.5	
11	443.3	376	52.2	
12	376.8	359	48.3	
1971-01	474.6	520	69.9	
02	464.5	364	54.2	
03	427.9	571	76.7	
04	434.5	597	82.9	
05	422.6	579	77.8	
06	420.7	491	68.2	
07	448.5	300	40.3	
08	–	0	0.0	
09	–	0	0.0	
10	–	0	0.0	
11	–	0	0.0	
12	480.7	60	8.1	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1972-01	447.4	471	63.3	
02	417.2	534	76.7	
03	404.1	614	82.5	
04	378.5	591	82.1	
05	414.3	530	71.2	
06	392.1	222	30.8	
07	350.6	141	19.0	
08	–	0	0.0	
09	–	0	0.0	
10	390.6	315	42.3	
11	419.0	447	62.1	
12	370.5	405	54.4	
1973-01	484.7	618	83.1	
02	511.3	603	89.7	
03	526.1	658	88.4	
04	565.3	547	76.0	
05	529.4	634	85.2	
06	527.0	662	91.9	
07	478.3	627	84.3	
08	426.2	420	56.5	
09	411.3	453	62.9	
10	461.2	414	55.6	
11	431.5	684	95.0	
12	444.4	670	90.1	
1974-01	520.3	732	98.4	
02	500.2	663	98.7	
03	540.1	744	100.0	
04	524.2	717	99.6	
05	522.4	711	95.6	
06	552.6	720	100.0	
07	543.3	741	99.6	
08	515.5	723	97.2	
09	533.7	672	93.3	
10	547.7	687	92.3	
11	521.8	681	94.6	
12	525.4	688	92.5	
1975-01	513.3	700	94.1	
02	553.6	642	95.5	
03	543.5	669	89.9	
04	502.4	664	92.2	
05	478.1	607	81.6	
06	484.0	627	87.1	
07	495.3	643	86.4	
08	440.1	506	68.0	
09	403.8	481	66.8	
10	396.7	404	54.3	
11	477.3	409	56.8	
12	509.3	418	56.2	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1976-01	462.0	425	57.1	
02	509.2	445	63.9	
03	528.8	425	57.1	
04	480.3	503	69.9	
05	449.7	500	67.2	
06	456.2	562	78.1	*E*(*Rm*)21
07	461.0	563	75.7	
08	411.7	521	70.0	
09	434.9	576	80.0	
10	402.4	577	77.6	
11	401.6	612	85.0	
12	410.7	608	81.7	
1977-01	408.3	588	79.0	
02	439.0	559	83.2	
03	408.4	573	77.0	
04	450.1	616	85.6	
05	404.3	610	82.0	
06	423.8	530	73.6	
07	448.6	554	74.5	
08	475.2	614	82.5	
09	407.6	648	90.0	
10	393.8	589	79.2	
11	380.5	687	95.4	
12	376.1	703	94.5	
1978-01	408.3	568	76.3	
02	415.0	472	70.2	
03	457.7	580	78.0	
04	493.8	615	85.4	
05	457.8	545	73.3	
06	462.2	490	68.1	
07	394.7	566	76.1	
08	397.6	700	94.1	
09	434.2	713	99.0	
10	402.9	730	98.1	
11	442.9	713	99.0	
12	440.2	722	97.0	
1979-01	452.9	707	95.0	
02	424.8	646	96.1	
03	425.9	712	95.7	
04	503.4	709	98.5	
05	452.3	734	98.7	
06	415.9	712	98.9	
07	407.9	744	100.0	
08	440.5	742	99.7	
09	383.7	716	99.4	
10	368.9	735	98.8	
11	367.8	710	98.6	
12	378.2	726	97.6	*E*(*RM*)21

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1980-01	420.9	702	94.4	
02	381.9	624	92.9	
03	344.1	718	96.5	
04	400.7	700	97.2	
05	370.8	722	97.0	
06	399.2	658	91.4	
07	388.2	654	87.9	
08	356.8	691	92.9	
09	345.7	696	96.7	
10	430.5	731	98.3	
11	460.4	641	89.0	
12	430.2	735	98.8	
1981-01	389.2	726	97.6	
02	419.2	609	90.6	
03	449.2	668	89.8	
04	502.5	674	93.6	
05	443.9	675	90.7	
06	402.1	711	98.8	
07	435.6	721	96.9	
08	446.1	694	93.3	
09	377.3	693	96.3	
10	465.9	703	94.5	
11	425.0	650	90.3	
12	376.4	683	91.8	
1982-01	426.0	702	94.4	
02	498.2	634	94.3	
03	432.6	649	87.2	
04	474.8	677	94.0	
05	487.2	710	95.4	
06	465.5	679	94.3	
07	515.4	674	90.6	
08	471.7	701	94.2	
09	510.9	663	92.1	
10	438.1	488	65.6	
11	522.7	320	44.4	
12	547.1	243	32.7	
1983-01	497.1	267	35.9	
02	489.1	101	15.0	
03	491.0	246	33.1	
04	522.0	274	38.1	
05	531.5	304	40.9	
06	452.3	289	40.1	
07	446.9	254	34.1	
08	452.1	358	48.1	
09	469.5	300	41.7	
10	458.8	402	54.0	
11	502.5	392	54.4	
12	450.0	318	42.7	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1984-01	449.2	303	40.7	
02	452.6	200	28.7	
03	511.0	322	43.3	
04	552.0	32	4.4	
05	464.5	255	34.3	
06	480.8	229	31.8	
07	447.2	227	30.5	
08	484.3	262	35.2	
09	584.7	139	19.3	
10	450.0	197	26.5	
11	505.1	74	10.3	
12	546.5	102	13.7	
1985-01	491.7	141	19.0	
02	500.3	146	21.7	
03	454.6	251	33.7	
04	504.8	259	36.0	
05	371.5	303	40.7	
06	449.1	195	27.1	
07	500.8	270	36.3	
08	521.7	310	41.7	
09	477.3	189	26.3	
10	479.6	252	33.9	
11	485.7	220	30.6	
12	465.8	142	19.1	
1986-01	522.0	287	38.6	
02	629.4	142	21.1	
03	470.6	254	34.1	
04	428.5	317	44.0	
05	401.3	338	45.4	
06	411.0	371	51.5	
07	408.9	325	43.7	
08	511.6	372	50.0	
09	508.7	287	39.9	*E*(*Rm*)22
10	483.5	345	46.4	
11	408.5	286	39.7	
12	393.8	265	35.6	
1987-01	397.4	318	42.7	
02	487.4	233	34.7	
03	478.0	327	44.0	
04	351.4	305	42.4	
05	341.7	289	38.8	
06	386.6	335	46.5	
07	381.2	288	38.7	
08	472.3	406	54.6	
09	505.4	266	36.9	
10	486.9	313	42.1	
11	488.8	323	44.9	
12	411.2	264	35.5	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1988-01	388.5	285	38.3	
02	416.2	201	28.9	
03	433.2	311	41.8	
04	441.8	232	32.2	
05	450.6	261	35.1	
06	401.7	269	37.4	
07	423.5	222	29.8	
08	444.0	378	50.8	
09	457.4	303	42.1	
10	449.5	377	50.7	
11	406.9	327	45.4	
12	458.0	303	40.7	
1989-01	534.7	284	38.2	
02	514.7	196	29.2	
03	570.3	269	36.2	
04	493.2	290	40.3	
05	421.1	263	35.3	
06	416.0	278	38.6	
07	370.6	252	33.9	*E*(*RM*)22
08	429.1	397	53.4	
09	385.9	297	41.3	
10	459.4	413	55.5	
11	448.0	361	50.1	
12	452.2	289	38.8	
1990-01	488.5	257	34.5	
02	497.8	261	38.8	
03	433.1	300	40.3	
04	462.7	229	31.8	
05	439.4	189	25.4	
06	433.9	298	41.4	
07	428.0	145	19.5	
08	506.9	370	49.7	
09	441.5	284	39.4	
10	439.8	346	46.5	
11	395.5	279	38.8	
12	385.2	310	41.7	
1991-01	385.2	296	39.8	
02	390.3	248	36.9	
03	426.5	164	22.0	
04	420.8	248	34.4	
05	497.4	239	32.1	
06	545.0	262	36.4	
07	546.5	229	30.8	
08	545.7	382	51.3	
09	428.2	261	36.3	
10	486.8	345	32.9	
11	513.4	261	36.3	
12	472.0	287	38.6	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1992-01	428.5	306	41.1	
02	431.2	242	34.8	
03	418.0	294	39.5	
04	387.5	293	40.7	
05	432.6	268	36.0	
06	466.5	321	44.6	
07	362.7	334	44.9	
08	400.2	290	39.0	
09	467.6	161	22.4	
10	508.4	208	28.0	
11	445.8	203	28.2	
12	480.1	218	29.3	
1993-01	509.6	244	32.8	
02	537.1	203	30.2	
03	464.0	302	40.6	
04	472.7	199	27.6	
05	442.7	256	34.4	
06	425.7	255	35.4	
07	426.8	240	32.3	
08	390.0	297	39.9	
09	372.2	196	27.2	
10	411.3	230	30.9	
11	445.4	160	22.2	
12	516.8	230	30.9	
1994-01	559.7	257	34.5	
02	641.3	221	32.9	
03	531.5	363	48.8	
04	569.2	341	47.4	
05	639.0	454	61.0	
06	575.2	381	52.9	
07	517.7	359	48.3	
08	419.7	308	41.4	
09	444.0	217	30.1	
10	475.9	277	37.2	
11	381.4	205	28.5	
12	471.0	294	39.5	
1995-01	446.7	721	96.9	
02	450.9	670	99.7	
03	456.8	738	99.2	
04	439.1	720	100.0	
05	491.6	737	99.1	
06	448.9	653	90.7	
07	386.5	741	99.6	
08	417.8	705	94.8	
09	418.3	713	99.0	
10	428.3	741	99.6	
11	390.5	694	96.4	
12	391.8	695	93.4	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1996-01	427.0	704	94.6	
02	446.1	696	100.0	
03	435.7	734	98.7	
04	434.3	712	98.9	
05	398.1	612	82.3	*E*(*Rm*)23
06	371.8	713	99.0	
07	392.9	561	75.4	
08	432.7	743	99.9	
09	482.7	695	96.5	
10	461.6	706	94.9	
11	405.7	696	96.7	
12	404.8	688	92.5	
1997-01	415.1	716	96.2	
02	411.5	672	100.0	
03	389.5	744	100.0	
04	399.0	720	100.0	
05	361.6	685	92.1	
06	379.9	377	52.4	
07	366.9	504	67.7	
08	387.2	743	99.9	
09	391.2	640	88.9	
10	378.6	702	94.4	
11	378.7	720	100.0	
12	327.1	740	99.5	
1998-01	373.6	743	99.9	
02	378.1	672	100.0	
03	403.5	744	100.0	
04	381.6	720	100.0	
05	465.6	744	100.0	
06	412.1	720	100.0	
07	420.1	744	100.0	
08	423.9	744	100.0	
09	410.3	720	100.0	
10	454.3	744	100.0	
11	420.7	687	95.4	
12	401.2	744	100.0	
1999-01	423.3	744	100.0	
02	414.3	672	100.0	
03	429.8	744	100.0	
04	440.0	720	100.0	
05	444.8	742	99.7	
06	399.7	720	100.0	
07	395.7	744	100.0	
08	469.0	744	100.0	
09	484.8	720	100.0	
10	485.4	744	100.0	
11	437.3	689	95.7	
12	455.1	744	100.0	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
2000-01	478.8	744	100.0	
02	498.4	696	100.0	
03	408.2	744	100.0	
04	434.0	720	100.0	*E*(*RM*)23
05	460.5	744	100.0	
06	477.4	720	100.0	
07	469.8	736	98.9	
08	437.6	740	99.5	
09	455.3	720	100.0	
10	412.7	744	100.0	
11	474.5	718	99.7	
12	393.5	744	100.0	
2001-01	373.5	744	100.0	
02	394.9	672	100.0	
03	423.1	744	100.0	
04	518.6	720	100.0	
05	429.8	744	100.0	
06	437.1	720	100.0	
07	429.8	744	100.0	
08	438.6	744	100.0	
09	430.5	719	99.9	
10	419.8	744	100.0	
11	437.1	701	97.4	
12	408.0	744	100.0	
2002-01	395.7	744	100.0	
02	414.3	672	100.0	
03	442.3	744	100.0	
04	456.6	720	100.0	
05	442.9	744	100.0	
06	396.4	720	100.0	
07	448.7	744	100.0	
08	434.0	744	100.0	
09	413.8	720	100.0	
10	485.3	744	100.0	
11	489.3	718	99.7	
12	473.7	744	100.0	
2003-01	472.9	744	100.0	
02	514.3	671	99.9	
03	524.4	744	100.0	
04	528.5	720	100.0	
05	586.6	744	100.0	
06	608.5	720	100.0	
07	561.9	744	100.0	
08	572.1	744	100.0	
09	532.2	720	100.0	
10	523.6	685	92.1	
11	571.5	708	98.3	
12	515.9	744	100.0	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
2004-01	542.3	744	100.0	
02	481.4	695	99.9	
03	497.7	744	100.0	
04	440.0	720	100.0	
05	425.9	743	99.9	
06	435.8	720	100.0	
07	491.6	744	100.0	
08	399.6	744	100.0	
09	407.5	718	99.7	
10	387.6	744	100.0	
11	478.1	720	100.0	
12	454.8	743	99.9	
2005-01	568.2	691	92.9	
02	491.4	672	100.0	
03	483.9	744	100.0	
04	442.4	715	99.3	
05	474.2	744	100.0	
06	447.0	720	100.0	
07	443.5	744	100.0	
08	489.1	744	100.0	
09	496.1	710	98.6	
10	409.1	744	100.0	
11	442.6	720	100.0	
12	458.5	744	100.0	
2006-01	403.6	744	100.0	
02	392.4	672	100.0	
03	427.3	744	100.0	
04	425.4	720	100.0	
05	418.7	743	99.9	
06	451.1	720	100.0	
07	403.7	744	100.0	
08	414.1	720	100.0	
09	420.0	719	99.9	
10	437.7	744	100.0	
11	429.1	717	99.6	
12	513.3	697	93.7	
2007-01	479.4	744	100.0	
02	427.9	672	100.0	
03	449.3	744	100.0	
04	440.2	719	99.9	
05	444.2	744	100.0	
06	427.0	720	100.0	
07	430.9	731	98.3	

Table 4. Monthly and annual weighted solar wind velocity (Continued).

Date (Yr-Mo)	Velocity (km s^{-1})	Hr	Coverage (%)	Comment
1964	418.4	2121	24.1	*E*(*Rmin*)20
1965	420.2	3762	42.9	
1966	429.2	2981	34.0	
1967	430.7	7041	80.4	
1968	467.8	5489	62.5	*E*(*Rmax*)20
1969	419.9	6052	69.1	
1970	421.9	5375	61.4	
1971	440.6	3482	39.7	
1972	403.2	4270	48.6	
1973	486.0	6990	79.8	
1974	529.1	8479	96.8	
1975	488.8	6770	77.3	
1976	446.8	6317	71.9	*E*(*Rmin*)21
1977	416.7	7271	83.0	
1978	433.2	7414	84.6	
1979	418.3	8593	98.1	*E*(*Rmax*)21
1980	394.0	8272	94.2	
1981	427.5	8207	93.7	
1982	477.6	7140	81.5	
1983	479.0	3505	40.0	
1984	482.0	2342	26.7	
1985	473.6	2678	30.6	
1986	456.9	3589	41.0	*E*(*Rmin*)22
1987	457.6	3667	41.9	
1988	432.1	3469	39.5	
1989	455.9	3589	41.0	*E*(*Rmax*)22
1990	447.0	3268	37.3	
1991	474.7	3222	36.8	
1992	430.5	3138	35.7	
1993	450.0	2812	32.1	
1994	528.1	3677	42.0	
1995	430.7	8528	97.4	
1996	425.3	8260	94.0	*E*(*Rmin*)23
1997	382.4	7963	90.9	
1998	412.4	8726	99.6	
1999	440.1	8727	99.6	
2000	449.7	8770	99.8	*E*(*Rmax*)23
2001	428.4	8740	99.8	
2002	441.3	8758	100.0	
2003	542.8	8688	99.2	
2004	453.5	8779	99.9	
2005	469.9	8689	99.2	
2006	427.9	8684	99.1	

Note: For each month, velocity is the weighted average of the daily minimum and maximum observed velocities (weighted by daily hours), based on the Omni tape and expressed in km s^{-1}. For each year, vel is the weighted average of the monthly averages (weighted by monthly hours) and expressed in km s^{-1}.

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa.

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1868-01	15.5	13.5	6.5	19.3				
02	15.7	18.9	11.9	21.5				
03	26.5	22.6	15.1	24.2				
04	36.6	23.9	15.9	27.6				
05	26.7	19.3	11.8	31.7				
06	31.1	20.9	13.2	35.5				
07	29.0	24.4	16.8	39.2	21.6	13.5	0.63	
08	34.4	22.3	14.4	42.9	22.2	14.0	0.63	
09	47.2	26.9	18.4	45.8	22.7	14.2	0.63	
10	61.6	28.9	19.8	47.1	23.1	14.6	0.63	
11	59.1	16.2	7.2	50.5	23.8	15.1	0.63	
12	67.6	16.6	7.2	56.9	24.1	15.2	0.63	
1869-01	60.9	22.1	13.0	61.4	24.0	14.8	0.62	
02	59.9	26.5	17.4	64.6	23.8	14.5	0.61	
03	52.7	25.2	16.5	68.0	24.1	14.6	0.61	
04	41.0	32.4	24.2	69.4	24.0	14.5	0.60	
05	103.9	26.1	15.0	70.1	23.7	14.2	0.60	
06	108.4	22.1	10.8	72.4	23.8	14.2	0.60	
07	59.2	20.3	11.3	74.6	24.0	14.2	0.59	
08	79.6	22.8	12.8	77.6	24.0	14.2	0.59	
09	80.6	32.7	22.7	84.3	24.0	13.8	0.58	
10	59.3	20.9	11.9	93.8	23.8	13.2	0.55	
11	78.1	17.6	7.7	101.7	23.5	12.5	0.53	
12	104.3	17.6	6.5	105.8	23.3	12.1	0.52	
1870-01	77.3	24.5	14.6	110.0	23.1	11.7	0.51	
02	114.9	26.1	14.5	116.2	23.0	11.3	0.49	
03	157.6	24.1	10.5	121.6	23.3	11.4	0.49	
04	160.0	28.7	15.0	127.5	23.9	11.7	0.49	
05	176.0	23.8	9.4	134.0	24.9	12.0	0.48	
06	135.6	19.3	6.7	138.0	25.0	12.3	0.49	
07	132.4	17.0	4.6	139.6	25.1	12.4	0.49	
08	153.8	24.4	11.0	140.5	25.1	12.3	0.49	*RM*(11)
09	136.0	38.1	25.5	140.2	25.2	12.4	0.49	
10	146.4	29.2	16.1	139.6	25.4	12.7	0.50	
11	147.5	24.8	11.7	138.5	25.5	12.8	0.50	
12	130.0	22.8	10.5	135.4	25.4	12.8	0.50	
1871-01	88.3	22.2	11.8	132.3	25.7	13.3	0.52	
02	125.3	27.7	15.6	129.3	26.1	13.8	0.53	
03	143.2	24.3	11.4	125.1	25.5	13.4	0.53	
04	162.4	34.1	20.3	120.4	24.5	12.6	0.51	
05	145.5	20.1	7.1	116.3	24.5	12.8	0.52	
06	91.7	20.0	9.5	112.9	24.5	13.0	0.53	
07	103.0	24.4	13.3	110.8	24.3	12.8	0.53	
08	110.1	26.5	15.1	110.3	24.3	12.9	0.53	
09	80.3	20.6	10.6	107.8	24.5	13.2	0.54	
10	89.0	22.9	12.5	103.0	24.3	13.2	0.54	
11	105.4	31.0	19.8	98.9	24.1	13.2	0.55	
12	90.4	18.6	8.1	98.0	24.2	13.4	0.55	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1872-01	79.5	19.9	9.9	98.9	24.4	13.5	0.55	
02	120.1	30.9	19.1	98.3	24.6	13.8	0.56	
03	88.4	26.0	15.6	99.0	24.8	14.0	0.56	
04	102.1	26.4	15.4	101.0	25.7	14.8	0.58	
05	107.6	23.3	12.0	101.9	26.4	15.4	0.58	
06	109.9	20.6	9.2	101.9	26.5	15.4	0.58	
07	105.5	28.2	17.0	102.0	27.2	16.2	0.60	
08	92.9	28.1	17.5	101.7	27.4	16.4	0.60	
09	114.6	23.6	12.0	101.6	27.1	16.1	0.59	
10	102.6	41.5	30.5	100.9	27.0	16.1	0.60	
11	112.0	27.9	16.4	97.4	26.9	16.2	0.60	
12	83.9	23.4	13.2	92.2	27.3	16.7	0.61	
1873-01	86.7	32.3	22.0	87.8	27.4	17.1	0.62	*aam*(11), aa_IM(11)
02	107.0	23.5	12.3	85.2	27.0	16.9	0.63	
03	98.3	27.0	16.2	81.4	26.7	16.6	0.62	
04	76.2	23.7	13.9	76.2	25.7	15.9	0.62	
05	47.9	23.7	15.2	71.5	24.3	14.7	0.60	
06	44.8	28.7	20.3	67.7	23.5	14.1	0.60	
07	66.9	23.5	14.1	65.2	22.7	13.4	0.59	
08	68.2	21.7	12.2	62.4	22.0	12.9	0.59	
09	47.1	22.2	13.7	58.4	21.4	12.4	0.58	
10	47.1	19.5	11.0	54.4	20.8	12.0	0.58	
11	55.4	17.5	8.6	52.4	20.5	11.7	0.57	
12	49.2	15.0	6.4	52.0	19.7	10.9	0.55	
1874-01	60.8	20.7	11.6	51.8	18.8	10.1	0.54	
02	64.2	19.0	9.7	51.5	18.3	9.6	0.52	
03	46.4	15.6	7.2	50.4	17.9	9.2	0.51	
04	32.0	22.1	14.3	49.1	17.8	9.2	0.52	
05	44.6	16.9	8.5	47.4	17.8	9.3	0.52	
06	38.2	15.7	7.6	45.5	17.7	9.3	0.53	
07	67.8	16.0	6.6	42.7	16.8	9.0	0.54	
08	61.3	15.9	6.8	39.1	16.9	8.8	0.52	
09	28.0	18.6	11.0	36.8	16.8	8.8	0.52	
10	34.3	20.7	12.8	36.1	16.5	8.5	0.52	
11	28.9	17.2	9.6	34.6	16.2	8.3	0.51	
12	29.3	13.0	5.3	32.7	16.0	8.2	0.51	
1875-01	14.6	13.0	6.0	29.8	15.9	8.2	0.52	
02	21.5	16.4	9.1	25.5	15.6	8.1	0.52	
03	33.8	15.6	7.7	22.5	15.3	8.0	0.52	
04	29.1	15.6	8.0	20.5	15.0	7.7	0.51	
05	11.5	15.9	9.1	19.2	14.6	7.4	0.51	
06	23.9	13.0	5.6	17.9	14.3	7.2	0.50	
07	12.5	14.7	7.8	17.1	14.2	7.1	0.50	
08	14.6	11.6	4.6	16.8	14.2	7.1	0.50	
09	2.4	16.1	9.7	16.3	14.1	7.0	0.50	
10	12.7	14.8	7.9	15.1	13.7	6.7	0.49	
11	17.7	12.7	5.6	13.7	13.3	6.3	0.47	
12	9.9	11.4	4.6	12.5	12.9	6.0	0.47	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1876-01	14.3	12.7	5.7	11.7	12.7	5.9	0.46	
02	15.0	15.5	8.5	11.6	12.7	5.8	0.46	
03	30.6	13.9	6.2	11.7	12.6	5.8	0.46	
04	2.3	9.4	3.0	12.0	12.4	5.6	0.45	
05	5.1	10.5	4.0	11.8	12.4	5.5	0.44	
06	1.6	10.6	4.2	11.4	12.5	5.6	0.45	
07	15.2	12.1	5.1	11.7	12.5	5.7	0.46	
08	8.8	13.1	6.4	11.9	12.4	5.5	0.44	
09	9.9	13.0	6.2	10.8	12.2	5.4	0.44	
10	14.3	13.4	6.4	10.6	12.3	5.5	0.45	
11	9.9	13.1	6.3	11.8	12.6	5.8	0.46	
12	8.2	13.0	6.3	13.0	12.9	6.0	0.47	
1877-01	24.4	12.2	4.8	13.1	12.9	6.0	0.47	
02	8.7	12.5	5.8	12.6	12.7	5.8	0.46	
03	11.9	13.4	6.6	12.7	12.5	5.6	0.45	
04	15.8	11.8	4.8	12.7	12.2	5.3	0.43	
05	21.6	15.9	8.6	12.6	12.2	5.3	0.43	
06	14.2	11.9	4.9	12.5	12.1	5.2	0.43	
07	6.0	10.7	4.1	11.4	11.9	5.0	0.42	
08	6.3	10.5	3.9	10.4	11.7	4.9	0.42	
09	16.9	10.3	3.2	10.1	11.4	4.7	0.41	
10	6.7	9.9	3.3	9.3	11.2	4.5	0.40	
11	14.2	14.5	7.5	8.0	11.0	4.3	0.39	
12	2.2	9.7	3.3	7.1	10.7	4.1	0.38	
1878-01	3.3	10.4	3.9	6.6	10.6	4.0	0.38	
02	6.6	10.4	3.8	6.0	10.4	3.8	0.37	
03	7.8	9.1	2.4	5.3	10.4	3.8	0.37	
04	0.1	11.4	5.1	4.6	10.4	3.6	0.35	
05	5.9	10.2	3.6	4.0	10.2	3.7	0.36	
06	6.4	11.6	5.0	3.5	10.1	3.7	0.37	
07	0.1	7.7	1.4	3.3	10.2	3.7	0.36	
08	0.0	9.4	3.1	3.9	10.1	3.6	0.36	
09	5.3	10.8	4.3	2.4	10.1	3.7	0.37	
10	1.1	9.7	3.3	2.3	10.1	3.7	0.37	
11	4.1	10.0	3.5	2.4	9.9	3.5	0.35	
12	0.5	12.2	5.9	2.2	9.8	3.4	0.35	*Rm*(12)
1879-01	1.0	9.1	2.8	2.5	9.7	3.3	0.34	*aam*(12)
02	0.6	8.7	2.4	3.2	9.8	3.4	0.35	
03	0.0	11.5	5.2	3.7	9.9	3.4	0.34	
04	6.2	8.5	1.9	4.2	10.0	3.5	0.35	
05	2.4	9.2	2.8	5.0	10.0	3.4	0.34	
06	4.8	8.9	2.4	5.7	10.0	3.4	0.34	
07	7.5	8.8	2.2	6.9	10.0	3.4	0.34	
08	10.7	10.9	4.1	9.0	10.0	3.3	0.33	
09	6.1	11.8	5.2	10.9	10.0	3.2	0.32	aa_IM(12)
10	12.3	9.9	3.0	12.3	10.2	3.3	0.32	
11	13.1	10.1	3.2	13.7	10.6	3.7	0.35	
12	7.3	12.2	5.6	15.8	11.0	3.9	0.35	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1880-01	24.0	10.2	2.8	17.7	11.2	4.1	0.37	
02	27.2	7.6	0.0	19.8	12.0	4.8	0.40	
03	19.3	12.7	5.5	23.9	12.7	5.3	0.42	
04	19.5	11.8	4.6	27.6	13.1	5.6	0.43	
05	23.5	16.0	8.6	29.7	13.7	6.1	0.45	
06	34.1	10.2	2.3	31.3	14.3	6.5	0.45	
07	21.9	12.8	5.5	32.8	14.8	7.0	0.47	
08	48.1	26.0	17.5	34.4	15.5	7.6	0.49	
09	66.0	14.3	5.0	36.8	16.0	8.0	0.50	
10	43.0	17.3	9.0	39.5	16.2	8.1	0.50	
11	30.7	17.4	9.7	41.6	16.1	7.9	0.49	
12	29.6	17.5	9.8	43.6	16.1	7.8	0.48	
1881-01	36.4	18.1	10.1	47.0	16.3	7.8	0.48	
02	53.2	15.7	6.9	49.7	15.8	7.2	0.46	
03	51.5	16.1	7.4	49.6	15.4	6.8	0.44	
04	51.6	14.3	5.6	49.9	15.7	7.0	0.45	
05	43.5	11.5	3.2	51.8	15.9	7.2	0.45	
06	60.5	13.6	4.5	53.5	16.4	7.6	0.46	
07	76.9	15.1	5.2	54.6	16.6	7.8	0.47	
08	58.4	10.7	1.7	55.6	16.9	8.0	0.47	
09	53.2	20.8	12.0	57.0	17.3	8.4	0.49	
10	64.4	16.9	7.6	59.5	18.5	9.4	0.51	
11	54.8	23.1	14.3	62.2	20.0	10.8	0.54	
12	47.3	23.2	14.7	62.4	20.9	11.7	0.56	
1882-01	45.0	18.6	10.2	60.4	21.3	12.2	0.57	
02	69.5	22.4	12.9	58.4	21.9	12.9	0.59	
03	66.8	19.4	10.0	57.9	22.3	13.3	0.60	
04	95.8	38.9	28.2	57.8	22.6	13.6	0.60	
05	64.1	23.5	14.2	58.9	24.5	15.5	0.63	
06	45.2	21.9	13.5	59.9	26.0	16.9	0.65	
07	45.4	17.4	9.0	60.3	25.9	16.9	0.65	
08	40.4	22.6	14.4	60.0	26.2	17.2	0.66	
09	57.7	17.9	8.9	58.1	26.8	17.8	0.66	*aam*(12), aa_IM(12)
10	59.2	27.9	18.9	56.5	26.3	17.4	0.66	
11	84.4	57.9	47.7	54.6	25.3	16.5	0.65	
12	41.8	23.0	14.8	54.5	25.0	16.2	0.65	
1883-01	60.6	18.3	9.2	57.3	25.3	16.3	0.64	
02	46.9	29.6	21.1	59.0	25.3	16.2	0.64	
03	42.8	26.2	17.9	59.0	25.2	16.1	0.64	
04	82.1	20.7	10.6	59.8	24.9	15.8	0.63	
05	31.5	16.9	9.1	60.9	22.8	13.7	0.60	
06	76.3	21.4	11.6	62.3	20.9	11.8	0.56	
07	80.6	24.4	14.4	65.0	20.3	11.0	0.54	
08	46.0	15.4	7.0	67.9	19.6	10.1	0.52	
09	52.6	22.4	13.7	71.4	18.8	9.2	0.49	
10	83.8	16.6	6.4	73.0	18.5	8.8	0.48	
11	84.5	20.5	10.3	74.2	18.3	8.6	0.47	
12	75.9	14.9	5.1	74.6	18.1	8.3	0.46	*RM*(12)

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1884-01	91.5	12.0	1.5	72.4	17.6	7.9	0.45	
02	86.9	17.2	6.9	71.7	17.4	7.7	0.44	
03	87.5	20.4	10.1	72.4	17.1	7.5	0.44	
04	76.1	18.5	8.7	71.3	17.0	7.4	0.44	
05	66.5	15.7	6.3	67.8	17.0	7.6	0.45	
06	51.2	16.0	7.3	64.6	17.1	7.8	0.46	
07	53.1	18.4	9.6	61.3	17.3	8.1	0.47	
08	55.8	15.9	7.0	58.8	17.5	8.5	0.49	
09	61.9	16.4	7.2	56.6	17.4	8.5	0.49	
10	47.8	19.0	10.5	54.2	17.1	8.3	0.49	
11	36.6	19.8	11.8	53.6	17.4	8.6	0.49	
12	47.2	16.1	7.6	55.2	17.8	9.0	0.51	
1885-01	42.8	16.1	7.8	57.1	17.8	8.8	0.49	
02	71.8	18.4	8.8	57.4	17.9	8.9	0.50	
03	49.8	16.2	7.6	56.2	18.4	9.5	0.52	
04	55.0	16.9	8.1	54.9	18.8	9.9	0.53	
05	73.0	24.1	14.4	54.4	18.6	9.8	0.53	
06	83.7	17.1	6.9	53.2	18.4	9.7	0.53	
07	66.5	15.9	6.5	51.6	18.6	9.9	0.53	
08	50.0	20.6	12.0	49.2	18.9	10.3	0.54	
09	39.6	25.0	16.9	47.6	19.5	11.0	0.56	
10	38.7	18.9	10.8	47.4	20.4	11.9	0.58	
11	30.9	16.6	8.9	45.2	20.8	12.4	0.60	
12	21.7	15.0	7.7	41.1	21.2	13.0	0.61	
1886-01	29.9	20.7	13.0	37.2	21.7	13.7	0.63	
02	25.9	20.0	12.5	34.3	22.0	14.1	0.64	
03	57.3	30.5	21.6	32.2	21.9	14.1	0.64	
04	43.7	24.5	16.2	30.2	22.0	14.3	0.65	
05	30.7	25.5	17.8	27.5	22.6	15.0	0.66	
06	27.1	24.5	16.9	25.8	23.2	15.7	0.68	
07	30.3	22.2	14.5	24.6	23.5	16.1	0.69	
08	16.9	21.0	13.9	23.2	23.7	16.3	0.69	$aam'(12)$, $aa_IM'(12)$
09	21.4	22.0	14.7	20.5	23.4	16.1	0.69	
10	8.6	24.6	17.9	16.7	22.9	15.7	0.69	
11	0.3	23.6	17.3	14.7	22.6	15.6	0.69	
12	13.0	23.5	16.6	13.8	22.0	15.0	0.68	
1887-01	10.3	19.8	13.0	13.1	21.4	14.4	0.67	
02	13.2	25.8	18.1	13.0	21.0	14.1	0.67	
03	4.2	18.1	11.6	12.6	21.0	14.1	0.67	
04	6.9	23.5	16.9	11.9	20.7	13.8	0.67	
05	20.0	20.2	13.0	12.1	20.1	13.2	0.66	
06	15.7	15.5	8.5	12.7	19.6	12.7	0.65	
07	23.3	15.4	8.0	13.2	19.5	12.5	0.64	
08	21.4	20.1	12.8	13.0	19.3	12.3	0.64	
09	7.4	21.8	15.2	12.9	18.9	12.0	0.63	
10	6.6	17.0	10.4	13.0	18.8	11.9	0.63	
11	6.9	17.5	10.9	12.4	18.7	11.8	0.63	
12	20.7	18.1	10.8	11.5	18.8	12.0	0.64	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1888-01	12.7	21.1	14.2	10.3	18.9	12.2	0.65	
02	7.1	18.8	12.2	8.6	18.8	12.1	0.64	
03	7.8	18.1	11.4	7.9	18.5	11.8	0.64	
04	5.1	19.3	12.8	7.8	18.4	11.7	0.64	
05	7.0	22.2	15.6	7.8	18.4	11.8	0.64	
06	7.1	17.4	10.8	7.3	18.4	12.2	0.66	
07	3.1	15.8	9.4	6.3	18.0	12.2	0.68	
08	2.8	16.6	10.2	5.8	17.5	11.7	0.67	
09	8.8	18.0	11.3	5.8	17.2	11.4	0.66	
10	2.1	17.9	11.5	5.8	17.0	11.2	0.66	
11	10.7	18.2	11.4	5.6	16.4	10.6	0.65	
12	6.7	17.0	19.4	5.3	15.8	10.0	0.63	
1889-01	0.8	12.8	6.5	5.6	15.6	9.8	0.63	
02	8.5	13.9	7.2	6.6	15.6	9.8	0.63	
03	6.7	16.8	10.2	7.2	15.6	9.7	0.62	
04	4.3	14.5	8.0	7.1	15.5	9.6	0.62	
05	2.4	13.1	6.7	6.7	15.6	9.7	0.62	
06	6.4	12.8	6.2	6.3	15.6	9.4	0.60	
07	9.4	16.4	9.7	6.5	15.6	9.0	0.58	
08	20.6	15.5	8.2	6.3	15.7	9.1	0.58	
09	6.5	17.5	10.9	5.9	15.5	9.0	0.58	
10	2.1	16.5	10.1	5.7	15.3	8.7	0.57	
11	0.2	21.4	15.1	5.7	15.0	8.5	0.57	
12	6.7	14.7	8.1	5.6	14.9	8.3	0.56	
1890-01	5.3	14.6	8.1	5.5	14.6	8.1	0.55	
02	0.6	14.7	8.4	5.0	14.4	7.8	0.54	
03	5.1	12.9	6.4	5.0	14.2	7.7	0.54	*Rm*(13)
04	1.6	11.3	4.9	5.8	14.3	7.7	0.54	
05	4.8	11.4	4.9	6.6	14.2	7.6	0.54	
06	1.3	10.2	3.8	7.0	13.8	7.2	0.52	
07	11.6	12.9	6.1	7.4	13.6	7.0	0.51	*aam*(13)
08	8.5	13.2	6.5	8.6	13.7	7.0	0.51	aa_IM(13)
09	17.2	16.8	9.7	9.8	14.2	7.5	0.53	
10	11.2	18.6	11.8	10.8	15.2	8.4	0.55	
11	9.6	16.2	9.5	13.1	16.5	9.6	0.58	
12	7.8	11.2	4.5	16.5	17.3	10.2	0.59	
1891-01	13.5	13.3	6.4	20.5	17.5	10.3	0.59	
02	22.2	17.2	9.9	23.5	17.8	10.4	0.58	
03	10.4	23.5	16.7	26.0	18.3	10.8	0.59	
04	20.5	25.4	18.2	29.2	18.9	11.2	0.59	
05	41.1	26.6	18.4	32.2	19.2	11.4	0.59	
06	48.3	14.6	6.1	34.6	19.7	11.8	0.60	
07	58.8	14.1	5.1	37.9	20.4	12.3	0.60	
08	33.0	18.0	10.2	42.5	21.6	13.4	0.62	
09	53.8	25.3	16.5	46.3	23.2	14.7	0.63	
10	51.5	23.6	14.9	50.0	23.7	15.1	0.64	
11	41.9	19.4	11.2	53.7	23.7	14.9	0.63	
12	32.5	19.1	11.3	56.5	24.0	15.1	0.63	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1892-01	69.1	22.4	12.9	58.4	25.2	16.2	0.64	
02	75.6	38.0	28.2	62.0	26.4	17.3	0.66	
03	49.9	39.2	30.6	65.2	26.6	17.3	0.65	
04	69.6	23.3	13.8	66.4	26.6	17.3	0.65	
05	79.6	28.0	18.0	68.1	26.7	17.2	0.64	
06	76.3	20.6	10.8	71.0	26.9	17.3	0.64	
07	76.5	36.6	26.8	73.2	27.1	17.4	0.64	*aam*(13), aa_IM(13)
08	101.4	25.0	14.0	73.4	26.4	16.7	0.63	
09	62.8	23.1	13.9	73.9	25.0	15.3	0.61	
10	70.5	26.0	16.4	75.3	24.0	14.2	0.59	
11	65.4	18.6	9.3	76.3	23.1	13.3	0.58	
12	78.6	25.1	15.2	77.0	22.6	12.7	0.56	
1893-01	75.0	21.1	11.3	78.0	21.8	11.8	0.54	
02	73.0	22.0	12.3	79.7	20.8	10.8	0.52	
03	65.7	21.3	12.0	81.5	20.6	10.6	0.51	
04	88.1	16.9	6.5	82.5	20.5	10.4	0.51	
05	84.7	14.9	4.7	83.3	20.5	10.4	0.51	
06	89.9	20.0	9.5	84.3	20.3	10.1	0.50	
07	88.6	17.5	7.1	85.3	20.0	9.8	0.49	
08	129.2	21.4	9.1	86.1	20.7	10.4	0.50	
09	77.9	22.4	12.5	86.0	21.4	11.1	0.52	
10	80.0	23.8	13.8	85.2	21.6	11.3	0.52	
11	75.1	21.4	11.6	85.6	22.0	11.7	0.53	
12	93.8	16.9	6.3	86.7	22.4	12.1	0.54	
1894-01	83.2	22.1	12.0	87.9	23.0	12.6	0.55	*RM*(13)
02	84.6	36.8	26.6	86.2	23.6	13.3	0.56	
03	52.3	22.9	14.2	83.2	23.8	13.7	0.58	
04	81.6	20.3	10.2	82.5	23.8	13.7	0.58	
05	101.2	21.9	10.9	81.6	23.8	13.7	0.58	
06	98.9	22.9	12.0	79.4	23.9	13.9	0.58	*aam′*(13), aa_IM'(13)
07	106.0	29.2	18.0	77.2	23.6	13.7	0.58	
08	70.3	23.9	14.4	75.6	22.9	13.1	0.57	
09	65.9	25.5	16.2	75.3	21.4	12.7	0.59	
10	75.5	20.0	10.2	75.4	22.7	13.0	0.57	
11	56.6	24.8	15.9	73.8	22.8	13.1	0.57	
12	60.0	14.9	5.8	71.3	22.6	13.0	0.58	
1895-01	63.3	18.3	9.1	67.7	22.1	12.7	0.57	
02	67.2	23.7	14.3	65.2	21.3	12.0	0.56	
03	61.0	25.9	16.8	64.8	20.6	11.3	0.55	
04	76.9	23.6	13.7	64.2	20.6	11.3	0.55	
05	67.5	19.5	10.1	63.5	20.8	11.6	0.56	
06	71.5	20.5	10.9	63.5	21.0	11.7	0.56	
07	47.8	20.8	12.3	62.5	21.5	12.3	0.57	
08	68.9	13.4	3.9	60.7	22.0	12.9	0.59	
09	57.7	18.8	9.8	59.9	22.1	12.8	0.58	
10	67.9	25.6	16.2	58.2	21.9	12.4	0.57	
11	47.2	25.4	16.9	55.1	21.9	12.6	0.58	
12	70.7	17.5	7.9	52.5	21.8	12.6	0.58	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1896-01	29.0	28.3	20.7	51.5	21.5	12.3	0.57	
02	57.4	26.5	17.5	49.6	21.7	12.6	0.58	
03	52.0	24.7	10.1	48.0	22.1	13.1	0.59	
04	43.8	20.1	11.8	46.5	22.0	13.0	0.59	
05	27.7	23.5	15.9	44.5	21.4	12.5	0.58	
06	49.0	14.6	6.0	43.0	21.0	12.2	0.58	
07	45.0	18.5	10.1	42.3	20.4	11.6	0.57	
08	27.2	21.0	13.4	41.6	19.4	10.7	0.55	
09	61.3	20.7	11.6	39.5	18.7	10.3	0.55	
10	28.7	20.4	12.8	38.0	18.6	10.5	0.56	
11	38.0	16.0	7.9	37.1	18.5	10.5	0.57	
12	42.6	16.7	8.4	35.2	18.3	10.4	0.57	
1897-01	40.6	14.9	6.7	32.9	18.1	10.2	0.56	
02	29.4	17.0	9.3	32.0	17.5	9.7	0.55	
03	29.1	17.1	9.5	31.2	16.9	9.2	0.54	
04	31.0	25.1	17.4	30.1	16.5	8.8	0.53	
05	20.0	17.5	10.3	28.3	16.3	8.7	0.53	
06	11.3	14.9	8.1	26.6	16.4	8.9	0.54	
07	27.6	12.2	4.6	25.8	16.6	9.1	0.55	
08	21.8	13.6	6.3	25.7	16.7	9.2	0.55	
09	48.1	13.9	5.4	26.3	17.0	9.5	0.56	
10	14.3	16.8	9.8	26.0	16.9	9.4	0.56	
11	8.4	15.5	8.8	25.6	16.6	9.1	0.55	
12	33.3	20.1	12.3	26.3	16.7	9.2	0.55	
1898-01	30.2	16.4	8.7	26.0	17.0	9.5	0.56	
02	36.4	18.0	10.0	25.6	17.3	9.8	0.57	
03	38.3	23.4	15.3	25.4	17.9	10.4	0.58	
04	14.5	16.3	9.3	25.7	18.3	10.8	0.59	
05	25.8	18.0	10.5	27.5	18.4	10.8	0.59	
06	22.3	17.2	9.9	27.6	18.3	10.7	0.58	
07	9.0	16.4	9.7	26.3	18.1	10.6	0.59	
08	31.4	17.5	9.7	24.7	18.3	10.8	0.59	
09	34.8	24.4	16.5	22.7	18.2	10.8	0.59	
10	34.4	17.0	9.1	21.9	18.0	10.7	0.59	
11	30.9	16.5	8.8	21.1	18.1	10.8	0.60	
12	12.6	15.9	9.0	20.3	18.1	10.8	0.60	
1899-01	19.5	17.3	10.1	20.4	18.0	10.7	0.59	
02	9.2	20.7	14.0	19.4	17.8	10.6	0.60	
03	18.1	18.5	11.4	17.1	17.3	10.2	0.59	
04	14.2	17.1	10.1	15.1	16.8	9.8	0.58	
05	7.7	18.8	12.1	13.2	16.4	9.5	0.58	
06	20.5	16.4	9.2	12.2	16.1	9.3	0.58	
07	13.5	14.5	7.6	11.7	16.0	9.1	0.57	
08	2.9	14.3	7.9	11.5	15.6	8.6	0.55	
09	8.4	16.5	9.8	11.2	15.1	8.1	0.54	
10	13.0	12.3	5.4	10.9	14.7	7.7	0.52	
11	7.8	11.6	4.9	11.3	14.2	7.1	0.50	
12	10.5	15.0	8.2	11.3	13.5	6.5	0.48	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1900-01	9.4	16.4	6.7	10.7	12.9	5.9	0.46	
02	13.6	11.8	4.9	10.5	12.4	5.4	0.44	
03	8.6	15.4	8.7	10.6	11.8	4.8	0.41	
04	16.0	10.1	3.1	10.6	11.4	4.3	0.38	
05	15.2	12.5	5.5	10.4	11.2	4.1	0.37	
06	12.1	7.6	0.7	9.9	10.7	3.7	0.35	
07	8.3	8.1	1.4	9.1	10.2	3.4	0.33	
08	4.3	8.9	2.4	8.2	9.9	3.2	0.32	
09	8.3	8.1	1.4	7.6	9.2	2.9	0.32	
10	12.9	10.0	3.1	6.8	9.2	2.6	0.28	
11	4.5	8.3	1.8	5.9	9.0	2.4	0.27	aa_IM(14)
12	0.3	8.3	2.0	5.4	8.9	2.4	0.27	
1901-01	0.2	10.2	3.9	4.8	9.0	2.5	0.28	
02	2.4	10.0	3.6	4.4	9.0	2.5	0.28	
03	4.5	9.4	2.9	3.9	9.0	2.6	0.29	
04	0.0	8.2	1.9	3.2	9.0	2.6	0.29	
05	10.2	9.1	2.3	2.8	8.9	2.5	0.28	
06	5.8	8.9	2.3	2.8	9.0	2.6	0.29	
07	0.7	8.5	2.2	3.0	9.0	2.5	0.28	
08	1.0	9.0	2.7	3.1	8.9	2.5	0.28	
09	0.6	8.9	2.6	3.3	8.9	2.5	0.28	*aam*(14)
10	3.7	8.3	1.8	3.6	9.0	2.6	0.29	
11	3.8	8.5	2.0	3.3	9.1	2.7	0.30	
12	0.0	9.3	3.0	2.8	9.1	2.6	0.29	
1902-01	5.5	9.0	2.4	2.6	9.1	2.6	0.29	*Rm*(14)
02	0.0	10.5	4.2	2.7	9.1	2.7	0.30	
03	12.4	8.9	2.0	3.1	9.2	2.7	0.29	
04	0.0	10.8	4.5	3.9	9.3	2.8	0.30	
05	2.8	8.5	2.1	4.7	9.4	2.9	0.31	
06	1.4	8.3	1.9	5.0	9.5	3.0	0.32	
07	0.9	9.2	2.9	5.2	9.5	3.0	0.32	
08	2.3	9.1	2.7	6.0	9.5	2.9	0.31	
09	7.6	9.9	3.2	6.8	9.4	2.8	0.30	
10	16.3	10.1	3.0	7.9	9.5	2.9	0.31	
11	10.3	10.5	3.7	9.5	9.7	3.0	0.31	
12	1.1	9.0	2.6	10.6	10.1	3.3	0.33	
1903-01	8.3	9.5	2.8	12.3	10.5	3.6	0.34	
02	17.0	8.8	1.7	14.6	11.0	4.0	0.36	
03	13.5	9.6	2.7	15.8	11.7	4.6	0.39	
04	26.1	13.2	5.7	16.9	12.7	5.7	0.45	
05	14.6	10.7	3.7	19.3	13.9	6.7	0.48	
06	16.3	14.3	7.2	22.5	14.6	7.2	0.49	
07	27.9	13.7	6.1	25.4	15.2	7.8	0.51	
08	28.8	17.1	9.5	26.6	15.9	8.3	0.52	
09	11.1	16.9	10.1	27.9	16.2	8.6	0.53	
10	38.9	29.2	21.1	29.6	16.4	8.8	0.54	
11	44.5	19.2	10.8	31.4	16.8	9.0	0.54	
12	45.6	16.4	8.0	33.5	17.0	9.1	0.54	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1904-01	31.6	18.0	10.2	35.5	16.9	9.0	0.53	
02	24.5	15.5	8.1	37.7	16.8	8.7	0.52	
03	37.2	11.7	3.7	39.7	16.5	8.3	0.50	
04	43.0	16.0	7.7	41.1	15.8	7.6	0.48	
05	39.5	15.9	7.8	41.5	15.0	6.8	0.45	
06	41.9	13.4	5.2	41.6	14.7	6.5	0.44	
07	50.6	13.7	5.1	42.9	14.6	6.4	0.44	
08	58.2	13.1	4.1	46.4	15.0	6.6	0.44	
09	30.1	14.1	6.4	49.8	15.7	7.1	0.45	
10	54.2	15.9	7.1	50.5	16.1	7.5	0.47	
11	38.0	14.5	6.4	50.7	16.2	7.5	0.46	
12	54.6	13.5	4.7	51.3	16.2	7.5	0.46	
1905-01	54.8	18.9	10.1	52.5	16.4	7.7	0.47	
02	85.8	23.2	12.9	53.5	16.7	7.9	0.47	
03	56.5	19.6	10.7	54.6	17.2	8.4	0.49	
04	39.3	19.5	11.4	56.6	17.3	8.4	0.49	
05	48.0	13.5	5.0	60.5	17.6	8.5	0.48	
06	49.0	16.7	8.1	63.4	18.0	8.7	0.48	
07	73.0	14.7	5.0	63.1	17.6	8.4	0.48	
08	58.8	19.7	10.7	60.4	17.2	8.1	0.47	
09	55.0	19.2	10.4	58.5	16.9	7.9	0.47	
10	78.7	14.1	4.2	59.5	16.6	7.6	0.46	
11	107.2	23.0	11.7	60.6	16.4	7.3	0.45	
12	55.5	13.6	4.7	61.6	16.4	7.2	0.44	
1906-01	45.5	10.5	2.1	63.4	16.3	7.1	0.44	
02	31.3	20.4	12.7	64.2	16.1	6.8	0.42	*RM*(14)
03	64.5	16.9	7.6	63.8	15.8	6.6	0.42	
04	55.3	14.5	5.6	61.3	15.8	6.7	0.42	
05	57.7	14.3	5.3	55.9	15.4	6.5	0.42	
06	63.2	14.2	5.0	53.5	15.2	6.5	0.43	
07	103.6	15.3	4.2	55.1	15.8	7.0	0.44	
08	47.7	14.9	6.4	59.6	16.5	7.5	0.45	
09	56.1	17.1	8.2	62.7	16.9	7.7	0.46	
10	17.8	15.6	8.5	62.4	16.9	7.7	0.46	
11	38.9	12.5	4.4	61.7	17.2	8.0	0.47	
12	64.7	19.4	10.1	60.1	17.5	8.5	0.49	
1907-01	76.4	19.4	9.6	56.9	17.9	8.9	0.50	
02	108.2	28.2	16.9	55.0	18.2	9.4	0.52	
03	60.7	17.2	8.1	56.4	18.5	9.6	0.52	
04	52.6	15.1	6.4	59.6	18.8	9.8	0.52	
05	42.9	19.7	11.4	62.6	19.3	10.1	0.52	
06	40.4	17.8	9.6	62.8	19.3	10.1	0.52	
07	49.7	19.8	11.2	60.5	18.9	9.9	0.52	
08	54.3	18.4	9.6	55.9	18.5	9.6	0.52	
09	85.0	19.7	9.5	51.4	18.5	9.8	0.53	
10	65.4	21.4	12.1	50.3	19.0	10.4	0.55	
11	61.5	17.5	8.4	50.4	19.3	10.6	0.55	
12	47.3	14.5	6.0	50.6	19.2	10.6	0.55	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1908-01	39.2	16.6	8.5	50.5	18.9	10.3	0.54	
02	33.9	19.9	12.0	51.6	18.7	10.0	0.53	
03	28.7	26.1	18.5	53.2	19.5	10.7	0.55	
04	57.6	18.6	9.6	51.9	20.0	11.3	0.57	
05	40.8	21.8	13.6	49.9	20.0	11.4	0.56	
06	48.1	15.5	7.0	48.9	20.1	11.5	0.57	
07	39.5	13.3	5.2	49.3	20.5	12.0	0.59	
08	90.5	21.1	10.6	50.5	21.0	12.4	0.59	
09	86.9	34.5	24.2	52.6	20.9	12.1	0.58	
10	32.3	18.7	10.9	53.1	20.6	11.8	0.57	
11	45.5	20.4	12.0	51.9	20.4	11.7	0.57	
12	39.5	14.4	6.3	50.6	20.3	11.7	0.58	
1909-01	56.7	27.7	18.8	49.4	20.4	11.8	0.58	
02	46.6	20.0	11.5	46.4	20.5	12.0	0.59	
03	66.3	22.7	13.3	41.6	20.3	12.0	0.59	
04	32.3	15.1	7.3	40.7	20.3	12.1	0.60	
05	36.0	21.2	13.2	42.2	20.2	11.9	0.59	
06	22.6	14.4	7.1	43.3	20.0	11.7	0.59	
07	35.8	15.5	7.5	42.6	19.6	11.3	0.58	
08	23.1	20.5	13.1	40.7	19.0	10.8	0.57	
09	38.8	30.6	22.5	38.2	18.9	10.9	0.58	
10	58.4	22.3	13.3	35.4	19.3	11.4	0.59	
11	55.8	14.5	5.6	33.8	19.6	11.7	0.60	
12	54.2	16.8	8.0	32.8	19.6	11.8	0.60	
1910-01	26.4	15.7	8.2	31.5	19.7	11.9	0.60	
02	31.5	17.5	9.7	30.1	19.7	12.0	0.61	
03	21.4	23.8	16.5	29.1	19.4	11.8	0.61	
04	8.4	22.7	16.0	27.7	19.3	11.7	0.61	
05	22.2	20.2	12.9	24.7	19.8	12.3	0.62	
06	12.3	16.7	9.8	20.6	19.6	13.0	0.66	
07	14.1	13.7	6.7	17.6	20.9	13.7	0.66	
08	11.5	23.1	16.3	15.7	21.6	14.6	0.68	
09	26.2	22.1	14.6	14.2	22.0	15.0	0.68	
10	38.3	27.3	19.2	14.0	22.1	15.1	0.68	
11	4.9	20.8	14.3	13.8	22.1	15.2	0.69	
12	5.8	22.4	15.8	12.8	22.1	15.2	0.69	
1911-01	3.4	24.2	17.7	12.0	22.2	15.4	0.69	*aam*(14), aa_IM(14)
02	9.0	26.6	19.9	11.2	22.1	15.3	0.69	
03	7.8	24.4	17.7	10.0	21.5	14.7	0.68	
04	16.5	24.1	17.0	7.6	20.7	14.0	0.68	
05	9.0	19.5	12.8	6.0	19.9	13.3	0.67	
06	2.2	16.5	10.1	5.9	19.2	12.6	0.66	
07	3.5	18.2	11.7	5.6	18.3	11.7	0.64	
08	4.0	14.8	8.3	5.1	17.1	10.5	0.61	
09	4.0	15.1	8.6	4.6	15.8	9.3	0.59	
10	2.6	15.4	9.0	4.0	14.8	8.3	0.56	
11	4.2	13.6	7.1	3.3	14.0	7.5	0.54	
12	2.2	13.9	7.5	3.2	13.5	7.0	0.52	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1912-01	0.3	10.5	4.2	3.2	12.9	6.5	0.50	
02	0.0	10.9	4.6	3.0	12.6	6.1	0.48	
03	4.9	10.6	4.1	3.1	12.4	6.0	0.48	
04	4.5	12.3	5.8	3.4	12.2	5.7	0.47	
05	4.4	12.5	6.0	3.4	12.0	5.6	0.47	
06	4.1	11.3	4.8	3.4	11.9	5.4	0.45	
07	3.0	10.7	4.3	3.7	11.9	5.5	0.46	
08	0.3	13.4	7.1	3.9	12.1	5.6	0.46	
09	9.5	12.7	6.0	3.8	12.3	5.8	0.47	
10	4.6	12.4	5.9	3.5	12.4	5.9	0.48	
11	1.1	12.3	5.9	3.2	12.4	5.9	0.48	
12	6.4	12.3	5.7	2.8	12.3	5.9	0.48	
1913-01	2.3	13.2	6.8	2.6	12.2	5.8	0.48	
02	2.9	12.4	6.0	2.5	12.0	5.6	0.47	
03	0.5	12.8	6.5	2.2	11.9	5.5	0.46	
04	0.9	12.8	6.5	1.8	11.9	5.5	0.46	
05	0.0	11.9	5.6	1.7	11.9	5.5	0.46	
06	0.0	9.9	3.6	1.6	11.7	5.3	0.45	
07	1.7	9.9	3.5	1.5	11.5	5.1	0.44	
08	0.2	9.6	3.3	1.5	11.2	4.9	0.44	*Rm*(15)
09	1.2	12.9	6.5	1.6	11.2	4.8	0.43	*aam*(15), aa_IM(15)
10	3.1	13.6	7.2	2.4	11.3	4.9	0.43	
11	0.7	10.5	4.2	3.3	11.4	5.0	0.44	
12	3.8	9.6	3.1	4.0	11.5	5.1	0.44	
1914-01	2.8	10.1	3.7	4.6	11.9	5.4	0.45	
02	2.6	10.2	3.8	5.1	12.5	6.0	0.48	
03	3.1	13.0	6.6	5.8	12.9	6.4	0.50	
04	17.3	16.4	9.3	6.5	13.1	6.5	0.50	
05	5.2	11.0	4.5	7.4	13.5	6.8	0.50	
06	11.4	13.2	6.4	8.8	13.8	7.1	0.51	
07	5.4	15.8	9.3	10.4	14.1	7.3	0.52	
08	7.7	17.8	11.1	12.9	14.5	7.6	0.52	
09	12.7	14.7	7.8	16.1	14.9	7.9	0.53	
10	8.2	16.2	9.5	18.6	15.2	8.1	0.53	
11	16.4	16.3	9.2	20.7	15.5	8.3	0.54	
12	22.3	12.2	4.9	24.3	16.1	8.7	0.54	
1915-01	23.0	13.9	6.5	29.4	16.3	8.7	0.53	
02	42.3	16.4	8.1	34.8	16.3	8.4	0.52	
03	38.8	17.9	9.8	38.9	16.5	8.4	0.51	
04	41.3	18.2	10.0	42.3	17.0	8.8	0.52	
05	33.0	16.8	9.0	45.3	17.8	9.4	0.53	
06	68.8	20.8	11.3	46.9	18.4	10.0	0.54	
07	71.6	14.1	4.5	48.3	18.8	10.2	0.54	
08	69.6	17.6	8.1	49.8	18.9	10.3	0.54	
09	49.5	19.9	11.3	51.5	19.3	10.6	0.55	
10	53.5	24.2	15.4	53.9	19.8	11.0	0.56	
11	42.5	27.8	19.5	56.9	20.3	11.3	0.56	
12	34.5	15.3	7.4	58.6	20.4	11.4	0.56	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1916-01	45.3	18.9	10.5	57.8	20.7	11.7	0.57	
02	55.4	14.5	5.6	55.6	21.3	12.5	0.59	
03	67.0	27.9	18.5	54.0	21.8	13.0	0.60	
04	71.8	22.1	12.5	53.7	22.2	13.4	0.60	
05	74.5	23.1	13.4	54.6	22.3	13.5	0.61	
06	67.7	18.7	9.3	56.3	22.5	13.6	0.60	
07	53.5	22.6	13.8	58.3	23.2	14.2	0.61	
08	35.2	24.3	16.4	60.2	23.9	14.8	0.62	
09	45.1	25.3	16.9	62.1	23.8	14.7	0.62	
10	50.7	27.4	18.8	63.3	23.3	14.1	0.61	
11	65.6	26.9	17.6	65.1	23.1	13.8	0.60	
12	53.0	21.8	13.1	68.7	22.7	13.3	0.59	
1917-01	74.7	28.0	18.2	73.4	22.4	12.7	0.57	
02	71.9	22.0	12.4	81.2	22.5	12.4	0.55	
03	94.8	19.1	8.4	89.7	22.5	12.1	0.54	
04	74.7	19.6	9.8	94.1	22.1	11.4	0.52	
05	114.1	18.8	7.2	96.3	21.5	10.7	0.50	
06	114.9	15.6	4.0	100.7	21.1	10.2	0.48	
07	119.8	17.5	5.7	104.8	20.9	9.7	0.46	
08	154.5	31.1	17.7	105.4	20.7	9.5	0.46	*RM*(15)
09	129.4	19.0	6.7	104.2	20.9	9.8	0.47	
10	72.2	23.1	13.5	103.5	21.2	10.1	0.48	
11	96.4	17.7	6.9	102.2	21.5	10.5	0.49	
12	129.3	22.7	10.4	98.3	21.7	10.9	0.50	
1918-01	96.0	20.7	10.0	95.5	22.0	11.3	0.51	
02	65.3	24.3	15.0	92.8	21.9	11.3	0.52	
03	72.2	22.6	13.0	88.5	22.1	11.7	0.53	
04	80.5	23.5	13.5	87.0	22.9	12.6	0.55	
05	76.7	21.7	11.9	87.0	23.5	13.2	0.56	
06	59.4	18.5	9.5	83.5	24.2	14.0	0.58	
07	107.6	20.3	9.0	78.6	24.9	15.0	0.60	
08	101.7	25.1	14.1	77.2	25.6	15.7	0.61	
09	79.9	31.3	21.3	77.5	26.2	16.4	0.63	
10	85.0	29.3	19.1	76.1	26.7	16.9	0.63	
11	83.4	26.0	15.8	75.4	27.1	17.3	0.64	
12	59.2	31.0	22.0	78.0	27.4	17.5	0.64	*aam*(15), aa_IM(15)
1919-01	48.1	30.7	22.2	78.4	27.2	17.3	0.64	
02	79.5	29.4	19.4	75.2	27.2	17.4	0.64	
03	66.5	33.6	24.2	72.8	27.0	17.4	0.64	
04	51.8	24.2	15.5	70.4	26.9	17.4	0.65	
05	88.1	30.4	20.0	67.4	26.6	17.2	0.65	
06	111.2	16.8	5.4	64.6	25.8	16.5	0.64	
07	64.7	17.8	8.5	63.7	25.0	15.7	0.63	
08	69.0	25.6	16.1	62.8	24.0	14.8	0.62	
09	54.7	28.2	19.4	61.9	23.4	14.2	0.61	
10	52.8	29.8	21.1	60.5	23.1	14.0	0.61	
11	42.0	17.2	9.0	56.7	22.6	13.7	0.61	
12	34.9	21.3	13.4	51.4	22.1	13.4	0.61	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1920-01	51.1	19.6	10.9	46.8	22.0	13.6	0.62	
02	53.9	17.0	8.2	43.2	21.6	13.4	0.62	
03	70.2	31.4	21.9	40.3	21.3	13.2	0.62	
04	14.8	20.7	13.7	39.4	20.9	12.8	0.61	
05	33.3	20.6	12.8	38.7	20.6	12.5	0.61	
06	38.7	15.3	7.2	37.9	20.6	12.5	0.61	
07	27.5	16.9	9.3	36.8	20.3	12.3	0.61	
08	19.2	17.7	10.5	34.9	19.9	12.0	0.60	
09	36.3	28.6	20.6	32.1	19.2	11.3	0.59	
10	49.6	20.2	11.6	31.0	18.7	10.7	0.57	
11	27.2	18.0	10.4	31.3	19.6	11.6	0.59	
12	29.9	19.9	12.2	30.6	20.6	12.6	0.61	
1921-01	31.5	14.6	6.8	31.0	20.5	12.5	0.61	
02	28.3	13.5	5.9	31.7	20.5	12.4	0.60	
03	26.7	18.5	7.5	31.1	19.9	11.9	0.60	
04	32.4	20.1	12.3	29.0	19.3	11.4	0.59	
05	22.2	43.5	36.2	27.3	19.3	11.5	0.60	
06	33.7	15.3	7.4	26.5	19.4	11.6	0.60	
07	41.9	16.2	8.0	25.3	19.7	12.0	0.61	
08	22.8	17.5	10.1	24.4	20.3	12.6	0.62	
09	17.8	15.3	8.2	25.5	21.0	13.4	0.64	
10	18.2	19.2	12.1	25.8	21.6	14.1	0.65	
11	17.8	19.1	12.0	24.3	21.0	13.5	0.64	
12	20.3	20.7	13.5	22.5	20.3	13.0	0.64	
1922-01	11.8	20.9	14.1	20.1	20.8	13.6	0.65	
02	26.4	21.5	14.0	18.1	21.4	14.2	0.66	
03	54.7	27.0	18.2	16.9	21.9	14.9	0.68	
04	11.0	26.4	19.6	15.8	22.4	15.4	0.69	
05	8.0	21.2	14.5	14.9	22.4	15.4	0.69	
06	5.8	21.5	14.9	14.4	22.0	15.0	0.68	
07	10.9	23.0	16.2	13.9	21.3	14.4	0.68	
08	6.5	23.6	17.0	12.6	20.8	13.9	0.67	
09	4.7	22.6	16.1	9.4	20.1	13.4	0.67	
10	6.2	23.0	16.4	7.1	19.0	12.4	0.65	
11	7.4	16.0	9.4	6.7	18.1	11.5	0.64	
12	17.5	13.3	6.2	6.6	17.5	10.9	0.62	
1923-01	4.5	13.1	6.6	6.4	16.7	10.1	0.60	
02	1.5	16.6	10.2	5.9	15.6	9.1	0.58	
03	3.3	15.0	8.5	6.0	14.7	8.1	0.55	
04	6.1	12.9	6.3	6.6	14.0	7.4	0.53	
05	3.2	13.0	6.6	6.9	13.5	6.9	0.51	
06	9.1	14.0	7.3	6.4	13.3	6.7	0.50	
07	3.5	11.3	4.8	5.6	13.4	6.8	0.51	
08	0.5	10.2	3.9	5.6	13.4	6.8	0.51	*Rm*(16)
09	13.2	13.7	6.8	5.7	13.3	6.8	0.51	
10	11.6	15.5	8.7	5.8	13.2	6.7	0.51	
11	10.0	10.8	4.0	6.8	13.1	6.5	0.50	
12	2.8	12.5	6.1	8.1	13.2	6.5	0.49	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1924-01	0.5	16.5	10.2	9.8	13.3	6.5	0.49	
02	5.1	13.9	7.4	11.6	13.3	6.5	0.49	
03	1.8	15.8	9.4	12.9	13.4	6.5	0.49	
04	11.3	10.2	3.4	14.0	13.3	6.4	0.48	
05	20.8	13.1	5.8	15.1	13.2	6.2	0.47	
06	24.0	15.3	7.9	16.1	13.2	6.2	0.47	
07	28.1	12.6	5.0	16.9	13.0	5.9	0.45	
08	19.3	9.8	2.6	17.9	12.7	5.5	0.43	
09	25.1	15.5	8.0	19.3	12.4	5.2	0.42	
10	25.6	11.7	4.2	20.9	12.4	5.1	0.41	*aam*(16), aa_IM(16)
11	22.5	12.3	5.0	22.6	12.5	5.2	0.42	
12	16.5	10.8	3.7	24.5	12.8	5.4	0.42	
1925-01	5.5	12.3	5.7	25.9	13.1	5.6	0.43	
02	23.2	11.5	4.1	27.1	13.5	5.9	0.44	
03	18.0	11.5	4.4	29.3	14.0	6.3	0.45	
04	31.7	13.7	5.9	32.6	14.7	6.9	0.47	
05	42.8	13.9	5.6	35.9	15.4	7.5	0.49	
06	47.5	20.6	12.1	40.9	15.8	7.6	0.48	
07	38.5	14.7	6.6	47.2	16.7	8.3	0.50	
08	37.9	16.5	8.4	51.8	18.2	9.5	0.52	
09	60.2	20.9	11.8	55.6	19.7	10.9	0.55	
10	69.2	24.6	15.1	57.7	21.2	12.2	0.58	
11	58.6	16.1	7.1	58.9	22.3	13.2	0.59	
12	98.6	15.8	4.9	60.9	22.6	13.4	0.59	
1926-01	71.8	30.0	20.4	62.6	22.5	13.3	0.59	
02	69.9	29.1	19.6	64.1	22.5	13.2	0.59	
03	62.5	30.5	21.3	65.1	22.6	13.3	0.59	
04	38.5	30.1	22.0	65.2	22.9	13.6	0.59	
05	64.3	22.6	13.3	65.4	22.9	13.6	0.59	
06	73.5	19.1	9.4	64.7	22.9	13.6	0.59	
07	52.3	14.3	5.6	64.3	22.4	13.1	0.58	
08	61.6	16.1	7.0	65.7	21.5	12.1	0.56	
09	60.8	25.6	16.5	66.9	20.7	11.3	0.55	
10	71.5	26.2	16.6	69.5	19.9	10.4	0.52	
11	60.5	14.8	5.7	72.4	19.3	9.7	0.50	
12	79.4	16.2	6.2	72.4	19.0	9.4	0.49	
1927-01	81.6	18.4	8.3	72.0	19.0	9.4	0.49	
02	93.0	18.1	7.5	71.8	19.5	9.8	0.50	
03	69.6	23.6	14.1	71.7	19.6	10.0	0.51	
04	93.5	18.5	7.9	71.7	19.6	10.0	0.51	
05	79.1	19.7	9.7	71.6	19.5	9.9	0.51	
06	59.1	14.1	5.1	70.5	19.4	9.9	0.51	
07	54.9	19.5	10.7	69.1	19.3	9.8	0.51	
08	53.8	21.4	12.6	68.4	19.0	9.6	0.51	
09	68.4	23.8	14.3	68.3	18.6	9.1	0.49	
10	63.1	27.6	18.4	68.4	18.0	8.6	0.48	
11	67.2	10.9	1.5	67.7	18.2	8.8	0.48	
12	45.2	18.7	10.3	69.0	18.9	9.4	0.50	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1928-01	83.5	13.1	2.9	72.1	19.7	10.1	0.51	
02	73.5	16.4	6.7	75.1	20.1	10.3	0.51	
03	85.4	14.2	4.0	77.3	19.9	10.1	0.51	
04	80.6	15.8	5.8	78.1	19.8	9.9	0.50	*RM*(16)
05	77.0	26.5	16.6	77.3	20.2	10.3	0.51	
06	91.4	23.2	12.7	77.2	20.6	10.7	0.52	
07	98.0	30.7	19.9	77.1	20.7	10.9	0.53	
08	83.8	18.8	8.6	76.1	21.3	11.5	0.54	
09	89.7	22.5	12.1	74.2	22.3	12.6	0.57	
10	61.4	26.3	17.2	71.6	23.0	13.4	0.58	
11	50.3	21.1	12.5	69.2	22.7	13.2	0.58	
12	59.0	18.5	9.5	67.7	22.2	12.8	0.58	
1929-01	68.9	15.9	6.4	66.2	21.6	12.2	0.56	
02	62.8	26.9	17.7	64.3	21.2	11.9	0.56	
03	50.2	29.1	20.5	61.3	21.3	12.2	0.57	
04	52.8	16.8	8.1	58.6	21.4	12.5	0.58	
05	58.2	19.2	10.2	59.6	21.7	12.7	0.59	
06	71.9	17.7	8.1	63.0	22.1	12.9	0.58	
07	70.2	21.5	12.0	64.8	22.7	13.4	0.59	
08	65.8	18.8	9.5	64.0	23.2	13.9	0.60	
09	34.4	24.4	16.5	62.8	23.5	14.3	0.61	
10	54.0	28.4	19.6	61.1	24.7	15.6	0.63	
11	81.1	25.6	15.6	60.6	26.6	17.5	0.66	
12	108.0	23.9	12.6	57.5	28.2	19.3	0.68	
1930-01	65.3	23.8	14.5	53.6	29.4	20.6	0.70	
02	49.9	30.8	22.2	49.8	30.5	21.9	0.72	
03	35.0	33.8	25.9	48.0	31.5	23.0	0.73	
04	38.2	41.1	33.0	47.1	32.0	23.5	0.73	
05	36.8	39.3	31.3	44.2	32.0	23.6	0.74	*aam*(16)
06	28.8	36.2	28.6	39.0	31.7	23.6	0.74	aa_IM(16)
07	21.9	31.2	23.9	33.5	31.2	23.3	0.75	
08	24.9	36.2	28.7	31.2	30.3	22.6	0.75	
09	32.1	31.7	23.9	30.7	29.1	21.3	0.73	
10	34.4	32.2	24.3	30.2	27.1	19.4	0.72	
11	35.6	21.7	13.8	29.4	24.9	17.3	0.69	
12	25.8	20.1	12.6	28.3	23.2	15.5	0.67	
1931-01	14.6	15.9	8.9	27.6	21.7	14.2	0.65	
02	43.1	18.3	10.0	26.9	20.5	12.9	0.63	
03	30.0	15.8	8.1	25.9	19.5	12.0	0.62	
04	31.2	12.9	5.2	24.2	19.1	11.7	0.61	
05	24.6	14.9	7.5	22.6	19.2	11.9	0.62	
06	15.3	17.6	10.6	21.6	19.6	12.3	0.63	
07	17.4	16.0	8.9	21.1	20.0	12.8	0.64	
08	13.0	20.6	13.7	19.7	20.6	13.4	0.65	
09	19.0	24.1	16.9	17.8	21.5	14.4	0.67	
10	10.0	30.2	23.4	16.3	22.9	15.8	0.69	
11	18.7	26.6	19.4	14.8	24.0	17.0	0.71	
12	17.8	24.0	16.9	14.8	24.3	17.4	0.72	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1932-01	12.1	23.1	16.2	14.8	24.2	17.2	0.71	
02	10.6	24.3	17.5	14.2	24.2	17.3	0.71	
03	11.2	30.8	24.0	13.3	24.2	17.3	0.71	
04	11.2	31.1	24.3	12.6	23.7	16.8	0.71	
05	17.9	25.1	18.0	12.2	22.9	16.0	0.70	
06	22.2	14.7	7.4	11.4	22.2	15.4	0.69	
07	9.6	15.4	8.7	11.2	21.8	15.0	0.69	
08	6.8	22.0	15.4	11.7	21.5	14.6	0.68	
09	4.0	22.0	15.5	12.0	21.0	14.1	0.67	
10	8.9	20.1	13.4	11.7	20.3	13.5	0.67	
11	8.2	16.7	10.0	10.7	19.8	13.1	0.66	
12	11.0	18.2	11.4	9.4	19.7	13.0	0.66	
1933-01	12.3	18.8	11.9	8.4	19.8	13.1	0.66	
02	22.2	21.3	14.0	7.9	19.6	12.9	0.66	
03	10.1	22.1	15.3	7.7	19.3	12.7	0.66	
04	2.9	24.0	17.6	7.5	19.3	12.7	0.66	
05	3.2	20.4	14.0	6.9	19.4	12.8	0.66	
06	5.2	16.5	10.0	6.2	19.4	12.8	0.66	
07	2.8	15.2	8.8	5.4	19.1	12.6	0.66	
08	0.2	17.1	10.8	4.3	18.8	12.3	0.65	
09	5.1	21.3	14.8	3.4	18.6	12.2	0.66	*Rm*(17)
10	3.0	19.7	13.3	3.6	18.3	11.8	0.64	
11	0.6	18.9	12.6	4.6	17.6	11.1	0.63	
12	0.3	15.9	9.6	5.4	17.2	10.7	0.62	
1934-01	3.4	14.4	7.9	5.7	17.0	10.4	0.61	
02	7.8	17.8	11.1	6.3	17.0	10.4	0.61	
03	4.3	22.9	16.4	6.6	17.1	10.5	0.61	
04	11.3	14.2	7.4	6.7	16.9	10.3	0.61	
05	19.7	14.4	7.2	7.2	16.4	9.8	0.60	
06	6.7	12.9	6.3	8.1	16.2	9.6	0.59	*aam*(17), aa_IM'(17)
07	9.3	13.2	6.5	9.4	16.5	9.8	0.59	
08	8.3	20.3	13.6	10.6	16.8	10.0	0.60	
09	4.0	20.6	14.1	11.9	16.7	9.9	0.59	
10	5.7	14.5	7.9	12.7	16.7	9.8	0.59	
11	8.7	12.4	5.7	13.0	16.8	9.9	0.59	
12	15.4	18.4	11.4	15.0	17.1	10.1	0.59	
1935-01	18.6	18.6	11.4	17.6	17.5	10.3	0.59	
02	20.5	19.4	12.2	19.6	17.2	10.0	0.58	
03	23.1	20.7	13.3	22.0	17.1	9.7	0.57	
04	12.2	16.5	9.6	25.6	17.5	10.1	0.58	
05	27.3	14.5	6.9	29.9	18.2	10.5	0.58	
06	45.7	19.3	10.9	34.2	18.5	10.6	0.57	
07	33.9	15.4	7.5	37.9	18.7	10.6	0.57	
08	30.1	12.8	5.1	42.0	18.9	10.6	0.56	
09	42.1	23.7	15.5	46.5	18.9	10.5	0.56	
10	53.2	23.1	14.3	51.3	19.2	10.5	0.55	
11	64.2	18.5	9.2	55.0	19.8	10.9	0.55	
12	61.5	20.6	11.5	57.2	20.2	11.2	0.55	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1936-01	62.8	20.4	11.2	59.0	20.5	11.5	0.56	
02	74.3	22.7	13.0	62.2	20.8	11.6	0.56	
03	77.1	18.4	8.5	65.9	20.3	11.0	0.54	
04	74.9	25.0	15.2	68.8	19.7	10.2	0.52	
05	54.6	20.4	11.6	72.5	19.6	9.9	0.51	
06	70.0	22.7	13.2	77.2	19.4	9.6	0.49	
07	52.3	20.9	12.2	82.6	19.0	8.9	0.47	
08	87.0	13.1	2.8	87.8	18.9	8.5	0.45	
09	76.0	12.7	2.9	90.3	19.1	8.6	0.45	
10	89.0	18.3	7.9	92.1	19.4	8.9	0.46	
11	115.4	20.9	9.3	96.1	19.6	8.9	0.45	
12	123.4	14.9	2.9	101.2	19.6	8.7	0.44	
1937-01	132.5	15.1	2.7	107.6	19.6	8.4	0.43	
02	128.5	25.2	13.0	113.5	19.9	8.3	0.42	aa_IM(17)
03	83.9	21.5	11.3	116.7	20.2	8.6	0.43	
04	109.3	29.2	17.9	119.2	21.0	9.2	0.44	*RM*(17)
05	116.7	21.5	9.8	119.0	21.5	9.7	0.45	
06	130.3	21.8	9.5	115.8	21.8	10.1	0.46	
07	145.1	21.7	8.7	113.0	23.4	11.9	0.51	
08	137.7	17.7	5.0	111.2	25.0	13.6	0.54	
09	100.7	17.6	6.6	110.9	25.2	13.8	0.55	
10	124.9	30.7	18.6	110.6	25.3	13.9	0.55	
11	74.4	22.3	12.6	110.8	25.5	14.1	0.55	
12	88.8	19.4	9.0	109.8	25.6	14.2	0.55	
1938-01	98.4	49.5	38.7	109.3	25.4	14.1	0.56	
02	119.2	28.9	17.1	109.2	25.7	14.3	0.56	
03	86.5	23.4	13.1	107.9	26.3	15.0	0.57	
04	101.0	29.0	18.0	106.3	26.6	15.4	0.58	
05	127.4	26.7	14.5	107.1	26.4	15.1	0.57	
06	97.5	17.7	6.9	109.4	26.4	15.1	0.57	
07	165.3	22.6	8.7	108.8	25.2	13.8	0.55	
08	115.7	22.8	11.2	106.3	23.6	12.4	0.53	
09	89.6	27.7	17.3	103.6	23.7	12.6	0.53	
10	99.1	27.0	16.1	103.0	24.4	13.3	0.55	
11	122.2	20.7	8.8	103.0	25.0	13.9	0.56	
12	92.7	22.4	11.8	102.8	25.5	14.4	0.56	
1939-01	80.3	16.4	6.4	101.1	26.1	15.4	0.59	
02	77.4	24.6	14.7	96.9	26.5	16.1	0.61	
03	64.6	29.9	20.6	97.4	26.4	16.0	0.61	
04	109.1	39.0	27.7	97.9	26.3	15.9	0.60	
05	118.3	30.7	18.9	95.2	26.4	16.1	0.61	
06	101.0	25.7	14.7	90.9	26.2	16.1	0.61	
07	97.6	29.1	23.6	87.6	26.6	16.7	0.63	
08	105.8	25.9	14.7	85.5	27.0	17.2	0.64	
09	112.6	22.1	10.6	85.5	27.7	17.9	0.65	
10	88.1	31.3	20.9	84.3	27.8	18.0	0.65	
11	68.1	17.5	8.1	79.6	26.9	17.4	0.65	
12	42.1	21.5	13.3	76.3	26.6	17.2	0.65	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1940-01	50.5	27.7	19.1	74.2	26.3	16.8	0.64	
02	59.4	23.0	14.0	73.0	25.8	16.2	0.63	
03	83.3	46.8	36.7	71.1	25.7	16.1	0.63	
04	60.7	25.3	16.2	67.8	25.4	16.0	0.63	
05	54.4	23.0	14.2	66.0	25.6	16.3	0.64	
06	83.9	26.5	16.3	66.7	26.2	16.9	0.65	
07	67.5	21.4	12.0	67.6	26.3	16.9	0.64	
08	105.5	21.3	10.1	66.8	26.5	17.1	0.65	
09	66.5	23.0	13.6	64.6	26.8	17.5	0.65	
10	55.0	24.8	16.0	61.9	26.7	17.6	0.66	
11	58.4	28.0	19.0	59.7	26.6	17.6	0.66	
12	68.3	26.6	17.1	57.6	26.3	17.4	0.66	
1941-01	45.6	24.8	16.4	56.6	26.5	17.6	0.66	
02	44.5	30.5	22.1	54.7	27.0	18.2	0.67	
03	46.4	45.8	37.4	52.8	28.0	19.2	0.69	
04	32.8	24.5	16.7	52.4	28.5	19.8	0.69	
05	29.5	22.0	14.3	51.2	28.3	19.6	0.69	
06	59.8	20.3	11.2	49.0	28.0	19.5	0.70	
07	66.9	30.9	21.5	47.0	27.6	19.1	0.69	
08	60.0	25.2	16.1	47.0	26.9	18.4	0.68	
09	65.9	41.1	31.8	47.6	26.1	17.6	0.67	
10	46.3	20.4	12.0	49.1	25.8	17.2	0.67	
11	38.4	26.6	18.5	50.2	25.7	17.1	0.67	
12	33.7	22.2	14.3	47.8	25.4	16.8	0.66	
1942-01	35.6	17.5	9.6	43.7	25.0	16.7	0.67	
02	52.8	21.7	13.0	41.1	24.8	16.7	0.67	
03	54.2	35.3	26.5	36.5	24.3	16.3	0.67	
04	60.7	27.4	18.3	33.3	24.3	16.5	0.68	
05	25.0	17.1	9.6	31.8	24.8	17.0	0.69	
06	11.4	17.5	10.7	31.0	24.7	17.0	0.69	
07	17.7	25.9	18.8	29.6	24.8	17.2	0.69	
08	20.2	24.8	17.6	27.7	24.9	17.3	0.69	
09	17.2	28.7	21.6	25.6	24.4	16.9	0.69	
10	19.2	33.2	26.0	23.0	23.8	16.4	0.69	
11	30.7	25.7	18.0	21.1	24.1	16.8	0.70	
12	22.5	21.4	14.1	20.5	24.8	17.6	0.71	
1943-01	12.4	21.0	14.1	20.1	25.1	17.9	0.71	
02	28.9	20.0	12.4	19.9	26.0	18.8	0.72	
03	27.4	23.9	16.3	19.6	27.2	20.0	0.74	
04	26.1	24.8	17.3	18.8	27.7	20.5	0.74	
05	14.1	27.4	20.4	17.5	28.1	20.9	0.74	
06	7.6	24.1	17.4	16.5	28.6	21.5	0.75	
07	13.2	27.3	20.4	16.0	28.9	21.8	0.75	
08	19.4	43.9	36.7	14.4	29.0	22.1	0.76	
09	10.0	38.2	31.4	12.6	29.3	22.4	0.76	
10	7.8	35.7	29.0	10.8	29.5	22.7	0.77	*aam*(17), aa_IM(17)
11	10.2	32.5	25.7	9.2	29.2	22.4	0.77	
12	18.8	26.2	19.0	8.6	28.6	21.9	0.77	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1944-01	3.7	24.1	17.6	8.2	27.7	21.1	0.76	
02	0.5	20.8	14.5	7.7	26.2	19.5	0.74	*Rm*(18)
03	11.0	29.5	22.7	7.8	24.4	17.7	0.73	
04	0.3	24.6	18.3	8.4	23.0	16.3	0.71	
05	2.5	19.0	12.6	8.8	21.6	14.9	0.69	
06	5.0	17.8	11.3	9.2	20.8	14.1	0.68	
07	5.0	14.0	7.5	10.2	20.5	13.7	0.67	
08	16.7	19.4	12.3	11.3	20.2	13.4	0.66	
09	14.3	20.4	13.4	12.3	20.1	13.2	0.66	
10	16.9	20.1	13.0	14.0	19.9	13.0	0.65	
11	10.8	14.2	7.4	16.5	19.8	12.7	0.64	
12	28.4	24.7	17.1	19.0	19.6	12.4	0.63	
1945-01	18.5	19.0	11.8	21.9	19.6	12.3	0.63	
02	12.7	19.4	12.5	23.8	19.6	12.2	0.62	
03	21.5	28.0	20.7	25.1	19.4	11.9	0.61	
04	32.0	22.1	14.3	28.1	19.3	11.7	0.61	*aam*(18)
05	30.6	18.3	10.6	31.7	19.4	11.6	0.60	
06	36.2	14.0	6.0	33.8	19.4	11.5	0.59	aa_IM(18)
07	42.6	18.2	9.9	34.3	19.4	11.5	0.59	
08	25.9	15.0	7.5	38.6	20.1	12.0	0.60	
09	34.9	18.6	10.7	43.9	21.5	13.1	0.61	
10	68.8	20.8	11.3	48.1	22.5	13.9	0.62	
11	46.0	14.9	6.5	52.1	23.1	14.4	0.62	
12	27.4	23.1	15.5	56.0	23.9	15.0	0.63	
1946-01	47.6	22.1	13.6	60.6	24.9	15.8	0.63	
02	86.2	33.1	22.8	67.0	25.7	16.3	0.63	
03	76.6	46.4	36.6	72.9	26.9	17.3	0.64	
04	75.7	27.9	18.1	76.8	28.1	18.2	0.65	
05	84.9	27.0	16.8	81.4	28.5	18.4	0.65	
06	73.5	25.3	15.6	88.6	28.5	18.1	0.64	
07	116.2	31.5	19.8	95.3	28.4	17.6	0.62	
08	107.2	19.6	8.3	100.2	27.9	16.9	0.61	
09	94.4	44.6	33.9	104.3	27.1	16.0	0.59	
10	102.3	22.5	11.5	109.6	26.8	15.4	0.57	
11	123.8	22.2	10.2	117.6	26.5	14.8	0.56	
12	121.7	17.3	5.4	126.2	26.2	14.1	0.54	
1947-01	115.7	23.5	11.9	131.7	25.9	13.7	0.53	
02	133.4	20.0	7.5	136.8	26.3	14.1	0.54	
03	129.8	40.8	28.5	143.4	26.8	14.4	0.54	
04	149.8	26.2	13.0	149.0	27.2	14.5	0.53	
05	201.3	22.1	6.5	151.8	27.8	14.9	0.54	*RM*(18)
06	163.9	24.0	10.1	151.7	28.0	15.1	0.54	
07	157.9	24.3	16.0	151.2	28.1	15.3	0.54	
08	188.8	35.8	20.8	148.9	28.3	15.6	0.55	
09	169.4	42.0	27.9	145.5	27.9	15.3	0.55	
10	163.6	34.2	20.3	145.7	27.1	14.5	0.54	
11	128.0	23.6	11.4	146.2	27.0	14.4	0.53	
12	116.5	20.8	9.1	145.3	27.0	14.4	0.53	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1948-01	108.5	23.7	12.4	144.8	26.5	13.7	0.52	
02	86.1	24.0	13.7	142.8	26.1	13.2	0.51	
03	94.8	27.1	16.4	140.5	25.2	12.4	0.49	
04	189.7	20.7	5.6	136.2	24.7	12.0	0.49	
05	174.0	26.6	12.3	135.8	25.0	12.4	0.50	
06	167.8	17.9	3.8	135.3	25.3	12.7	0.50	
07	142.2	19.1	6.2	136.6	25.9	13.3	0.51	
08	157.9	31.2	17.6	141.1	26.2	13.4	0.51	
09	143.3	24.9	12.0	147.7	26.2	13.1	0.50	
10	136.3	39.0	26.4	148.5	26.2	13.1	0.50	
11	95.8	26.0	15.3	143.9	26.2	13.2	0.50	
12	138.0	25.9	13.2	139.2	26.2	13.5	0.52	
1949-01	119.1	32.7	20.9	136.6	26.2	13.6	0.52	
02	182.3	23.3	8.6	134.5	25.6	13.1	0.51	
03	157.5	27.6	14.0	133.2	25.1	12.6	0.50	
04	147.0	20.5	7.4	133.0	24.8	12.3	0.50	
05	106.2	25.3	14.1	134.8	24.7	12.2	0.49	
06	121.7	20.9	9.0	136.0	24.4	11.8	0.48	
07	125.8	14.7	2.6	134.4	23.7	11.2	0.47	
08	123.8	22.1	10.1	130.0	23.4	11.1	0.47	
09	145.3	20.7	7.7	124.4	23.3	11.3	0.48	
10	131.6	35.7	23.3	121.0	23.4	11.5	0.49	
11	143.5	27.6	14.7	119.6	23.6	11.8	0.50	
12	117.6	18.0	6.3	118.0	23.6	11.9	0.50	
1950-01	101.6	22.4	11.4	115.0	24.0	12.4	0.52	
02	94.8	26.1	15.4	111.9	24.8	13.3	0.54	
03	109.7	23.5	12.1	106.4	25.7	14.5	0.56	
04	113.4	26.7	15.2	99.5	26.3	15.4	0.59	
05	106.2	24.6	13.4	92.9	26.5	15.9	0.60	
06	83.6	21.9	11.7	86.6	27.0	16.7	0.62	
07	91.0	22.4	11.9	82.2	27.5	17.4	0.63	
08	85.2	33.1	22.9	79.0	27.9	17.9	0.64	
09	51.3	32.2	23.5	75.3	28.5	18.7	0.66	
10	61.4	37.4	28.3	72.2	29.1	19.5	0.67	
11	54.8	30.9	22.1	71.4	29.7	20.0	0.67	
12	54.1	26.9	18.1	72.2	30.0	20.3	0.68	
1951-01	59.9	26.0	16.9	71.7	30.4	20.8	0.68	
02	59.9	32.1	23.0	69.5	30.6	21.1	0.69	
03	55.9	31.4	22.5	69.8	31.2	21.7	0.70	
04	92.9	35.0	24.4	70.7	31.7	22.1	0.70	
05	108.5	28.4	17.1	70.2	31.4	21.9	0.70	
06	100.6	26.1	15.2	69.8	31.5	22.0	0.70	
07	61.5	28.1	19.0	68.6	31.9	22.4	0.70	
08	61.0	32.6	23.5	66.3	32.3	23.0	0.71	
09	83.1	47.3	37.2	63.3	33.0	23.8	0.72	
10	51.6	33.2	24.5	59.2	33.8	24.7	0.73	
11	52.4	28.6	19.9	53.0	34.3	25.6	0.75	
12	45.8	31.1	22.7	46.8	34.7	26.2	0.76	*aam*(18)

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1952-01	40.7	31.4	23.2	43.2	34.5	26.2	0.76	aa_IM(18)
02	22.7	37.2	29.9	32.0	33.9	25.7	0.76	
03	22.0	43.1	35.8	39.5	32.8	24.7	0.75	
04	29.1	40.9	33.3	36.1	31.9	24.0	0.75	
05	23.4	36.0	28.6	33.6	31.5	23.7	0.75	
06	36.4	26.8	18.8	31.9	31.0	23.3	0.75	
07	39.3	23.7	15.6	30.8	30.6	22.8	0.75	
08	54.9	21.9	13.1	29.4	29.8	22.1	0.74	
09	28.2	31.4	23.8	28.2	28.7	21.1	0.74	
10	23.8	29.3	21.9	27.6	27.5	19.9	0.72	
11	22.1	21.8	14.5	27.1	26.4	18.8	0.71	
12	34.3	26.3	18.4	26.0	25.7	18.2	0.71	
1953-01	26.5	25.2	17.7	24.1	25.5	18.1	0.71	
02	3.9	24.1	17.6	21.6	25.9	18.6	0.72	
03	10.0	30.4	23.6	19.9	26.2	19.0	0.73	
04	27.8	25.6	18.0	18.9	26.1	18.9	0.72	
05	12.5	24.4	17.5	17.4	25.9	18.8	0.73	
06	21.8	21.3	14.0	15.2	25.6	18.5	0.72	
07	8.6	25.4	18.7	12.8	24.8	17.9	0.72	
08	23.5	29.0	21.6	11.5	24.5	17.7	0.72	
09	19.3	31.9	24.7	11.4	24.6	17.8	0.72	
10	8.2	25.3	18.6	10.4	24.4	17.6	0.72	
11	1.6	23.1	16.7	8.8	23.9	17.2	0.72	
12	2.5	15.5	9.1	7.4	23.2	16.5	0.71	
1954-01	0.2	16.8	10.5	6.4	22.4	15.8	0.71	
02	0.5	27.4	21.1	5.6	21.6	15.1	0.70	
03	10.9	28.4	21.6	4.2	21.1	14.6	0.69	
04	1.8	23.5	17.1	3.4	20.9	14.4	0.69	*Rm*(19)
05	0.8	14.9	8.6	3.7	20.6	14.1	0.68	
06	0.2	12.6	6.3	4.2	20.3	13.8	0.68	
07	4.8	16.0	9.5	5.4	20.4	13.9	0.68	
08	8.4	19.4	12.7	7.2	20.4	13.8	0.68	
09	1.5	28.3	21.9	7.8	20.1	13.6	0.68	
10	7.0	24.0	17.4	7.9	20.0	13.8	0.69	
11	9.2	17.4	10.7	9.5	20.2	13.9	0.69	
12	7.6	13.8	7.1	12.0	20.6	14.2	0.69	
1955-01	23.1	22.2	14.8	14.2	20.8	14.3	0.69	
02	20.8	21.1	13.8	16.4	20.7	14.1	0.68	
03	4.9	26.5	25.3	19.5	20.3	13.6	0.67	
04	11.3	24.0	17.2	23.4	19.9	13.0	0.65	*aam*(19)
05	28.9	19.6	12.0	28.8	20.0	12.8	0.64	aa_IM(19)
06	31.7	18.0	10.2	35.1	20.4	12.9	0.63	
07	26.7	15.2	7.7	40.1	20.9	13.2	0.63	
08	40.7	17.2	9.0	46.5	21.5	13.5	0.63	
09	42.7	22.0	13.7	55.5	21.9	13.3	0.61	
10	58.5	20.7	11.7	64.4	22.5	13.2	0.59	
11	89.2	22.8	12.4	73.0	23.5	13.8	0.59	
12	76.9	17.0	7.1	81.0	24.4	14.3	0.59	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1956-01	73.6	31.6	21.9	88.8	25.0	14.6	0.58	
02	124.0	26.2	14.2	98.5	25.6	14.7	0.57	
03	118.4	30.5	18.7	109.3	26.0	14.6	0.56	
04	110.7	34.6	23.2	118.7	26.2	14.4	0.55	
05	136.6	32.2	19.6	127.4	26.8	14.6	0.54	
06	116.6	26.4	14.7	136.9	27.5	14.8	0.54	
07	129.1	22.7	10.4	145.5	27.5	14.5	0.53	
08	169.6	23.6	9.5	149.6	27.4	14.2	0.52	
09	173.2	25.3	11.0	151.5	27.7	14.4	0.52	
10	155.3	22.2	8.7	155.8	27.7	14.2	0.51	
11	201.3	35.2	19.6	159.6	26.9	13.2	0.49	
12	192.1	21.1	5.9	164.3	26.4	12.5	0.47	
1957-01	165.0	28.6	14.7	170.2	26.4	12.3	0.47	
02	130.2	26.7	14.4	172.2	26.3	12.0	0.46	
03	157.4	36.6	23.0	174.3	27.5	13.1	0.48	
04	175.2	28.7	14.3	181.0	28.9	14.2	0.49	
05	164.6	18.0	4.1	185.5	28.7	13.8	0.48	
06	200.7	29.0	13.4	187.9	28.9	13.9	0.48	
07	187.2	21.6	6.7	191.4	29.2	14.0	0.48	
08	158.0	20.7	7.1	194.4	29.7	14.5	0.49	
09	235.8	56.9	39.7	197.3	30.4	15.0	0.49	
10	253.8	24.0	6.0	199.5	30.3	14.8	0.49	
11	210.9	29.4	13.4	200.8	30.6	15.0	0.49	
12	239.4	31.6	14.2	200.0	30.9	15.3	0.50	
1958-01	202.5	25.4	9.7	199.0	31.5	16.2	0.51	
02	164.9	43.1	29.2	200.9	32.3	17.1	0.53	
03	190.7	36.0	20.9	201.3	31.2	16.0	0.51	*RM*(19)
04	196.0	27.5	12.1	196.8	29.9	15.2	0.51	
05	175.3	25.1	10.7	191.4	29.4	15.3	0.52	
06	171.5	29.6	15.4	186.8	28.6	15.0	0.52	
07	191.4	35.9	26.1	185.2	28.4	14.8	0.52	
08	200.2	25.0	9.5	184.9	28.0	14.5	0.52	
09	201.2	26.4	10.8	183.8	27.4	14.2	0.52	
10	181.5	24.7	15.3	182.2	27.0	14.1	0.52	
11	152.3	14.9	6.9	180.7	26.9	14.1	0.52	
12	187.6	27.2	12.2	180.5	26.6	13.8	0.52	
1959-01	217.4	24.2	7.9	178.6	26.5	13.6	0.51	
02	143.1	35.8	22.9	176.9	27.1	14.2	0.52	
03	185.7	29.8	20.2	174.5	27.7	15.1	0.55	
04	163.3	24.2	10.4	169.2	28.3	15.7	0.55	
05	172.0	25.6	11.4	165.1	29.1	16.3	0.56	
06	168.7	21.6	7.5	161.4	30.0	17.1	0.57	
07	149.6	42.4	29.2	155.8	30.2	17.6	0.58	
08	199.6	31.1	20.9	151.3	29.7	17.3	0.58	
09	145.2	36.0	23.0	146.3	29.1	16.7	0.57	
10	111.4	28.1	16.7	141.1	30.1	17.8	0.59	
11	124.0	32.0	20.0	137.2	31.5	19.3	0.61	
12	125.0	30.7	18.6	132.5	32.0	20.0	0.63	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1960-01	146.3	25.2	12.1	128.9	31.6	19.8	0.63	
02	106.0	23.4	12.2	125.0	30.9	19.0	0.61	
03	102.2	27.6	16.6	121.6	30.3	18.4	0.61	
04	122.0	51.4	39.5	119.6	30.6	18.8	0.61	
05	119.6	31.5	19.7	117.0	32.0	20.3	0.63	
06	110.2	27.5	16.1	113.9	32.7	21.1	0.65	*aam*(19)
07	121.7	28.1	16.2	108.6	32.6	21.3	0.65	
08	134.1	27.2	14.7	102.4	32.5	21.5	0.66	aa_IM(19)
09	127.2	26.3	14.1	97.9	32.3	21.5	0.67	
10	82.8	45.6	35.5	93.3	30.9	20.3	0.66	
11	89.6	45.8	35.4	87.9	29.3	18.9	0.65	
12	85.6	34.4	24.1	83.7	28.6	18.4	0.64	
1961-01	57.9	20.6	11.6	80.2	28.6	18.6	0.65	
02	46.1	25.0	16.6	74.8	28.5	18.8	0.66	
03	53.0	21.9	13.2	68.9	27.9	18.5	0.66	
04	61.4	21.8	12.7	64.3	26.8	17.5	0.65	
05	51.0	22.2	13.5	60.1	24.6	15.6	0.63	
06	77.4	20.0	10.1	55.8	22.9	14.0	0.61	
07	70.2	35.9	26.4	53.1	22.0	13.3	0.60	
08	55.8	18.4	9.5	52.5	21.5	12.7	0.59	
09	63.6	20.7	11.5	52.3	20.9	12.2	0.58	
10	37.7	23.2	15.2	51.4	20.7	12.0	0.58	
11	32.6	17.2	9.4	50.5	20.4	11.7	0.57	
12	39.9	21.0	12.9	48.7	19.9	11.4	0.57	
1962-01	38.7	13.1	5.0	45.2	19.2	10.8	0.56	
02	50.3	19.1	10.5	41.8	18.9	10.7	0.57	
03	45.6	15.4	7.0	39.8	19.6	11.5	0.59	
04	46.4	22.5	14.1	39.4	20.4	12.3	0.60	
05	43.7	13.3	5.0	39.2	21.0	12.9	0.61	
06	42.0	18.0	9.8	38.3	21.3	13.3	0.62	
07	21.8	20.9	13.6	36.8	21.7	13.7	0.63	
08	21.8	26.1	18.8	34.9	21.8	13.9	0.64	
09	51.3	29.7	21.0	32.7	21.6	13.8	0.64	
10	39.5	33.2	25.1	30.8	21.4	13.7	0.64	
11	26.9	22.4	14.9	30.0	21.5	13.8	0.64	
12	23.2	23.4	16.0	29.8	21.9	14.2	0.65	
1963-01	19.8	19.2	12.0	29.4	22.0	14.3	0.65	
02	24.4	15.2	7.8	29.8	21.8	14.1	0.65	
03	17.1	14.8	7.7	29.7	22.1	14.4	0.65	
04	29.3	18.1	10.4	29.1	22.1	14.5	0.66	
05	43.0	20.3	12.0	28.7	21.6	14.0	0.65	
06	35.9	20.5	12.5	28.2	21.4	13.8	0.64	
07	19.6	20.7	13.5	27.7	21.2	13.6	0.64	
08	33.2	22.4	14.6	27.2	21.5	13.9	0.65	
09	38.8	40.2	32.1	26.9	21.9	14.4	0.66	
10	35.3	23.4	15.5	26.0	22.3	14.8	0.66	
11	23.4	20.6	13.2	23.8	22.3	14.9	0.67	
12	14.9	18.8	11.8	21.3	22.0	14.7	0.67	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1964-01	15.3	20.0	13.0	19.5	21.6	14.4	0.67	
02	17.7	20.0	12.9	17.8	21.1	14.0	0.66	
03	16.5	20.9	13.8	15.4	19.9	12.9	0.65	
04	8.6	21.6	14.9	12.7	18.7	11.8	0.63	
05	9.5	17.4	10.7	10.8	18.1	11.3	0.62	
06	9.1	15.1	8.4	10.2	17.5	10.7	0.61	
07	3.1	16.8	10.4	10.3	16.8	10.0	0.60	
08	9.3	14.7	8.0	10.2	16.3	9.5	0.58	
09	4.7	18.1	11.6	9.9	15.8	9.1	0.58	
10	6.1	16.8	10.2	9.6	15.2	8.4	0.55	*Rm*(20)
11	7.4	13.7	7.1	10.2	14.5	7.7	0.53	
12	15.1	10.3	3.3	11.0	14.2	7.4	0.52	
1965-01	17.5	11.7	4.6	11.7	14.2	7.3	0.51	
02	14.2	16.2	9.2	12.0	14.2	7.3	0.51	
03	11.7	14.2	7.4	12.5	14.2	7.4	0.52	
04	6.8	12.5	5.9	13.6	14.0	7.1	0.51	
05	24.1	10.4	3.0	14.6	13.8	6.8	0.49	aa_IM'(20)
06	15.9	15.7	8.7	15.2	13.8	6.9	0.50	*aam*(20)
07	11.9	14.7	7.9	15.5	14.1	7.1	0.50	
08	8.9	16.7	10.0	16.4	14.1	7.1	0.50	
09	16.8	17.4	10.3	17.4	14.2	7.2	0.51	
10	20.1	13.0	5.8	19.7	14.4	7.2	0.50	
11	15.8	11.6	4.6	22.3	14.6	7.2	0.49	
12	17.0	13.7	6.6	24.5	14.6	7.2	0.49	
1966-01	28.2	14.1	6.5	27.7	14.6	7.0	0.48	
02	24.4	14.8	7.4	31.3	14.8	7.0	0.47	
03	25.3	18.5	11.0	34.5	15.4	7.5	0.49	
04	48.7	11.9	3.4	37.4	16.1	8.1	0.50	
05	45.3	14.7	6.3	40.7	16.5	8.3	0.50	
06	47.7	12.4	3.9	44.7	17.0	8.6	0.51	
07	56.7	17.0	8.1	50.3	17.5	8.8	0.50	
08	51.2	19.9	11.2	56.7	17.9	9.0	0.50	
09	50.2	29.3	20.7	63.1	17.9	8.7	0.49	
10	57.2	17.4	8.5	67.6	17.8	8.4	0.47	
11	57.2	16.8	7.9	70.2	18.7	9.2	0.49	
12	70.4	20.4	10.8	72.7	19.7	10.1	0.51	
1967-01	110.9	18.8	7.4	75.0	19.9	10.1	0.51	
02	93.6	19.7	9.1	78.8	19.7	9.7	0.49	
03	111.8	13.7	2.2	82.2	19.4	9.3	0.48	
04	69.5	15.4	5.9	84.6	19.2	9.0	0.47	
05	86.5	33.0	22.7	87.5	19.3	8.9	0.46	
06	67.5	18.5	9.1	91.3	19.5	9.0	0.46	
07	91.5	14.3	3.8	94.1	19.8	9.1	0.46	
08	107.2	17.5	6.2	95.3	20.2	9.5	0.47	
09	76.8	24.6	14.8	95.3	20.9	10.1	0.48	
10	88.2	17.7	7.3	95.0	21.5	10.8	0.50	
11	94.3	18.8	8.1	97.1	21.3	10.5	0.49	
12	126.4	24.4	12.3	100.6	21.1	10.1	0.48	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1968-01	121.8	21.0	9.1	102.6	21.5	10.5	0.49	
02	111.9	26.5	15.0	102.9	21.8	10.7	0.49	
03	92.2	23.3	12.7	104.7	21.8	10.6	0.49	
04	81.2	22.2	12.1	107.2	22.0	10.7	0.49	
05	127.2	21.3	9.1	107.6	22.5	11.3	0.50	
06	110.3	24.8	13.4	106.6	22.7	11.4	0.50	
07	96.1	17.9	7.2	105.2	22.4	11.2	0.50	
08	109.3	20.0	8.7	104.8	22.2	11.0	0.50	
09	117.2	21.9	10.2	107.0	22.3	11.1	0.50	
10	107.7	24.7	13.4	109.9	22.5	11.2	0.50	
11	86.0	26.1	15.8	110.6	22.7	11.3	0.50	*RM*(20)
12	109.8	20.2	8.8	110.1	22.6	11.2	0.50	
1969-01	104.4	17.7	6.6	110.0	22.1	10.7	0.48	
02	120.5	25.7	13.8	109.6	21.8	10.4	0.48	
03	135.8	27.2	14.6	108.0	21.7	10.4	0.48	
04	106.8	23.5	12.3	106.4	21.4	10.2	0.48	
05	120.0	25.1	13.3	106.2	20.8	9.6	0.46	
06	106.0	16.6	5.4	106.1	20.2	9.0	0.45	
07	96.8	14.9	4.1	105.9	19.8	8.6	0.43	
08	98.0	15.3	4.5	106.5	19.1	7.9	0.41	
09	91.3	23.8	13.3	105.4	18.5	7.4	0.40	
10	95.7	17.1	6.4	104.1	18.5	7.4	0.40	
11	93.5	18.6	8.0	104.6	18.1	7.0	0.39	
12	97.9	13.7	2.9	104.9	17.8	6.7	0.38	aa_IM(20)
1970-01	111.5	14.3	2.8	105.6	18.4	7.3	0.40	
02	127.8	12.6	0.4	106.0	19.2	8.0	0.42	
03	102.9	26.3	15.2	106.2	19.3	8.1	0.42	
04	109.5	23.1	11.7	106.1	19.3	8.0	0.41	
05	127.5	16.5	4.3	105.8	19.5	8.3	0.43	
06	106.8	18.3	7.1	105.3	19.8	8.6	0.43	
07	112.5	28.3	16.8	103.9	20.3	9.1	0.45	
08	93.0	20.9	10.3	101.0	21.0	10.0	0.48	
09	99.5	19.6	8.7	97.2	21.1	10.3	0.49	
10	86.6	20.5	10.2	93.9	20.9	10.3	0.49	
11	95.2	21.6	10.9	89.4	21.1	10.7	0.51	
12	83.5	16.5	6.3	84.1	21.3	11.3	0.53	
1971-01	91.3	23.4	12.9	80.4	20.7	11.1	0.54	
02	79.0	21.1	11.2	77.8	20.0	10.5	0.53	
03	60.7	21.0	11.9	74.4	19.9	10.6	0.53	
04	71.8	23.8	14.2	70.9	20.0	10.9	0.55	
05	57.5	21.0	12.0	68.1	20.0	11.0	0.55	
06	49.8	16.9	13.6	66.7	19.9	11.0	0.55	
07	81.0	15.1	5.1	65.4	19.9	11.1	0.56	
08	61.4	17.1	8.0	64.6	19.7	11.0	0.56	
09	50.2	21.3	12.7	65.8	19.6	10.8	0.55	
10	51.7	22.1	13.4	66.2	19.4	10.5	0.54	
11	53.2	18.7	9.9	66.8	19.0	10.1	0.53	
12	82.2	18.5	8.4	69.4	19.0	9.8	0.52	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1972-01	61.5	21.8	12.7	70.8	19.1	9.6	0.50	
02	88.4	18.2	7.8	71.2	19.8	10.2	0.52	
03	80.1	21.4	11.4	72.4	20.5	10.8	0.53	
04	63.2	18.0	8.8	73.4	20.3	10.7	0.53	
05	80.5	16.5	6.5	72.9	20.4	10.7	0.52	
06	88.0	21.4	11.0	70.5	20.5	11.0	0.54	
07	76.5	13.9	4.1	68.2	20.7	11.3	0.55	
08	76.8	34.1	24.3	65.5	21.5	12.2	0.57	
09	64.0	20.3	11.0	62.2	22.7	13.6	0.60	
10	61.3	20.3	11.2	60.6	24.3	15.2	0.63	
11	41.6	21.7	13.5	58.7	25.6	16.5	0.64	
12	45.3	18.8	10.4	55.1	26.2	17.3	0.66	
1973-01	43.4	26.0	17.7	50.7	26.7	18.1	0.68	
02	42.9	32.6	24.3	46.4	26.4	18.0	0.68	
03	46.0	36.8	28.4	44.0	26.0	17.6	0.68	
04	57.7	39.5	30.5	42.6	26.4	18.1	0.69	
05	42.4	26.0	17.7	40.6	26.7	18.5	0.69	
06	39.5	27.2	19.1	38.9	26.7	18.6	0.70	
07	23.1	20.8	13.4	37.3	26.7	18.7	0.70	
08	25.6	20.5	13.0	36.0	26.4	18.5	0.70	
09	59.3	22.7	13.7	34.2	26.0	18.2	0.70	
10	30.7	28.1	20.7	32.5	25.6	17.8	0.70	
11	23.9	20.7	13.3	31.6	25.5	17.7	0.69	
12	23.3	19.8	12.4	31.4	25.7	18.0	0.70	
1974-01	27.6	25.7	18.1	32.7	26.2	18.4	0.70	
02	26.0	26.3	18.8	34.4	27.1	19.2	0.71	
03	21.3	33.6	26.3	34.0	27.9	20.1	0.72	
04	40.3	32.8	24.6	33.9	28.8	20.9	0.73	
05	39.5	29.1	21.0	34.6	29.4	21.5	0.73	
06	36.0	29.1	21.1	34.5	30.0	22.1	0.74	
07	55.8	31.9	23.0	34.0	30.4	22.5	0.74	
08	33.6	30.1	22.2	33.1	30.6	22.8	0.75	
09	40.2	33.6	25.4	32.1	30.8	23.0	0.75	*aam*(20), aa_IM(20)
10	47.1	37.2	28.7	30.2	30.3	22.6	0.75	
11	25.0	26.7	19.2	27.5	29.7	22.1	0.74	
12	20.5	27.4	20.2	25.2	29.1	21.6	0.74	
1975-01	18.9	27.5	20.3	23.0	28.3	20.9	0.74	
02	11.5	31.0	24.2	22.1	27.4	20.1	0.73	
03	11.5	31.9	25.1	21.2	26.2	18.9	0.72	
04	5.1	24.3	17.8	18.6	24.8	17.6	0.71	
05	9.0	22.6	15.9	16.8	24.1	17.1	0.71	
06	11.4	20.6	13.8	16.0	24.0	17.0	0.71	
07	28.2	21.6	14.0	15.0	23.5	16.6	0.71	
08	39.7	18.0	9.9	14.3	23.3	16.3	0.70	
09	13.9	16.8	9.9	14.4	23.2	16.2	0.70	
10	9.1	20.1	13.4	15.4	23.3	15.3	0.66	
11	19.4	29.2	22.0	16.1	23.4	16.3	0.70	
12	7.8	21.0	14.3	16.3	23.3	16.2	0.70	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1976-01	8.1	23.2	16.5	15.2	23.0	16.0	0.70	
02	4.3	28.4	21.9	13.2	22.9	16.0	0.70	
03	21.9	33.3	26.0	12.2	23.1	16.3	0.71	
04	18.8	25.3	18.1	12.6	23.4	16.5	0.71	
05	12.4	23.6	16.7	12.5	22.9	16.0	0.70	
06	12.2	17.4	10.5	12.2	22.3	15.4	0.69	*Rm*(21)
07	1.9	18.3	11.9	12.9	22.0	15.1	0.69	
08	16.4	17.6	10.5	14.0	21.5	14.5	0.67	
09	13.5	23.6	16.7	14.3	20.6	13.7	0.67	
10	20.6	20.3	13.0	13.5	20.0	13.1	0.66	
11	5.2	16.8	10.3	13.5	19.9	13.0	0.65	
12	15.3	18.5	11.5	14.8	19.6	12.6	0.64	
1977-01	16.4	18.7	11.6	16.7	19.6	12.6	0.64	*aam′*(21), aa_IM'(21)
02	23.1	20.9	13.5	18.1	20.1	12.9	0.64	
03	8.7	19.8	13.5	20.0	20.3	13.1	0.65	
04	12.9	24.8	17.9	22.2	20.2	12.9	0.64	
05	18.6	20.0	12.8	24.2	20.3	12.9	0.64	
06	38.5	14.1	6.0	26.3	20.2	12.8	0.63	
07	21.4	22.8	15.5	29.0	20.4	12.8	0.63	
08	30.1	23.1	15.4	33.4	20.9	12.9	0.62	
09	44.0	22.9	14.6	39.1	21.3	12.8	0.60	
10	43.8	20.8	12.5	45.6	21.9	13.1	0.60	
11	29.1	17.3	9.7	51.9	22.6	13.5	0.60	
12	43.2	16.9	8.6	56.9	23.6	14.3	0.61	
1978-01	51.9	24.5	15.8	61.3	24.1	14.6	0.61	
02	93.6	26.1	10.6	64.5	24.1	14.4	0.60	
03	76.5	25.8	16.0	69.6	24.4	14.5	0.59	
04	99.7	31.2	20.3	76.9	24.5	14.3	0.58	
05	82.7	31.1	21.0	83.2	24.8	14.3	0.58	
06	95.1	28.2	17.7	89.3	25.3	14.5	0.57	
07	70.4	19.8	10.2	97.4	25.6	14.4	0.56	
08	58.1	25.6	16.6	104.0	25.7	14.4	0.56	
09	138.2	26.9	14.2	108.4	25.6	14.3	0.56	
10	125.1	20.7	8.6	111.1	25.7	14.3	0.56	
11	97.9	24.5	13.7	113.3	25.4	13.9	0.55	
12	122.7	21.9	9.9	117.7	24.6	12.8	0.52	
1979-01	166.6	27.3	13.3	123.7	24.1	12.0	0.50	
02	137.5	23.6	10.9	130.9	24.0	11.6	0.48	
03	138.0	26.8	14.1	136.5	23.8	11.2	0.47	
04	101.5	33.4	22.4	141.1	23.5	10.7	0.46	
05	134.4	20.9	8.4	147.3	23.1	10.0	0.43	
06	149.5	18.3	5.1	153.0	22.6	9.2	0.41	
07	159.4	17.8	4.1	155.0	22.1	8.6	0.39	
08	142.2	25.9	13.0	155.4	21.5	8.0	0.37	
09	188.4	21.9	6.9	155.7	20.7	7.2	0.35	
10	186.2	19.2	4.3	157.8	19.5	5.9	0.30	
11	183.3	17.0	2.2	162.3	18.6	4.8	0.26	
12	176.3	16.8	2.4	164.5	18.5	4.6	0.25	*RM*(21)

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1980-01	159.6	19.7	6.0	163.9	18.5	4.7	0.25	
02	155.0	17.8	4.3	162.6	18.1	4.3	0.24	
03	126.2	12.3	0.2	160.9	17.4	3.6	0.21	
04	164.1	18.3	4.4	158.7	17.2	3.6	0.21	*aam*(21), aa_IM(21)
05	179.9	15.8	1.2	156.3	17.7	4.1	0.23	
06	157.3	20.4	6.8	154.7	18.2	4.8	0.26	
07	136.3	16.9	4.3	152.8	18.4	5.0	0.27	
08	135.4	16.4	3.8	150.3	18.5	5.2	0.28	
09	155.0	14.3	0.8	150.1	19.3	6.0	0.31	
10	164.7	22.9	9.0	150.2	20.5	7.3	0.36	
11	147.9	23.5	10.4	147.7	21.6	8.5	0.39	
12	174.4	23.7	9.3	142.7	22.0	9.1	0.41	
1981-01	114.0	16.7	5.1	140.3	22.3	9.6	0.43	
02	141.3	22.8	10.0	141.5	23.1	10.3	0.45	
03	135.5	27.0	14.4	143.0	23.7	10.8	0.46	
04	156.4	33.3	19.8	143.4	24.4	11.5	0.47	
05	127.5	27.2	15.0	142.9	25.0	12.1	0.48	
06	90.9	18.1	7.6	141.5	24.8	12.0	0.48	
07	143.8	27.5	14.6	140.3	24.9	12.2	0.49	
08	158.7	24.2	10.6	141.0	26.3	13.5	0.51	
09	167.3	20.7	6.7	142.8	27.4	14.5	0.53	
10	162.4	34.3	20.5	142.2	27.4	14.6	0.53	
11	137.5	24.4	11.7	138.8	27.3	14.6	0.53	
12	150.1	19.6	6.4	137.8	27.8	15.2	0.55	
1982-01	111.2	23.4	12.0	137.0	29.0	16.4	0.57	
02	163.6	49.3	35.4	133.3	29.9	17.5	0.59	
03	153.8	27.5	14.1	129.2	31.3	19.0	0.61	
04	122.0	32.1	20.2	124.3	32.1	20.1	0.63	
05	82.2	26.1	16.0	119.9	32.3	20.7	0.64	
06	110.4	31.4	20.0	117.3	33.3	22.0	0.66	
07	106.1	42.3	31.1	115.2	34.0	23.1	0.68	
08	107.6	32.0	20.7	109.4	33.8	23.3	0.69	
09	118.8	45.8	34.0	101.0	33.7	23.6	0.70	
10	94.7	28.9	18.2	95.7	34.2	24.3	0.71	
11	98.1	33.6	28.1	94.7	34.6	24.8	0.72	
12	127.0	34.4	22.2	94.6	34.6	24.8	0.72	*aam*(21), aa_IM(21)
1983-01	84.3	26.6	21.7	92.8	33.4	23.7	0.71	
02	51.0	40.7	32.0	90.3	32.3	22.7	0.70	
03	66.5	34.1	24.7	85.9	31.1	21.7	0.70	
04	80.7	36.3	26.3	81.5	30.2	21.0	0.70	
05	99.2	32.0	21.1	77.1	30.2	21.0	0.70	
06	91.1	25.0	14.5	70.5	29.8	20.7	0.69	
07	82.2	21.3	11.2	65.5	29.4	20.3	0.69	
08	71.8	25.1	15.5	65.8	28.7	19.6	0.68	
09	50.3	24.0	15.4	67.9	28.0	19.0	0.68	
10	55.8	28.7	19.8	68.2	27.7	18.9	0.68	
11	33.3	34.0	26.2	66.8	27.4	19.1	0.70	
12	33.4	26.3	18.5	64.0	27.1	19.2	0.71	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1984-01	57.0	23.7	14.8	60.2	27.3	19.6	0.72	
02	85.4	26.4	21.5	56.4	27.6	20.0	0.72	
03	83.5	31.2	21.0	53.0	28.0	20.6	0.74	
04	69.7	33.0	28.8	49.8	28.6	21.3	0.74	
05	76.4	27.4	22.9	47.5	28.7	21.5	0.75	
06	46.1	23.9	15.5	46.5	28.7	21.6	0.75	
07	37.4	26.6	18.6	44.2	28.9	21.9	0.76	
08	25.5	26.2	18.7	39.6	28.9	21.9	0.76	
09	15.7	33.1	26.1	33.9	28.3	21.3	0.75	
10	12.0	33.6	26.7	28.9	27.7	20.7	0.75	
11	22.8	31.4	24.0	24.7	27.1	19.9	0.73	
12	18.7	29.3	22.1	21.7	26.4	19.1	0.72	
1985-01	16.5	26.0	18.9	20.5	26.1	18.9	0.72	
02	15.9	24.3	17.3	19.6	25.9	18.6	0.72	
03	17.2	19.1	12.0	18.6	25.2	18.0	0.71	
04	16.2	29.9	22.9	18.3	24.2	17.1	0.71	
05	27.5	15.6	8.0	18.3	23.5	16.3	0.71	
06	24.2	20.1	12.7	18.0	22.8	15.7	0.69	
07	30.7	23.6	15.9	17.4	22.4	15.3	0.68	
08	11.1	22.2	15.4	17.1	22.9	15.8	0.69	
09	3.9	21.4	14.9	17.3	23.6	16.6	0.70	
10	18.6	22.4	15.2	17.3	23.1	16.0	0.69	
11	16.2	23.9	16.9	16.8	22.6	15.5	0.69	
12	17.3	21.4	14.3	15.3	22.5	15.5	0.69	
1986-01	2.5	22.6	16.2	13.8	22.1	15.1	0.68	
02	23.2	40.5	33.1	13.1	21.8	14.9	0.68	
03	15.1	21.2	14.2	13.0	21.9	15.0	0.68	
04	18.5	14.3	7.1	13.7	21.9	15.0	0.68	
05	13.7	18.9	12.0	14.3	21.7	14.7	0.68	
06	1.1	15.9	9.5	13.8	21.3	14.4	0.68	
07	18.1	16.4	9.3	13.7	20.7	13.8	0.67	
08	7.4	22.5	15.9	13.2	19.4	12.5	0.64	
09	3.8	24.9	18.4	12.3	18.3	11.4	0.62	*Rm*(22)
10	35.4	18.7	10.8	13.2	18.1	11.2	0.62	
11	15.2	21.4	14.4	14.9	17.8	10.9	0.61	
12	6.8	15.3	8.7	16.3	17.5	10.5	0.60	
1987-01	10.4	14.8	8.0	17.6	17.5	10.4	0.59	*aam*(22), aa_IM(22)
02	2.4	16.7	10.3	19.6	17.7	10.5	0.59	
03	14.7	17.7	10.7	22.1	18.0	10.7	0.59	
04	39.6	12.9	4.8	24.4	18.5	11.1	0.60	
05	33.0	14.7	6.9	26.5	18.9	11.3	0.60	
06	17.4	13.2	6.1	28.4	18.9	11.3	0.60	
07	33.0	19.1	11.3	31.3	19.2	11.5	0.60	
08	38.7	24.2	16.1	34.8	19.8	11.9	0.60	
09	33.9	30.2	22.3	39.0	20.3	12.2	0.60	
10	60.6	25.6	16.5	43.6	21.0	12.7	0.60	
11	39.9	22.2	14.1	46.7	21.8	13.3	0.61	
12	27.1	15.9	8.3	51.3	22.2	13.6	0.61	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1988-01	59.0	22.3	13.3	58.2	22.5	13.5	0.60	
02	40.0	21.8	13.7	64.6	22.4	13.1	0.58	
03	76.2	24.7	14.9	71.3	21.9	12.3	0.56	
04	88.0	24.3	13.9	77.5	21.5	11.6	0.54	
05	60.1	20.3	11.2	83.8	21.4	11.2	0.52	
06	101.8	19.2	8.2	93.7	21.8	11.1	0.51	
07	113.8	20.2	8.6	104.3	22.6	11.5	0.51	
08	111.6	20.5	9.0	113.7	23.2	11.9	0.51	
09	120.1	21.7	9.9	121.2	24.8	13.3	0.54	
10	125.1	23.0	10.9	125.3	26.6	14.9	0.56	
11	125.1	22.4	10.3	130.4	27.1	15.2	0.56	
12	179.2	25.4	10.8	137.6	27.5	15.3	0.56	
1989-01	161.3	33.8	20.0	142.0	27.5	15.1	0.55	
02	165.1	24.7	16.1	145.0	27.6	15.2	0.55	
03	131.4	59.9	47.5	149.7	28.1	15.7	0.56	
04	130.6	31.6	19.3	153.5	28.6	16.0	0.56	
05	138.5	25.6	12.9	156.9	29.4	16.7	0.57	
06	196.2	24.0	8.6	158.4	30.1	17.3	0.57	
07	126.9	14.3	2.1	158.5	30.0	17.4	0.58	*RM*(22)
08	168.9	28.2	19.4	157.7	30.3	17.5	0.58	
09	176.7	25.7	11.2	156.6	29.8	16.8	0.56	
10	159.4	31.2	17.5	157.4	28.9	15.9	0.55	
11	173.0	33.4	19.1	157.5	29.2	16.1	0.55	
12	165.5	31.2	17.3	153.5	29.2	16.3	0.56	
1990-01	177.3	27.4	14.5	150.6	29.5	16.8	0.57	
02	130.5	37.8	25.5	152.9	29.8	16.8	0.56	
03	140.3	33.9	21.1	152.0	29.8	16.6	0.56	
04	140.3	37.4	24.6	149.3	29.5	16.4	0.56	
05	132.2	25.1	12.7	147.0	28.6	15.6	0.55	
06	105.4	24.6	13.4	143.8	27.2	14.6	0.54	
07	149.4	21.6	8.4	140.6	26.1	14.1	0.54	
08	200.3	28.2	12.6	140.5	25.0	13.1	0.52	
09	125.2	25.1	13.0	142.1	24.4	12.4	0.51	
10	145.5	25.1	12.1	142.1	24.0	12.0	0.50	
11	131.4	17.4	5.0	141.7	23.5	11.6	0.49	
12	129.7	15.2	8.2	143.9	24.9	12.9	0.52	
1991-01	136.9	17.2	9.9	147.6	26.8	14.6	0.54	
02	167.5	20.1	6.1	147.6	27.9	15.7	0.56	
03	141.9	37.3	24.4	146.6	28.7	16.5	0.57	
04	140.0	24.3	11.5	146.5	29.7	17.5	0.59	
05	121.3	27.3	15.4	145.5	31.8	19.7	0.62	
06	169.7	56.2	42.1	145.2	33.7	21.4	0.64	
07	173.7	35.2	20.9	146.3	34.6	21.8	0.63	
08	176.3	40.8	26.4	146.6	36.1	23.0	0.64	
09	125.3	30.7	18.6	144.9	36.7	23.7	0.65	*aam*(22), aa_IM(22)
10	144.1	44.1	31.1	141.7	36.0	23.2	0.64	
11	108.2	49.7	38.4	138.1	35.9	23.2	0.65	
12	144.4	28.0	15.0	131.7	34.7	22.3	0.64	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
1992-01	150.0	25.9	12.7	123.7	32.6	20.6	0.63	
02	161.1	47.7	34.0	115.4	31.2	19.6	0.63	
03	106.7	24.5	13.3	108.2	30.7	19.4	0.63	
04	99.8	19.8	8.9	103.3	30.2	19.2	0.64	
05	73.8	29.1	19.4	100.3	28.5	17.6	0.62	
06	65.2	24.8	15.5	97.1	27.4	16.6	0.61	
07	85.7	17.9	7.6	90.7	27.5	17.0	0.62	
08	64.5	24.1	14.8	84.0	26.9	16.7	0.62	
09	63.9	35.8	26.5	79.5	26.6	16.6	0.62	
10	88.7	27.0	16.6	76.4	27.5	17.7	0.64	
11	91.8	25.0	14.5	74.4	27.6	17.9	0.65	
12	82.6	26.1	16.0	73.2	27.2	17.5	0.64	
1993-01	59.3	31.2	22.2	71.4	27.1	17.5	0.65	
02	91.0	27.1	16.6	69.3	26.9	17.4	0.65	
03	69.8	37.9	28.4	66.6	26.2	16.9	0.65	
04	62.2	29.2	20.0	63.6	25.6	16.4	0.64	
05	61.3	22.1	13.0	59.9	25.5	16.5	0.65	
06	49.8	21.8	13.2	56.1	25.5	16.6	0.65	
07	57.9	18.2	9.2	54.7	25.3	16.5	0.65	
08	42.2	19.2	11.0	52.3	25.7	17.0	0.66	
09	22.4	23.8	16.5	48.4	26.4	17.9	0.68	
10	56.4	24.6	15.7	44.9	26.9	18.5	0.69	
11	35.6	25.5	17.6	41.2	28.1	19.9	0.71	
12	48.9	24.8	16.2	38.4	29.1	21.0	0.72	
1994-01	51.8	26.5	17.8	36.6	29.4	21.4	0.73	
02	35.5	43.2	35.3	34.8	29.3	21.5	0.73	
03	31.7	37.9	30.1	34.1	29.1	21.2	0.73	
04	16.1	40.2	33.2	33.7	29.3	21.4	0.73	
05	17.8	40.2	33.1	32.5	29.6	21.8	0.74	
06	28.0	27.2	19.6	30.8	29.4	21.8	0.74	
07	35.1	20.6	12.7	28.5	29.3	21.7	0.74	
08	22.5	16.0	8.7	26.8	28.4	20.9	0.74	
09	25.7	20.2	12.7	26.6	27.0	19.5	0.72	
10	44.0	33.3	25.0	26.5	25.8	18.3	0.71	
11	18.0	23.6	16.5	26.2	24.7	17.2	0.70	
12	26.2	24.1	16.6	25.6	24.0	16.5	0.69	
1995-01	24.2	23.6	16.2	24.2	23.4	16.0	0.68	
02	29.9	24.5	16.8	23.0	23.2	15.9	0.69	
03	31.1	23.8	16.1	22.1	23.4	16.0	0.68	
04	14.0	24.2	17.3	20.6	23.2	16.0	0.69	
05	14.5	30.9	23.9	19.2	22.7	15.5	0.68	
06	15.6	19.1	12.1	18.2	22.2	15.1	0.68	
07	14.5	14.9	7.9	17.0	21.8	14.7	0.67	
08	14.3	17.0	10.0	15.4	21.4	14.4	0.67	
09	11.8	22.2	15.4	13.4	21.2	14.3	0.67	
10	21.1	27.9	20.6	12.1	21.0	14.1	0.67	
11	9.0	17.2	10.5	11.3	20.1	13.3	0.66	
12	10.0	18.2	11.4	10.8	19.1	12.3	0.64	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
1996-01	11.5	18.8	12.0	10.4	18.7	12.0	0.64	
02	4.4	20.8	14.3	10.1	18.8	12.0	0.64	
03	9.2	22.3	15.6	9.7	19.0	12.3	0.65	
04	4.8	20.5	14.0	8.5	19.0	12.3	0.65	
05	5.5	14.0	7.4	8.0	18.8	12.1	0.64	*Rm*(23)
06	11.8	11.1	4.3	8.5	18.7	12.0	0.64	
07	8.2	14.7	8.0	8.4	18.5	11.8	0.64	
08	14.4	18.8	11.8	8.3	18.5	11.8	0.64	
09	1.6	26.2	19.8	8.4	18.2	11.5	0.63	
10	0.9	23.5	17.2	8.8	17.9	11.2	0.63	
11	17.9	16.3	9.2	9.8	17.8	11.1	0.62	
12	13.3	15.9	9.0	10.4	18.0	11.2	0.62	
1997-01	5.7	17.4	10.8	10.5	18.1	11.2	0.62	
02	7.6	21.0	14.3	11.0	17.9	10.9	0.61	
03	8.7	16.3	9.6	13.5	17.6	10.2	0.58	
04	15.3	18.4	11.4	16.5	17.1	9.5	0.56	
05	18.5	15.1	7.9	18.3	16.5	9.3	0.56	
06	12.7	13.7	6.8	20.3	16.4	9.1	0.55	
07	10.4	12.1	5.3	22.6	16.3	8.8	0.54	
08	24.4	13.7	6.3	25.0	16.0	8.4	0.53	
09	51.3	18.4	9.7	28.3	15.8	8.3	0.53	aa_IM(23)
10	22.8	18.7	11.3	31.8	15.8	8.3	0.53	*aam*(23)
11	39.0	18.0	9.9	35.0	16.0	8.7	0.54	
12	41.2	10.8	2.6	39.0	16.5	9.3	0.56	
1998-01	31.9	16.8	9.0	43.7	17.9	9.6	0.54	
02	40.3	16.4	8.2	48.9	18.7	10.2	0.55	
03	54.8	21.2	12.4	53.4	19.4	10.6	0.55	
04	53.4	18.0	9.2	56.5	19.7	10.7	0.54	
05	56.3	28.1	19.2	59.4	20.2	11.1	0.55	
06	70.7	18.8	9.2	62.5	20.7	11.5	0.56	
07	66.6	19.3	9.9	65.4	21.1	11.8	0.56	
08	92.2	27.0	16.4	67.8	21.5	12.0	0.56	
09	92.9	21.1	10.5	69.5	21.8	12.3	0.56	
10	55.5	22.4	13.5	70.5	22.0	12.5	0.57	
11	74.0	26.5	16.8	73.0	21.7	12.0	0.55	
12	81.9	15.9	5.8	77.9	20.9	11.0	0.53	
1999-01	62.0	20.8	11.6	82.6	20.5	10.4	0.51	
02	66.3	21.3	11.9	84.6	20.4	10.2	0.50	
03	68.8	23.5	14.0	83.8	20.8	10.6	0.51	
04	63.7	21.3	12.1	85.5	21.6	11.3	0.52	
05	106.4	15.8	4.6	90.5	21.9	11.4	0.52	
06	137.7	12.7	0.0	93.1	22.0	11.4	0.52	
07	113.5	16.9	5.4	94.3	22.3	11.7	0.52	
08	93.7	26.2	15.6	97.5	22.8	12.0	0.53	
09	71.5	31.2	21.6	102.3	22.9	11.9	0.52	
10	116.7	31.3	19.6	107.8	22.8	11.5	0.50	
11	133.2	25.1	12.6	111.0	23.3	11.9	0.51	
12	84.6	20.1	9.9	111.1	24.2	12.8	0.53	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
2000-01	90.1	24.2	13.7	112.9	25.3	13.8	0.55	
02	112.9	29.4	17.9	116.8	25.8	14.1	0.55	
03	138.5	17.1	4.4	119.9	25.7	13.8	0.54	
04	125.5	25.1	13.0	120.8	25.5	13.6	0.53	*RM*(23)
05	121.6	25.0	13.1	119.0	25.6	13.7	0.54	
06	124.9	24.9	12.8	118.7	25.6	13.8	0.54	
07	170.1	31.1	16.9	119.8	25.1	13.3	0.53	
08	130.5	24.3	12.0	118.6	24.3	12.5	0.51	
09	109.7	30.2	18.8	116.3	24.2	12.5	0.52	
10	99.4	28.1	17.2	114.6	25.1	13.5	0.54	
11	106.8	29.1	17.9	112.7	25.1	13.6	0.54	
12	104.4	16.1	5.0	112.0	24.5	13.0	0.53	
2001-01	95.6	18.0	7.3	108.7	23.7	12.4	0.52	
02	80.6	14.7	4.7	104.0	23.0	11.9	0.52	
03	113.5	30.2	18.7	104.8	22.5	11.4	0.51	
04	107.7	33.0	21.7	107.5	22.3	11.1	0.50	
05	96.6	17.8	7.0	108.6	22.3	11.0	0.49	
06	134.0	18.2	5.7	109.8	22.2	10.9	0.49	
07	81.8	18.7	8.6	111.7	22.3	10.9	0.49	
08	106.4	19.9	8.7	113.6	22.5	10.9	0.48	
09	150.7	22.7	9.4	114.1	22.3	10.7	0.48	
10	125.5	31.4	19.3	114.0	21.6	10.0	0.46	
11	106.5	24.4	13.2	115.5	21.4	9.7	0.45	
12	132.2	19.5	7.1	114.6	21.3	9.7	0.46	
2002-01	114.1	16.8	5.2	113.5	21.2	9.6	0.45	
02	107.4	20.0	8.7	114.6	21.4	9.7	0.45	
03	98.4	20.2	9.4	113.3	21.4	9.9	0.46	
04	120.7	26.0	14.1	110.5	21.6	10.2	0.47	
05	120.8	19.9	8.0	108.8	22.1	10.8	0.49	
06	88.3	14.2	3.8	106.2	22.5	11.3	0.50	
07	99.6	19.9	9.0	102.7	23.0	12.0	0.52	
08	116.4	22.5	10.8	98.7	23.8	12.9	0.54	
09	109.6	21.4	10.0	94.6	24.9	14.2	0.57	
10	97.5	38.1	27.3	90.5	25.9	15.4	0.59	
11	95.0	29.3	18.6	85.2	27.6	17.4	0.63	
12	81.6	24.4	14.3	82.0	30.1	20.0	0.66	
2003-01	79.7	24.2	14.2	80.8	31.7	21.7	0.68	
02	46.0	31.3	22.9	78.3	32.8	22.9	0.70	
03	61.1	35.2	26.1	74.0	33.8	24.0	0.71	
04	60.0	34.9	25.8	70.1	34.7	25.2	0.73	
05	54.6	52.7	43.9	67.6	36.0	26.5	0.74	
06	77.4	40.2	30.3	65.0	36.9	27.6	0.75	
07	83.3	32.4	22.3	61.8	37.7	28.5	0.76	
08	72.7	36.4	26.7	60.1	38.0	28.9	0.76	*aam*(23), aa_IM(23)
09	48.7	30.7	22.2	59.6	37.2	28.2	0.76	
10	65.5	52.2	42.9	58.2	36.2	27.2	0.75	
11	67.3	44.7	35.3	56.7	34.1	25.2	0.74	
12	46.5	30.4	22.0	54.8	31.6	22.7	0.72	

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date	Monthly Values			12-mma Values			Ratio	
(Yr-Mo)	*R*	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	Comments
2004-01	37.3	38.1	30.1	52.0	30.4	21.8	0.72	
02	45.8	23.9	15.5	49.3	29.5	20.9	0.71	
03	49.1	25.2	16.6	47.1	28.0	19.6	0.70	
04	39.3	20.1	12.0	45.5	25.9	17.5	0.68	
05	41.5	16.6	8.4	43.8	24.1	15.8	0.66	
06	43.2	15.9	7.6	41.6	23.4	15.2	0.65	
07	51.1	29.9	21.2	40.2	23.1	15.0	0.65	
08	40.9	16.3	8.1	39.2	23.1	14.9	0.65	
09	27.7	15.6	8.0	37.5	22.8	14.8	0.65	
10	48.0	16.3	7.8	35.9	22.6	14.6	0.65	
11	43.5	36.4	28.1	35.3	23.0	15.1	0.66	
12	17.9	22.6	15.5	35.2	23.7	15.8	0.67	
2005-01	31.3	39.0	31.3	34.6	23.6	15.7	0.67	
02	29.2	21.6	14.0	33.9	23.7	15.8	0.67	
03	24.5	21.4	14.0	33.5	24.7	16.8	0.68	
04	24.2	18.8	11.4	31.6	25.3	17.6	0.70	
05	42.7	28.4	20.1	28.9	24.5	16.8	0.69	
06	39.3	19.7	11.6	28.8	23.4	15.8	0.68	
07	40.1	24.0	15.8	29.1	22.1	14.5	0.66	
08	36.4	24.0	16.0	27.4	20.8	13.2	0.63	
09	21.9	31.8	24.5	25.8	20.2	12.7	0.63	
10	8.7	15.5	8.8	25.5	20.0	12.5	0.63	
11	18.0	17.1	10.0	24.9	19.3	11.9	0.62	
12	41.1	17.1	8.9	23.0	18.5	11.2	0.61	
2006-01	15.3	13.6	6.6	20.8	17.9	10.6	0.59	
02	4.9	13.6	7.1	18.6	17.1	10.0	0.58	
03	10.6	15.8	9.0	17.4	16.2	9.1	0.56	
04	30.2	18.8	11.1	17.1	15.5	8.4	0.54	
05	22.3	13.7	6.4	17.3	15.6	8.5	0.54	
06	13.9	15.2	8.3	16.3	15.9	8.8	0.55	
07	12.2	12.4	5.5	15.3	16.4	9.4	0.57	
08	12.9	17.4	10.5	15.6	16.7	9.7	0.58	
09	14.4	15.5	8.5	15.6	16.7	9.7	0.58	
10	10.5	16.6	9.8	14.2	16.7	9.8	0.59	
11	21.4	16.8	9.5	12.7	16.7	9.9	0.59	
12	13.6	24.7	17.8	12.1	16.7	9.8	0.59	
2007-01	16.9	19.2	12.1	12.0	16.6	9.8	0.59	
02	10.6	14.4	7.6	11.6	16.5	9.7	0.59	
03	4.8	16.3	9.8	10.8	16.4	9.6	0.59	
04	3.7	18.0	11.5	9.9	16.3	9.6	0.59	
05	11.7	15.0	8.2	8.7	16.1	9.4	0.58	
06	12.0	12.7	5.8	7.7	15.5	8.8	0.57	
07	10.0	13.5	6.7	7.0	14.9	8.2	0.55	
08	6.2	13.2	6.6	6.1				
09	2.4	17.1	10.7	5.9				
10	0.9	13.8	7.5					
11	1.7	14.0	7.6					
12	10.1	12.7	5.9					

Table 5. Monthly and 12-mo moving averages (mma) of *R*, *aa*, and aa_I for July 1868–present and the ratio aa_I/aa (Continued).

Date (Yr-Mo)	Monthly Values			12-mma Values			Ratio	Comments
	R	*aa*	aa_I	*R*	*aa*	aa_I	aa_I/aa	
2008-01	3.4	16.3	9.8					
02	2.1							
03	9.3							

Note: Monthly values of *aa* are the adjusted values; i.e., prior to 1957, all monthly values are equal to the original *aa* value + 3. Monthly values of aa_I are the residual values, computed as $aa_I = aa - aaR$, where $aaR = 6.3 + 0.0462R$, from the straight-line fit of *aa* versus *R*, established by the *R* and *aa* points for February 1880 (27.2, 7.6) and June 1999 (137.7, 12.7). All *aa* values lie on or above this line and all aa_I values are greater than or equal to zero. Values marked with an apostrophe denote alternate minimum values in the vicinity of *E*(*Rm*), as in cycles 17, 20, and 21, and alternate maximum values post-E(*RM*), as in cycles 12 and 13.

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13. ABSTRACT *(Maximum 200 words)*
For 1996–2006 (cycle 23), 12-month moving averages of the aa geomagnetic index strongly correlate ($r = 0.92$) with 12-month moving averages of solar wind speed, and 12-month moving averages of the number of coronal mass ejections (CMEs) (halo and partial halo events) strongly correlate ($r = 0.87$) with 12-month moving averages of sunspot number. In particular, the minimum (15.8, September/October 1997) and maximum (38.0, August 2003) values of the *aa* geomagnetic index occur simultaneously with the minimum (376 km s^{-1}) and maximum (547 km s^{-1}) solar wind speeds, both being strongly correlated with the following recurrent component (due to high-speed streams). The large peak of *aa* geomagnetic activity in cycle 23, the largest on record, spans the interval late 2002 to mid 2004 and is associated with a decreased number of halo and partial halo CMEs, whereas the smaller secondary peak of early 2005 seems to be associated with a slight rebound in the number of halo and partial halo CMEs. Based on the observed *aaM* during the declining portion of cycle 23, *RM* for cycle 24 is predicted to be larger than average, being about 168 ± 60 (the 90% prediction interval), whereas based on the expected *aam* for cycle 24 (≥ 14.6), *RM* for cycle 24 should measure $\geq 118 \pm 30$, yielding an overlap of about 128 ± 20.

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