[] Dendrochronology Program Library Run MWT Program COF 13:19 Tue 13 Jun 2017 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30116

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

File of DATED series: mwt1.txt

CONTENTS:

Part 1: Title page, options selected, summary, absent rings by series

Part 2: Histogram of time spans

Part 3: Master series with sample depth and absent rings by year

Part 4: Bar plot of Master Dating Series

Part 5: Correlation by segment of each series with Master

Part 6: Potential problems: low correlation, divergent year-to-year changes, absent rings, outliers

Part 7: Descriptive statistics

RUN CONTROL OPTIONS SELECTED VALUE

1 Cubic smoothing spline 50% wavelength cutoff for filtering

32 years

2 Segments examined are 50 years lagged successively by 25 years

3 Autoregressive model applied A Residuals are used in master dating series and testing

4 Series transformed to logarithms Y Each series log-transformed for master dating series and testing

5 CORRELATION is Pearson (parametric, quantitative)

Critical correlation, 99% confidence level .3281

6 Master dating series saved N

7 Ring measurements listed N

8 Parts printed 1234567

9 Absent rings are omitted from master series and segment correlations (Y)

Time span of Master dating series is 1902 to 2016 115 years

Continuous time span is 1902 to 2016 115 years

Portion with two or more series is 1903 to 2016 114 years

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

\*C\* Number of dated series 20 \*C\*

\*O\* Master series 1902 2016 115 yrs \*O\*

\*F\* Total rings in all series 1854 \*F\*

\*E\* Total dated rings checked 1853 \*E\*

\*C\* Series intercorrelation .688 \*C\*

\*H\* Average mean sensitivity .408 \*H\*

\*A\* Segments, possible problems 3 \*A\*

\*\*\* Mean length of series 92.7 \*\*\*

\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*

ABSENT RINGS listed by SERIES: (See Master Dating Series for absent rings listed by year)

No ring measurements of zero value

PART 2: TIME PLOT OF TREE-RING SERIES: 13:19 Tue 13 Jun 2017 Page 2

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1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050 Ident Seq Time-span Yrs

: : : : : : : : : : : : : : : : : : : : : -------- --- ---- ---- ----

. . . . . . . . . . . . . . . . . . <========> . MWT01A 1 1920 2016 97

. . . . . . . . . . . . . . . . . <==========> . MWT01B 2 1907 2016 110

. . . . . . . . . . . . . . . . . <==========> . MWT02A 3 1902 2016 115

. . . . . . . . . . . . . . . . . . <======> . MWT02B 4 1940 2016 77

. . . . . . . . . . . . . . . . . . <========> . MWT03A 5 1921 2016 96

. . . . . . . . . . . . . . . . . . <=======> . MWT03B 6 1936 2016 81

. . . . . . . . . . . . . . . . . . <======> . MWT04A 7 1947 2016 70

. . . . . . . . . . . . . . . . . . <========> . MWT04B 8 1926 2016 91

. . . . . . . . . . . . . . . . . . <=======> . MWT05A 9 1935 2016 82

. . . . . . . . . . . . . . . . . . <=======> . MWT05C 10 1936 2016 81

. . . . . . . . . . . . . . . . . . <========> . MWT06A 11 1924 2016 93

. . . . . . . . . . . . . . . . . <==========> . MWT06B 12 1909 2016 108

. . . . . . . . . . . . . . . . . .<=========> . MWT07A 13 1914 2016 103

. . . . . . . . . . . . . . . . . . <======> . MWT07B 14 1940 2016 77

. . . . . . . . . . . . . . . . . <==========> . MWT08A 15 1908 2013 106

. . . . . . . . . . . . . . . . . <==========> . MWT08B 16 1903 2016 114

. . . . . . . . . . . . . . . . . . <========> . MWT09A 17 1927 2016 90

. . . . . . . . . . . . . . . . . . <======> . MWT09B 18 1946 2016 71

. . . . . . . . . . . . . . . . . <==========> . MWT10A 19 1906 2016 111

. . . . . . . . . . . . . . . . . . <=======> . MWT10B 20 1936 2016 81

: : : : : : : : : : : : : : : : : : : : :

1050 1100 1150 1200 1250 1300 1350 1400 1450 1500 1550 1600 1650 1700 1750 1800 1850 1900 1950 2000 2050

PART 3: Master Dating Series: 13:19 Tue 13 Jun 2017 Page 3

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Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab Year Value No Ab

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1950 1.353 20 2000 .216 20

1951 1.193 20 2001 1.166 20

1902 .471 1 1952 .025 20 2002 .254 20

1903 .769 2 1953 -1.287 20 2003 .408 20

1904 -1.318 2 1954 -3.161 20 2004 .602 20

1905 .370 2 1955 -.200 20 2005 .625 20

1906 2.196 3 1956 .310 20 2006 .750 20

1907 .904 4 1957 1.047 20 2007 -1.375 20

1908 -.604 5 1958 1.131 20 2008 -.742 20

1909 -.569 6 1959 -.388 20 2009 .411 20

1910 .155 6 1960 .680 20 2010 .909 20

1911 -2.690 6 1961 .218 20 2011 -.472 20

1912 .575 6 1962 -.328 20 2012 -1.452 20

1913 1.138 6 1963 .328 20 2013 -.941 20

1914 -1.641 7 1964 -1.502 20 2014 -.339 19

1915 1.361 7 1965 -1.863 20 2015 .776 19

1916 1.095 7 1966 -1.143 20 2016 .799 19

1917 .348 7 1967 -1.390 20

1918 -.932 7 1968 .362 20

1919 -.927 7 1969 .805 20

1920 -.279 8 1970 -.749 20

1921 -1.386 9 1971 .667 20

1922 -.017 9 1972 .617 20

1923 .410 9 1973 1.474 20

1924 1.201 10 1974 .819 20

1925 .337 10 1975 -.157 20

1926 1.734 11 1976 -.081 20

1927 .478 12 1977 -.633 20

1928 .583 12 1978 .933 20

1929 .259 12 1979 .742 20

1930 -1.376 12 1980 1.060 20

1931 -1.223 12 1981 -.023 20

1932 .164 12 1982 .591 20

1933 .009 12 1983 -.699 20

1934 -.845 12 1984 -2.244 20

1935 .764 13 1985 -.152 20

1936 -2.264 16 1986 .111 20

1937 -.241 16 1987 .973 20

1938 1.579 16 1988 -2.475 20

1939 1.371 16 1989 -.267 20

1940 -.341 18 1990 .322 20

1941 -1.636 18 1991 -.846 20

1942 .033 18 1992 .504 20

1943 .544 18 1993 .347 20

1944 -.868 18 1994 -.443 20

1945 .307 18 1995 -.236 20

1946 .167 19 1996 -.861 20

1947 .507 20 1997 -.240 20

1948 .196 20 1998 .943 20

1949 1.069 20 1999 .280 20

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PART 4: Master Bar Plot: 13:19 Tue 13 Jun 2017 Page 4

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Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value Year Rel value

1950----------E 2000-----A

1951---------E 2001---------E

1902-------B 1952----@ 2002-----A

1903--------C 1953-e 2003------B

1904-e 1954m 2004-------B

1905------A 1955---a 2005-------B

1906----------I 1956------A 2006--------C

1907--------D 1957---------D 2007-e

1908--b 1958---------E 2008--c

1909--b 1959---b 2009------B

1910-----A 1960--------C 2010---------D

1911k 1961-----A 2011---b

1912-------B 1962---a 2012-f

1913---------E 1963------A 2013--d

1914g 1964-f 2014---a

1915----------E 1965g 2015--------C

1916---------D 1966-e 2016--------C

1917------A 1967-f

1918--d 1968------A

1919--d 1969--------C

1920---a 1970--c

1921-f 1971-------C

1922----@ 1972-------B

1923------B 1973----------F

1924---------E 1974--------C

1925------A 1975---a

1926----------G 1976----@

1927-------B 1977--c

1928-------B 1978---------D

1929-----A 1979--------C

1930-f 1980---------D

1931-e 1981----@

1932-----A 1982-------B

1933----@ 1983--c

1934--c 1984i

1935--------C 1985---a

1936i 1986----@

1937---a 1987---------D

1938----------F 1988j

1939----------E 1989---a

1940---a 1990------A

1941g 1991--c

1942----@ 1992-------B

1943-------B 1993------A

1944--c 1994---b

1945-----A 1995---a

1946-----A 1996--c

1947-------B 1997---a

1948-----A 1998---------D

1949---------D 1999-----A

PART 5: CORRELATION OF SERIES BY SEGMENTS: 13:19 Tue 13 Jun 2017 Page 5

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Correlations of 50-year dated segments, lagged 25 years

Flags: A = correlation under .3281 but highest as dated; B = correlation higher at other than dated position

Seq Series Time\_span 1900 1925 1950 1975

1949 1974 1999 2024

--- -------- --------- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----

1 MWT01A 1920 2016 .49 .46 .62 .53

2 MWT01B 1907 2016 .89 .87 .66 .41

3 MWT02A 1902 2016 .69 .81 .71 .72

4 MWT02B 1940 2016 .81 .80 .77

5 MWT03A 1921 2016 .82 .86 .86 .79

6 MWT03B 1936 2016 .90 .68 .31A

7 MWT04A 1947 2016 .62 .63 .80

8 MWT04B 1926 2016 .79 .78 .68

9 MWT05A 1935 2016 .62 .79 .85

10 MWT05C 1936 2016 .49 .68 .81

11 MWT06A 1924 2016 .84 .84 .85 .89

12 MWT06B 1909 2016 .83 .82 .84 .65

13 MWT07A 1914 2016 .79 .80 .82 .82

14 MWT07B 1940 2016 .78 .63 .47

15 MWT08A 1908 2013 .79 .83 .66 .62

16 MWT08B 1903 2016 .77 .80 .75 .81

17 MWT09A 1927 2016 .76 .79 .84

18 MWT09B 1946 2016 .32B .34 .58

19 MWT10A 1906 2016 .74 .72 .33 .22B

20 MWT10B 1936 2016 .62 .68 .55

Av segment correlation .77 .73 .70 .66

PART 6: POTENTIAL PROBLEMS: 13:19 Tue 13 Jun 2017 Page 5

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For each series with potential problems the following diagnostics may appear:

[A] Correlations with master dating series of flagged 50-year segments of series filtered with 32-year spline,

at every point from ten years earlier (-10) to ten years later (+10) than dated

[B] Effect of those data values which most lower or raise correlation with master series

Symbol following year indicates value in series is greater (>) or lesser (<) than master series value

[C] Year-to-year changes very different from the mean change in other series

[D] Absent rings (zero values)

[E] Values which are statistical outliers from mean for the year

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MWT01A 1920 to 2016 97 years Series 1

[B] Entire series, effect on correlation ( .506) is:

Lower 1936> -.048 2001< -.038 1960< -.028 1935< -.019 1970> -.018 2005< -.017 Higher 1954 .055 1988 .050

[C] Year-to-year changes diverging by over 4.0 std deviations:

1935 1936 4.0 SD

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

2001 -4.5 SD

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MWT01B 1907 to 2016 110 years Series 2

[B] Entire series, effect on correlation ( .709) is:

Lower 2005< -.037 2006< -.010 2003< -.010 2011> -.008 1983> -.007 1992< -.006 Higher 1936 .030 1954 .022

====================================================================================================================================

MWT02A 1902 to 2016 115 years Series 3

[\*] Early part of series cannot be checked from 1902 to 1902 -- not matched by another series

[B] Entire series, effect on correlation ( .715) is:

Lower 1904< -.021 1914> -.014 1999> -.011 1981< -.010 1919< -.008 1998< -.007 Higher 1954 .022 1988 .020

====================================================================================================================================

MWT02B 1940 to 2016 77 years Series 4

[B] Entire series, effect on correlation ( .811) is:

Lower 1987< -.031 1978< -.012 1999< -.011 1943< -.006 1942> -.005 1975> -.004 Higher 1954 .022 1988 .013

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MWT03A 1921 to 2016 96 years Series 5

[B] Entire series, effect on correlation ( .808) is:

Lower 1924< -.016 1989< -.014 1931> -.013 1922< -.006 2011> -.006 2004< -.005 Higher 1936 .027 1954 .019

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MWT03B 1936 to 2016 81 years Series 6

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

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1967 2016 0 .02 -.19 -.03 .02 -.16 .01 -.03 -.03 .16 -.17 .31\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .584) is:

Lower 1988> -.060 2006< -.044 2010< -.020 2007> -.018 1990< -.015 2014> -.012 Higher 1954 .047 1936 .026

1967 to 2016 segment:

Lower 1988> -.075 2006< -.059 2010< -.030 2007> -.022 1990< -.019 2001< -.016 Higher 1984 .100 1973 .037

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1988 +3.3 SD

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MWT04A 1947 to 2016 70 years Series 7

[B] Entire series, effect on correlation ( .606) is:

Lower 1954> -.099 1958< -.032 1953< -.022 2009< -.014 1947< -.010 2010< -.009 Higher 1988 .085 1973 .013

[C] Year-to-year changes diverging by over 4.0 std deviations:

1953 1954 5.4 SD

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1953 -4.7 SD; 1954 +5.1 SD

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MWT04B 1926 to 2016 91 years Series 8

[B] Entire series, effect on correlation ( .758) is:

Lower 1991> -.026 1931> -.020 1990< -.017 1937> -.007 1927< -.007 1974< -.007 Higher 1954 .024 1988 .020

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1931 +3.0 SD

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MWT05A 1935 to 2016 82 years Series 9

[B] Entire series, effect on correlation ( .710) is:

Lower 1954> -.030 1936> -.023 1977> -.013 1968< -.013 2015< -.010 1935< -.009 Higher 1988 .056 2007 .010

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MWT05C 1936 to 2016 81 years Series 10

[B] Entire series, effect on correlation ( .631) is:

Lower 1936> -.065 1964> -.015 1972< -.014 1945< -.014 1959> -.013 1980< -.009 Higher 1988 .069 2007 .015

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1936 +3.2 SD

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MWT06A 1924 to 2016 93 years Series 11

[B] Entire series, effect on correlation ( .843) is:

Lower 1989> -.013 1954> -.006 2009< -.005 1953> -.005 1937< -.005 1942< -.005 Higher 1988 .025 1984 .006

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MWT06B 1909 to 2016 108 years Series 12

[B] Entire series, effect on correlation ( .748) is:

Lower 2010< -.031 1942< -.012 2014< -.012 2013> -.011 2000< -.009 2007> -.009 Higher 1988 .017 1914 .010

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MWT07A 1914 to 2016 103 years Series 13

[B] Entire series, effect on correlation ( .793) is:

Lower 1914> -.013 1976> -.011 1929< -.008 1966> -.007 1941> -.006 1928< -.005 Higher 1988 .020 1936 .020

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MWT07B 1940 to 2016 77 years Series 14

[B] Entire series, effect on correlation ( .586) is:

Lower 2006< -.057 1993< -.026 1998< -.023 1991> -.019 2001< -.016 1990< -.010 Higher 1954 .031 1964 .026

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MWT08A 1908 to 2013 106 years Series 15

[B] Entire series, effect on correlation ( .724) is:

Lower 1983> -.012 1987< -.010 1989< -.009 1984> -.009 1919> -.006 1920> -.006 Higher 1936 .029 1911 .009

[E] Outliers 1 3.0 SD above or -4.5 SD below mean for year

1983 +3.1 SD

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MWT08B 1903 to 2016 114 years Series 16

[B] Entire series, effect on correlation ( .762) is:

Lower 1904> -.037 1908< -.014 1970> -.010 1991< -.008 1995< -.006 1903< -.005 Higher 1988 .021 1936 .021

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MWT09A 1927 to 2016 90 years Series 17

[B] Entire series, effect on correlation ( .804) is:

Lower 1984> -.010 1953> -.008 1939< -.007 1954> -.007 1937> -.006 1964> -.005 Higher 1988 .030 1936 .027

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MWT09B 1946 to 2016 71 years Series 18

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1946 1995 1 .03 -.03 -.26 .06 -.10 -.01 .03 -.10 -.15 -.07 .32| .36\*-.01 .00 -.21 -.06 .09 .08 -.04 -.12 -.26

[B] Entire series, effect on correlation ( .424) is:

Lower 1954> -.058 1951< -.024 1969< -.020 1967> -.019 1958< -.018 1970> -.017 Higher 1988 .086 2007 .026

1946 to 1995 segment:

Lower 1954> -.063 1951< -.027 1969< -.023 1967> -.021 1958< -.020 1970> -.020 Higher 1988 .129 1973 .018

[C] Year-to-year changes diverging by over 4.0 std deviations:

1953 1954 5.7 SD

[E] Outliers 2 3.0 SD above or -4.5 SD below mean for year

1953 -5.7 SD; 1954 +3.7 SD

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MWT10A 1906 to 2016 111 years Series 19

[A] Segment High -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 +0 +1 +2 +3 +4 +5 +6 +7 +8 +9 +10

--------- ---- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- --- ---

1967 2016 -4 -.23 .11 -.09 -.22 .10 .07 .46\*-.09 .03 .16 .22| - - - - - - - - - -

[B] Entire series, effect on correlation ( .517) is:

Lower 1991> -.040 1992< -.030 2007> -.021 1917< -.016 1978< -.016 1977> -.015 Higher 1936 .041 1911 .026

1967 to 2016 segment:

Lower 1991> -.095 1992< -.064 2007> -.047 1978< -.035 1977> -.033 2000< -.017 Higher 1988 .122 1984 .046

[E] Outliers 3 3.0 SD above or -4.5 SD below mean for year

1911 -4.7 SD; 1977 +3.3 SD; 1991 +4.4 SD

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MWT10B 1936 to 2016 81 years Series 20

[B] Entire series, effect on correlation ( .606) is:

Lower 1964> -.020 2005< -.014 1937< -.012 1972< -.011 1978< -.011 2013> -.009 Higher 1954 .049 1988 .031

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PART 7: DESCRIPTIVE STATISTICS: 13:19 Tue 13 Jun 2017 Page 6

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Corr //-------- Unfiltered --------\\ //---- Filtered -----\\

No. No. No. with Mean Max Std Auto Mean Max Std Auto AR

Seq Series Interval Years Segmt Flags Master msmt msmt dev corr sens value dev corr ()

--- -------- --------- ----- ----- ----- ------ ----- ----- ----- ----- ----- ----- ----- ----- --

1 MWT01A 1920 2016 97 4 0 .506 4.17 8.85 2.146 .651 .399 2.66 .486 .040 1

2 MWT01B 1907 2016 110 4 0 .709 3.50 7.18 1.626 .569 .363 2.59 .404 -.036 1

3 MWT02A 1902 2016 115 4 0 .715 3.09 8.02 1.760 .445 .504 2.81 .532 -.016 1

4 MWT02B 1940 2016 77 3 0 .811 3.95 9.55 2.114 .385 .464 2.80 .647 .012 2

5 MWT03A 1921 2016 96 4 0 .808 3.98 9.51 1.799 .362 .386 2.60 .481 -.026 2

6 MWT03B 1936 2016 81 3 1 .584 4.21 10.33 2.093 .608 .345 2.71 .519 .067 1

7 MWT04A 1947 2016 70 3 0 .606 4.67 9.23 2.103 .430 .401 2.58 .489 -.054 1

8 MWT04B 1926 2016 91 3 0 .758 4.61 9.96 2.138 .464 .392 2.55 .469 .002 1

9 MWT05A 1935 2016 82 3 0 .710 2.87 8.42 1.853 .632 .404 2.68 .417 -.047 2

10 MWT05C 1936 2016 81 3 0 .631 2.19 6.13 1.162 .499 .362 2.86 .477 -.024 1

11 MWT06A 1924 2016 93 4 0 .843 3.50 10.39 1.797 .467 .431 2.69 .440 -.061 1

12 MWT06B 1909 2016 108 4 0 .748 3.61 7.73 1.616 .264 .439 2.74 .580 -.038 1

13 MWT07A 1914 2016 103 4 0 .793 4.00 8.62 1.781 .299 .452 2.70 .520 .031 1

14 MWT07B 1940 2016 77 3 0 .586 3.68 8.77 1.970 .564 .432 2.69 .582 .078 1

15 MWT08A 1908 2013 106 4 0 .724 3.22 7.21 1.527 .666 .319 2.68 .408 -.037 3

16 MWT08B 1903 2016 114 4 0 .762 2.80 8.49 1.703 .737 .390 2.65 .448 -.035 1

17 MWT09A 1927 2016 90 3 0 .804 4.45 10.72 2.244 .563 .434 2.52 .434 -.090 4

18 MWT09B 1946 2016 71 3 1 .424 4.35 8.35 1.811 .416 .409 2.47 .447 .039 1

19 MWT10A 1906 2016 111 4 1 .517 3.25 10.06 1.675 .343 .425 2.70 .399 -.031 2

20 MWT10B 1936 2016 81 3 0 .606 3.25 6.54 1.488 .405 .406 2.68 .421 -.004 2

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Total or mean: 1854 70 3 .688 3.63 10.72 1.808 .489 .408 2.86 .478 -.013

- = [ COFECHA MWT COF ] = -