[] Dendrochronology Program Library Run OWS Program COF 16:05 Fri 20 Jul 2018 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30518

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

File of DATED series: ows.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 1855 to 2016 162 years

Continuous time span is 1855 to 2016 162 years

Portion with two or more series is 1871 to 2016 146 years

>> OWS07A 1979 absent in 1 of 24 series, but is not usually narrow: master index is -.234

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

\*C\* Number of dated series 24 \*C\*

\*O\* Master series 1855 2016 162 yrs \*O\*

\*F\* Total rings in all series 2889 \*F\*

\*E\* Total dated rings checked 2873 \*E\*

\*C\* Series intercorrelation .529 \*C\*

\*H\* Average mean sensitivity .297 \*H\*

\*A\* Segments, possible problems 12 \*A\*

\*\*\* Mean length of series 120.4 \*\*\*

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

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

OWS01A 1 absent rings: 1945

OWS04B 2 absent rings: 1937 1945

OWS06A 1 absent rings: 1949

OWS07A 1 absent rings: 1979

OWS08A 2 absent rings: 1937 1949

OWS08B 3 absent rings: 1937 1949 1985

OWS10A 1 absent rings: 1985

OWS12A 1 absent rings: 1985

OWS12B 1 absent rings: 1949

13 absent rings .450%

PART 2: TIME PLOT OF TREE-RING SERIES: 16:05 Fri 20 Jul 2018 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

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

. . . . . . . . . . . . . . . . . <==========> . OWS01A 1 1901 2016 116

. . . . . . . . . . . . . . . . . <==========> . OWS01B 2 1908 2015 108

. . . . . . . . . . . . . . . . . <===========> . OWS02A 3 1896 2016 121

. . . . . . . . . . . . . . . . . <===========> . OWS02B 4 1899 2016 118

. . . . . . . . . . . . . . . . . <===========> . OWS03A 5 1895 2015 121

. . . . . . . . . . . . . . . . . <==========> . OWS03B 6 1907 2014 108

. . . . . . . . . . . . . . . . . <==========> . OWS04A 7 1909 2016 108

. . . . . . . . . . . . . . . . . <==========> . OWS04B 8 1908 2011 104

. . . . . . . . . . . . . . . . . <==========> . OWS05A 9 1905 2016 112

. . . . . . . . . . . . . . . . . . <========> . OWS05B 10 1920 2011 92

. . . . . . . . . . . . . . . . . <===========> . OWS06A 11 1899 2016 118

. . . . . . . . . . . . . . . . . <=============> . OWS06B 12 1874 2016 143

. . . . . . . . . . . . . . . . . <============> . OWS07A 13 1887 2015 129

. . . . . . . . . . . . . . . . . <==========> . OWS07B 14 1905 2016 112

. . . . . . . . . . . . . . . . . <===========> . OWS08A 15 1896 2016 121

. . . . . . . . . . . . . . . . . <===========> . OWS08B 16 1896 2016 121

. . . . . . . . . . . . . . . . . <============> . OWS09A 17 1889 2016 128

. . . . . . . . . . . . . . . . . <===========> . OWS09B 18 1890 2016 127

. . . . . . . . . . . . . . . . . <===========> . OWS10A 19 1891 2016 126

. . . . . . . . . . . . . . . . . <===========> . OWS10B 20 1890 2016 127

. . . . . . . . . . . . . . . . . <==========> . OWS11A 21 1909 2016 108

. . . . . . . . . . . . . . . . . <===========> . OWS11B 22 1898 2016 119

. . . . . . . . . . . . . . . . . <=============> . OWS12A 23 1871 2016 146

. . . . . . . . . . . . . . . . <===============> . OWS12B 24 1855 2010 156

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

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: 16:05 Fri 20 Jul 2018 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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1900 .702 15 1950 .936 24 2000 -.624 24

1901 .605 16 1951 1.279 24 2001 -1.191 24

1902 -1.803 16 1952 .866 24 2002 .582 24

1903 1.260 16 1953 .417 24 2003 -.230 24

1904 .853 16 1954 -1.079 24 2004 -.471 24

1855 .082 1 1905 .418 18 1955 -.819 24 2005 .746 24

1856 1.245 1 1906 .519 18 1956 .743 24 2006 1.233 24

1857 -3.979 1 1907 .069 19 1957 -.306 24 2007 -.375 24

1858 .359 1 1908 -.574 21 1958 1.325 24 2008 -.253 24

1859 1.273 1 1909 -.743 23 1959 .758 24 2009 -.134 24

1860 .671 1 1910 -.839 23 1960 -.212 24 2010 -.171 24

1861 -2.598 1 1911 -2.421 23 1961 .078 24 2011 1.018 23

1862 .718 1 1912 -1.542 23 1962 .716 24 2012 -.670 21

1863 1.682 1 1913 .159 23 1963 .848 24 2013 -1.417 21

1864 1.042 1 1914 -.086 23 1964 .002 24 2014 -.351 21

1865 -2.113 1 1915 .120 23 1965 .574 24 2015 -.229 20

1866 .876 1 1916 2.169 23 1966 -.067 24 2016 1.503 17

1867 2.078 1 1917 .569 23 1967 -1.369 24

1868 .495 1 1918 1.153 23 1968 -1.742 24

1869 .554 1 1919 -.839 23 1969 -.715 24

1870 1.621 1 1920 -.550 24 1970 .310 24

1871 .343 2 1921 1.167 24 1971 .516 24

1872 -1.365 2 1922 -.206 24 1972 .238 24

1873 -1.667 2 1923 .948 24 1973 .207 24

1874 .422 3 1924 .255 24 1974 -.179 24

1875 .787 3 1925 1.553 24 1975 .257 24

1876 .375 3 1926 -.343 24 1976 .453 24

1877 -.460 3 1927 .651 24 1977 -.162 24

1878 1.385 3 1928 .849 24 1978 -.097 24

1879 2.065 3 1929 .273 24 1979 -.234 24 1<<

1880 .107 3 1930 -.654 24 1980 -.101 24

1881 .525 3 1931 -.898 24 1981 1.138 24

1882 -.187 3 1932 -1.486 24 1982 -.553 24

1883 -.713 3 1933 .241 24 1983 .079 24

1884 -1.705 3 1934 -.708 24 1984 .030 24

1885 -2.189 3 1935 -1.646 24 1985 -1.753 24 3

1886 -1.897 3 1936 -.498 24 1986 -.268 24

1887 .084 4 1937 -1.989 24 3 1987 .622 24

1888 .063 4 1938 .833 24 1988 .100 24

1889 .592 5 1939 -.406 24 1989 -.843 24

1890 1.055 7 1940 .836 24 1990 -.324 24

1891 -.619 8 1941 .846 24 1991 .116 24

1892 .234 8 1942 .826 24 1992 -.704 24

1893 .266 8 1943 .766 24 1993 .212 24

1894 -1.445 8 1944 .093 24 1994 1.071 24

1895 .081 9 1945 -1.079 24 2 1995 1.456 24

1896 -.175 12 1946 -.915 24 1996 .116 24

1897 .673 12 1947 -.458 24 1997 -1.349 24

1898 -.367 13 1948 .083 24 1998 .603 24

1899 .606 15 1949 -1.769 24 4 1999 .602 24

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PART 4: Master Bar Plot: 16:05 Fri 20 Jul 2018 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

1900--------C 1950---------D 2000--b

1901-------B 1951----------E 2001-e

1902g 1952--------C 2002-------B

1903---------E 1953------B 2003---a

1904--------C 1954-d 2004--b

1855-----@ 1905------B 1955--c 2005--------C

1856---------E 1906-------B 1956--------C 2006---------E

1857p 1907-----@ 1957---a 2007---a

1858------A 1908--b 1958----------E 2008---a

1859----------E 1909--c 1959--------C 2009----a

1860--------C 1910--c 1960---a 2010----a

1861j 1911j 1961-----@ 2011---------D

1862--------C 1912f 1962--------C 2012--c

1863----------G 1913-----A 1963--------C 2013-f

1864---------D 1914----@ 1964-----@ 2014---a

1865h 1915-----@ 1965-------B 2015---a

1866--------D 1916----------I 1966----@ 2016----------F

1867----------H 1917-------B 1967-e

1868-------B 1918---------E 1968g

1869-------B 1919--c 1969--c

1870----------F 1920--b 1970------A

1871------A 1921---------E 1971-------B

1872-e 1922---a 1972------A

1873g 1923---------D 1973------A

1874------B 1924------A 1974----a

1875--------C 1925----------F 1975------A

1876------B 1926---a 1976-------B

1877---b 1927-------C 1977----a

1878----------F 1928--------C 1978----@

1879----------H 1929------A 1979---a

1880-----@ 1930--c 1980----@

1881-------B 1931-d 1981---------E

1882----a 1932f 1982--b

1883--c 1933------A 1983-----@

1884g 1934--c 1984-----@

1885i 1935g 1985g

1886h 1936--b 1986---a

1887-----@ 1937h 1987-------B

1888-----@ 1938--------C 1988-----@

1889-------B 1939---b 1989--c

1890---------D 1940--------C 1990---a

1891--b 1941--------C 1991-----@

1892------A 1942--------C 1992--c

1893------A 1943--------C 1993------A

1894f 1944-----@ 1994---------D

1895-----@ 1945-d 1995----------F

1896----a 1946-d 1996-----@

1897--------C 1947---b 1997-e

1898---a 1948-----@ 1998-------B

1899-------B 1949g 1999-------B

PART 5: CORRELATION OF SERIES BY SEGMENTS: 16:05 Fri 20 Jul 2018 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 1850 1875 1900 1925 1950 1975

1899 1924 1949 1974 1999 2024

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

1 OWS01A 1901 2016 .34 .46 .35 .41

2 OWS01B 1908 2015 .63 .47 .31B .46

3 OWS02A 1896 2016 .64 .61 .40 .31A .23B

4 OWS02B 1899 2016 .65 .59 .39 .32A .29A

5 OWS03A 1895 2015 .46 .61 .50 .52 .45

6 OWS03B 1907 2014 .56 .40 .52 .58

7 OWS04A 1909 2016 .67 .66 .62 .54

8 OWS04B 1908 2011 .55 .51 .65 .53

9 OWS05A 1905 2016 .56 .54 .64 .78

10 OWS05B 1920 2011 .64 .64 .64 .67

11 OWS06A 1899 2016 .39B .38B .57 .53 .53

12 OWS06B 1874 2016 .49 .50 .60 .52 .47 .62

13 OWS07A 1887 2015 .64 .70 .56 .50 .29B

14 OWS07B 1905 2016 .68 .57 .56 .41

15 OWS08A 1896 2016 .70 .71 .73 .65 .51

16 OWS08B 1896 2016 .61 .61 .66 .45 .46

17 OWS09A 1889 2016 .70 .67 .55 .49 .57

18 OWS09B 1890 2016 .57 .63 .69 .48 .45

19 OWS10A 1891 2016 .67 .69 .57 .56 .56

20 OWS10B 1890 2016 .68 .71 .67 .66 .61

21 OWS11A 1909 2016 .66 .58 .26A .34

22 OWS11B 1898 2016 .66 .65 .55 .50 .53

23 OWS12A 1871 2016 .38 .55 .52 .48 .21B .35

24 OWS12B 1855 2010 .30A .46 .53 .46 .33 .26A

Av segment correlation .39 .59 .60 .55 .48 .48

PART 6: POTENTIAL PROBLEMS: 16:05 Fri 20 Jul 2018 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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OWS01A 1901 to 2016 116 years Series 1

[B] Entire series, effect on correlation ( .402) is:

Lower 1903< -.042 1902> -.030 1985> -.020 1971< -.017 1942< -.013 1957> -.010 Higher 1911 .021 1916 .018

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

1902 1903 -4.8 SD

[D] 1 Absent rings: Year Master N series Absent

1945 -1.079 24 2

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

1945 -5.9 SD

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

OWS01B 1908 to 2015 108 years Series 2

[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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1950 1999 -3 -.19 -.06 .14 -.21 .11 -.13 -.18 .36\*-.30 -.10 .31|-.01 -.11 -.04 .16 -.05 -.12 .20 .14 .04 -.16

[B] Entire series, effect on correlation ( .492) is:

Lower 1960< -.047 1963< -.026 1997> -.022 1923< -.020 1981< -.010 1912> -.009 Higher 1911 .032 1916 .015

1950 to 1999 segment:

Lower 1960< -.054 1963< -.049 1997> -.044 1981< -.019 1952< -.012 1983< -.012 Higher 1985 .055 1954 .023

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

OWS02A 1896 to 2016 121 years Series 3

[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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1950 1999 0 .20 .01 .10 .24 .06 -.08 -.12 -.04 -.21 .02 .31\*-.13 -.35 -.24 .07 .24 -.09 .00 .05 -.05 -.01

1967 2016 -7 .09 -.18 .11 .31\*-.09 -.14 .13 -.08 -.42 -.05 .23| - - - - - - - - - -

[B] Entire series, effect on correlation ( .448) is:

Lower 1985> -.028 2012> -.024 1949> -.021 1967> -.019 1939> -.018 1968> -.012 Higher 1937 .027 1997 .018

1950 to 1999 segment:

Lower 1985> -.073 1967> -.050 1956< -.029 1968> -.028 1982> -.022 1990> -.022 Higher 1997 .080 1954 .045

1967 to 2016 segment:

Lower 1985> -.065 2012> -.056 1967> -.045 1968> -.026 1982> -.021 1990> -.014 Higher 1997 .071 1994 .036

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

1985 +3.0 SD; 2014 +3.2 SD

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OWS02B 1899 to 2016 118 years Series 4

[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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1950 1999 0 .03 .00 .24 .07 .06 -.08 .09 -.10 -.37 -.06 .32\*-.20 -.31 -.09 .11 -.08 .04 .18 .13 -.15 .12

1967 2016 0 -.02 -.03 .06 .06 -.05 -.04 .07 -.03 -.41 -.11 .29\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .456) is:

Lower 1985> -.031 1949> -.027 1968> -.015 1954> -.010 2007> -.009 2014> -.009 Higher 1902 .041 1916 .021

1950 to 1999 segment:

Lower 1985> -.081 1968> -.040 1954> -.023 1982> -.019 1966> -.018 1953< -.011 Higher 1997 .112 1994 .023

1967 to 2016 segment:

Lower 1985> -.075 1968> -.037 2007> -.023 1982> -.017 2014> -.016 2011< -.013 Higher 1997 .102 1994 .028

[E] Outliers 4 3.0 SD above or -4.5 SD below mean for year

1949 +3.2 SD; 1968 +3.0 SD; 1985 +3.3 SD; 2014 +3.3 SD

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OWS03A 1895 to 2015 121 years Series 5

[B] Entire series, effect on correlation ( .452) is:

Lower 1897< -.028 1898> -.022 1939> -.013 1960> -.012 1926> -.010 2009< -.010 Higher 1911 .016 1954 .015

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

2015 +3.2 SD

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OWS03B 1907 to 2014 108 years Series 6

[B] Entire series, effect on correlation ( .542) is:

Lower 1939> -.028 1949> -.013 1927< -.013 2005< -.013 1956< -.013 1963< -.012 Higher 1985 .029 1911 .016

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

1939 +3.3 SD

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OWS04A 1909 to 2016 108 years Series 7

[B] Entire series, effect on correlation ( .581) is:

Lower 2001> -.027 1940< -.022 2012> -.014 1997< -.009 1945> -.009 1910> -.008 Higher 1985 .020 1916 .016

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

1997 -5.1 SD; 2001 +3.2 SD

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OWS04B 1908 to 2011 104 years Series 8

[B] Entire series, effect on correlation ( .546) is:

Lower 2001> -.019 1992> -.018 1932> -.015 1939> -.014 1949> -.013 1908> -.012 Higher 1937 .030 1985 .027

[D] 2 Absent rings: Year Master N series Absent

1937 -1.989 24 3

1945 -1.079 24 2

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

1937 -5.0 SD

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OWS05A 1905 to 2016 112 years Series 9

[B] Entire series, effect on correlation ( .632) is:

Lower 1925< -.019 1926< -.016 1951< -.016 1939> -.014 1932> -.013 1912> -.008 Higher 1985 .023 1949 .019

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OWS05B 1920 to 2011 92 years Series 10

[B] Entire series, effect on correlation ( .643) is:

Lower 1939> -.022 1997> -.016 1937> -.014 1951< -.013 1936> -.011 1983< -.011 Higher 1935 .013 1950 .010

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OWS06A 1899 to 2016 118 years Series 11

[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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1899 1948 2 -.15 -.02 -.01 -.06 .09 -.17 -.19 -.08 .10 .08 .39|-.19 .58\*-.09 .07 -.05 -.26 -.01 -.11 .04 -.08

1900 1949 2 -.16 -.05 .01 -.07 .08 -.14 -.20 -.08 .08 .11 .38|-.21 .58\*-.04 .04 -.06 -.27 -.03 -.11 .06 -.07

[B] Entire series, effect on correlation ( .505) is:

Lower 1911> -.034 1900< -.020 1985> -.016 1902> -.015 1986< -.015 1939> -.014 Higher 1949 .032 1937 .024

1899 to 1948 segment:

Lower 1911> -.068 1900< -.049 1939> -.030 1933< -.020 1902> -.020 1914> -.019 Higher 1937 .075 1916 .042

1900 to 1949 segment:

Lower 1911> -.063 1900< -.035 1902> -.029 1939> -.025 1933< -.015 1914> -.014 Higher 1949 .077 1937 .048

[D] 1 Absent rings: Year Master N series Absent

1949 -1.769 24 4

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

1949 -6.4 SD

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OWS06B 1874 to 2016 143 years Series 12

[B] Entire series, effect on correlation ( .530) is:

Lower 1884> -.023 1889< -.016 1937> -.016 1886> -.011 1954> -.011 1935> -.010 Higher 1949 .018 1916 .012

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

1949 -4.5 SD

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OWS07A 1887 to 2015 129 years Series 13

[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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1966 2015 -4 -.13 -.18 .14 -.01 .01 .12 .33\* .01 -.29 -.22 .29| .27 - - - - - - - - -

[B] Entire series, effect on correlation ( .376) is:

Lower 1979< -.097 2005< -.017 2011< -.014 1890< -.014 2006< -.011 1939> -.010 Higher 1916 .021 1958 .014

1966 to 2015 segment:

Lower 1979< -.103 2005< -.034 2011< -.029 2006< -.023 1992> -.015 1971< -.009 Higher 2002 .031 1985 .030

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

1978 1979 -5.7 SD 1979 1980 5.6 SD

[D] 1 Absent rings: Year Master N series Absent

1979 -.234 24 1 >> WARNING: Ring is not usually narrow

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

1979 -9.1 SD

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OWS07B 1905 to 2016 112 years Series 14

[B] Entire series, effect on correlation ( .521) is:

Lower 2011< -.032 1949> -.019 1997> -.016 1932> -.013 2006< -.012 1955> -.012 Higher 1985 .029 1911 .020

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OWS08A 1896 to 2016 121 years Series 15

[B] Entire series, effect on correlation ( .667) is:

Lower 1906< -.022 2007> -.021 2002< -.021 1997> -.013 1988> -.007 1896> -.006 Higher 1902 .022 1911 .016

[D] 2 Absent rings: Year Master N series Absent

1937 -1.989 24 3

1949 -1.769 24 4

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OWS08B 1896 to 2016 121 years Series 16

[B] Entire series, effect on correlation ( .602) is:

Lower 1937< -.017 1982> -.017 1976< -.015 1913< -.014 1919> -.012 1980> -.009 Higher 1902 .019 1949 .016

[D] 3 Absent rings: Year Master N series Absent

1937 -1.989 24 3

1949 -1.769 24 4

1985 -1.753 24 3

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

1937 -7.2 SD

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OWS09A 1889 to 2016 128 years Series 17

[B] Entire series, effect on correlation ( .596) is:

Lower 1997> -.019 1980< -.016 1954> -.015 1937> -.014 1939< -.013 2001> -.009 Higher 1902 .025 1911 .012

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OWS09B 1890 to 2016 127 years Series 18

[B] Entire series, effect on correlation ( .565) is:

Lower 1997> -.025 1994< -.017 1992< -.011 1939< -.011 1898> -.009 1937> -.009 Higher 1949 .022 1894 .011

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OWS10A 1891 to 2016 126 years Series 19

[B] Entire series, effect on correlation ( .634) is:

Lower 1939< -.041 1968> -.014 2002< -.010 2011< -.010 1891> -.008 1983< -.007 Higher 1949 .014 1937 .011

[D] 1 Absent rings: Year Master N series Absent

1985 -1.753 24 3

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

1939 -5.1 SD

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OWS10B 1890 to 2016 127 years Series 20

[B] Entire series, effect on correlation ( .678) is:

Lower 1939< -.023 1919> -.012 1977< -.012 1936< -.010 2000> -.010 1989> -.008 Higher 1985 .017 1949 .014

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OWS11A 1909 to 2016 108 years Series 21

[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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1950 1999 0 -.08 -.22 .20 .20 -.13 .02 -.09 .03 .08 .07 .26\*-.02 -.19 -.14 -.03 .02 -.01 -.04 -.02 .03 .09

[B] Entire series, effect on correlation ( .501) is:

Lower 1981< -.038 1982> -.029 1987< -.019 1959< -.016 1997> -.012 1962< -.011 Higher 1937 .027 1916 .016

1950 to 1999 segment:

Lower 1981< -.083 1982> -.065 1987< -.040 1959< -.030 1962< -.023 1997> -.020 Higher 1958 .045 1985 .034

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

1981 1982 4.5 SD

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OWS11B 1898 to 2016 119 years Series 22

[B] Entire series, effect on correlation ( .583) is:

Lower 1949> -.026 1898< -.013 2014< -.012 2013> -.011 1960> -.011 1996> -.010 Higher 1902 .013 1911 .012

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OWS12A 1871 to 2016 146 years Series 23

[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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1950 1999 7 -.05 .10 .19 .03 .03 -.01 -.28 -.19 -.17 .21 .21|-.06 -.20 -.06 -.01 .02 .18 .25\*-.12 -.30 .11

[B] Entire series, effect on correlation ( .442) is:

Lower 1871> -.039 1915< -.023 1873< -.017 1993< -.014 1938< -.012 1936< -.010 Higher 1985 .033 1949 .018

1950 to 1999 segment:

Lower 1993< -.035 1989> -.028 1962< -.022 1957> -.021 1995< -.018 1965< -.018 Higher 1985 .184 1954 .053

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

1872 1873 -4.4 SD

[D] 1 Absent rings: Year Master N series Absent

1985 -1.753 24 3

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

1871 +3.6 SD; 1915 -4.8 SD

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

OWS12B 1855 to 2010 156 years Series 24

[\*] Early part of series cannot be checked from 1855 to 1870 -- not matched by another series

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

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

1871 1920 0 .02 -.20 -.08 -.07 -.15 -.43 .12 .26 .01 -.07 .30\* .23 .02 -.15 -.13 .14 -.25 -.08 -.07 .01 .01

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

1961 2010 0 -.21 -.12 .17 .18 -.07 -.08 -.01 .01 -.06 -.02 .26\*-.05 .00 -.04 .02 .04 -.24 - - - -

[B] Entire series, effect on correlation ( .359) is:

Lower 1897< -.038 1871< -.038 1873> -.027 1980< -.018 2001> -.016 1938< -.009 Higher 1949 .040 1916 .012

1871 to 1920 segment:

Lower 1897< -.116 1871< -.098 1873> -.059 1891> -.010 1894> -.010 1920> -.009 Higher 1916 .039 1911 .033

1961 to 2010 segment:

Lower 2001> -.062 1980< -.060 1987< -.023 1974> -.017 1976< -.015 2005< -.014 Higher 1995 .032 1967 .030

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

1872 1873 4.4 SD

[D] 1 Absent rings: Year Master N series Absent

1949 -1.769 24 4

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

1873 +3.2 SD; 1897 -5.3 SD; 1949 -5.6 SD

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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 ()

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1 OWS01A 1901 2016 116 4 0 .402 1.90 4.32 .925 .789 .288 2.55 .394 .072 1

2 OWS01B 1908 2015 108 4 1 .492 1.95 5.53 1.104 .842 .245 2.49 .416 -.065 1

3 OWS02A 1896 2016 121 5 2 .448 1.77 5.93 1.102 .854 .193 2.84 .542 -.015 4

4 OWS02B 1899 2016 118 5 2 .456 1.54 4.22 .813 .837 .218 2.70 .442 -.060 1

5 OWS03A 1895 2015 121 5 0 .452 1.92 5.81 1.173 .844 .240 2.68 .492 .012 1

6 OWS03B 1907 2014 108 4 0 .542 2.00 5.36 .884 .833 .204 2.80 .433 .017 1

7 OWS04A 1909 2016 108 4 0 .581 1.94 5.60 .919 .712 .255 2.61 .378 .032 1

8 OWS04B 1908 2011 104 4 0 .546 1.77 5.95 1.151 .808 .366 2.47 .424 -.019 1

9 OWS05A 1905 2016 112 4 0 .632 2.04 4.73 .751 .624 .253 2.63 .489 .000 1

10 OWS05B 1920 2011 92 4 0 .643 2.58 4.72 .830 .625 .201 2.55 .369 -.010 1

11 OWS06A 1899 2016 118 5 2 .505 1.60 4.06 .817 .604 .339 2.67 .353 -.041 1

12 OWS06B 1874 2016 143 6 0 .530 1.39 5.39 .820 .667 .319 2.78 .444 -.028 1

13 OWS07A 1887 2015 129 5 1 .376 2.07 4.82 .985 .666 .310 2.43 .271 -.056 1

14 OWS07B 1905 2016 112 4 0 .521 2.45 7.34 1.399 .802 .309 2.58 .399 -.027 1

15 OWS08A 1896 2016 121 5 0 .667 2.01 8.58 1.457 .826 .381 2.54 .436 -.040 1

16 OWS08B 1896 2016 121 5 0 .602 2.02 7.31 1.413 .827 .410 2.41 .292 -.052 1

17 OWS09A 1889 2016 128 5 0 .596 1.90 4.62 .964 .763 .298 2.65 .456 -.047 1

18 OWS09B 1890 2016 127 5 0 .565 1.83 4.51 .795 .753 .243 2.60 .493 -.106 1

19 OWS10A 1891 2016 126 5 0 .634 1.78 5.55 1.113 .800 .326 2.54 .389 -.017 1

20 OWS10B 1890 2016 127 5 0 .678 1.59 5.90 1.171 .859 .311 2.63 .466 -.018 1

21 OWS11A 1909 2016 108 4 1 .501 1.91 7.16 1.406 .837 .384 2.72 .563 .026 1

22 OWS11B 1898 2016 119 5 0 .583 2.05 5.38 1.205 .832 .322 2.70 .511 .010 1

23 OWS12A 1871 2016 146 6 1 .442 1.47 4.59 1.164 .865 .328 2.61 .395 .000 1

24 OWS12B 1855 2010 156 6 2 .359 1.28 4.82 1.051 .859 .340 2.49 .368 -.004 1

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Total or mean: 2889 114 12 .529 1.84 8.58 1.059 .782 .297 2.84 .425 -.019

- = [ COFECHA OWS COF ] = -