[] Dendrochronology Program Library Run HUB Program COF 13:48 Thu 08 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 30111

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

File of DATED series: hubfinal

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 1724 to 2016 293 years

Continuous time span is 1724 to 2016 293 years

Portion with two or more series is 1771 to 2016 246 years

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

\*C\* Number of dated series 18 \*C\*

\*O\* Master series 1724 2016 293 yrs \*O\*

\*F\* Total rings in all series 2792 \*F\*

\*E\* Total dated rings checked 2745 \*E\*

\*C\* Series intercorrelation .564 \*C\*

\*H\* Average mean sensitivity .319 \*H\*

\*A\* Segments, possible problems 13 \*A\*

\*\*\* Mean length of series 155.1 \*\*\*

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

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

HUB04A 2 absent rings: 2011 2012

HUB08A 3 absent rings: 1996 2011 2012

5 absent rings .179%

PART 2: TIME PLOT OF TREE-RING SERIES: 13:48 Thu 08 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

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

. . . . . . . . . . . . . . . . . . <======> . HUB01A 1 1948 2016 69

. . . . . . . . . . . . . . . . . . <======> . HUB01B 2 1940 2016 77

. . . . . . . . . . . . . . <============================> . HUB02A 3 1724 2016 293

. . . . . . . . . . . . . . . . .<==============> . HUB02B 4 1865 2016 152

. . . . . . . . . . . . . . . <====================> . HUB03A 5 1800 2016 217

. . . . . . . . . . . . . . . <====================> . HUB03B 6 1804 2016 213

. . . . . . . . . . . . . . . . . . <=======> . HUB04A 7 1933 2016 84

. . . . . . . . . . . . . . . . . . <========> . HUB04B 8 1922 2016 95

. . . . . . . . . . . . . . . . . . <======> . HUB06A 9 1940 2016 77

. . . . . . . . . . . . . . . . . . <=======> . HUB06B 10 1930 2016 87

. . . . . . . . . . . . . . . . <==================> . HUB07A 11 1829 2016 188

. . . . . . . . . . . . . . . <=====================> . HUB07B 12 1795 2016 222

. . . . . . . . . . . . . . . . . <===========> . HUB08A 13 1896 2016 121

. . . . . . . . . . . . . . . . <===============> . HUB08B 14 1851 2016 166

. . . . . . . . . . . . . . . . . <==========> . HUB09A 15 1900 2016 117

. . . . . . . . . . . . . . . .<===================> . HUB09C 16 1812 2016 205

. . . . . . . . . . . . . . . <=======================> . HUB10A 17 1771 2016 246

. . . . . . . . . . . . . . . . <===============> . HUB10B 18 1854 2016 163

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

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: 13:48 Thu 08 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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1750 2.416 1 1800 .406 4 1850 -.544 7 1900 1.106 12 1950 1.453 18

1751 1.252 1 1801 .949 4 1851 1.457 8 1901 -1.514 12 1951 1.153 18

1752 .217 1 1802 .769 4 1852 1.092 8 1902 -1.793 12 1952 -1.788 18

1753 2.641 1 1803 .953 4 1853 .777 8 1903 .532 12 1953 -.952 18

1754 -.059 1 1804 -1.751 5 1854 .831 9 1904 .510 12 1954 -1.107 18

1755 -1.132 1 1805 -1.194 5 1855 .634 9 1905 -.122 12 1955 1.496 18

1756 -.102 1 1806 -1.333 5 1856 -1.467 9 1906 .218 12 1956 .510 18

1757 .589 1 1807 -1.380 5 1857 -.195 9 1907 .483 12 1957 .071 18

1758 -.576 1 1808 -.581 5 1858 -.122 9 1908 -.033 12 1958 .392 18

1759 .764 1 1809 -.639 5 1859 -.096 9 1909 -.943 12 1959 .584 18

1760 -.442 1 1810 .849 5 1860 -.823 9 1910 -.610 12 1960 -.250 18

1761 -1.460 1 1811 .454 5 1861 -.033 9 1911 -1.006 12 1961 -.555 18

1762 -.441 1 1812 -.332 6 1862 1.281 9 1912 1.076 12 1962 .569 18

1763 -1.301 1 1813 .269 6 1863 -.040 9 1913 .727 12 1963 -1.164 18

1764 -1.014 1 1814 -.471 6 1864 -.615 9 1914 -1.281 12 1964 -.420 18

1765 -.500 1 1815 1.105 6 1865 -1.241 10 1915 1.924 12 1965 -.731 18

1766 -1.756 1 1816 .768 6 1866 .629 10 1916 1.401 12 1966 -1.309 18

1767 -1.509 1 1817 1.692 6 1867 .482 10 1917 .639 12 1967 -.934 18

1768 -.436 1 1818 1.528 6 1868 .579 10 1918 -.206 12 1968 .952 18

1769 -.619 1 1819 .450 6 1869 1.705 10 1919 .072 12 1969 1.629 18

1770 1.161 1 1820 -.041 6 1870 -.969 10 1920 -.154 12 1970 .740 18

1771 .418 2 1821 .052 6 1871 -.269 10 1921 -1.116 12 1971 .399 18

1772 1.582 2 1822 -.550 6 1872 -.979 10 1922 -.690 13 1972 .587 18

1773 .760 2 1823 1.112 6 1873 -1.858 10 1923 -.346 13 1973 -.165 18

1724 -.802 1 1774 1.818 2 1824 1.040 6 1874 -1.084 10 1924 1.522 13 1974 1.223 18

1725 .587 1 1775 1.191 2 1825 -.527 6 1875 .748 10 1925 -.446 13 1975 .207 18

1726 -.266 1 1776 .442 2 1826 .077 6 1876 .388 10 1926 .666 13 1976 -.594 18

1727 -2.408 1 1777 .986 2 1827 -.550 6 1877 .185 10 1927 1.037 13 1977 -1.352 18

1728 1.648 1 1778 -.524 2 1828 .345 6 1878 -.617 10 1928 .347 13 1978 -.792 18

1729 2.136 1 1779 1.254 2 1829 -.859 7 1879 -.795 10 1929 .119 13 1979 -.335 18

1730 1.394 1 1780 -.598 2 1830 -.747 7 1880 1.571 10 1930 -1.051 14 1980 .884 18

1731 1.134 1 1781 -.011 2 1831 -.916 7 1881 -.043 10 1931 -2.191 14 1981 .033 18

1732 .100 1 1782 -1.807 2 1832 -.823 7 1882 .076 10 1932 .383 14 1982 1.399 18

1733 -.132 1 1783 -1.603 2 1833 -.532 7 1883 1.322 10 1933 -.516 15 1983 .102 18

1734 -3.062 1 1784 -.559 2 1834 .946 7 1884 -.080 10 1934 -1.174 15 1984 -1.702 18

1735 1.510 1 1785 -1.206 2 1835 .345 7 1885 -.654 10 1935 1.073 15 1985 1.086 18

1736 .980 1 1786 -.143 2 1836 .209 7 1886 .704 10 1936 -.857 15 1986 .978 18

1737 -1.508 1 1787 -.303 2 1837 -.227 7 1887 -.141 10 1937 -1.187 15 1987 -1.046 18

1738 .054 1 1788 -1.139 2 1838 -1.440 7 1888 -.959 10 1938 1.467 15 1988 -2.078 18

1739 1.235 1 1789 .166 2 1839 -1.729 7 1889 1.764 10 1939 1.200 15 1989 -1.472 18

1740 -1.743 1 1790 -.526 2 1840 -.095 7 1890 -.576 10 1940 -.725 17 1990 -.603 18

1741 .251 1 1791 .286 2 1841 -1.478 7 1891 .997 10 1941 .146 17 1991 .760 18

1742 -1.664 1 1792 -1.365 2 1842 .424 7 1892 .291 10 1942 .947 17 1992 .577 18

1743 -1.412 1 1793 .624 2 1843 .058 7 1893 .097 10 1943 .839 17 1993 1.250 18

1744 -.189 1 1794 .948 2 1844 .611 7 1894 -.049 10 1944 -1.184 17 1994 .235 18

1745 -.511 1 1795 1.016 3 1845 .589 7 1895 -.389 10 1945 -.972 17 1995 1.242 18

1746 -.301 1 1796 .253 3 1846 .439 7 1896 .457 11 1946 .699 17 1996 -1.022 18 1

1747 -.850 1 1797 -.451 3 1847 .537 7 1897 1.507 11 1947 1.381 17 1997 -.437 18

1748 -1.072 1 1798 -.388 3 1848 -.084 7 1898 -1.190 11 1948 .157 18 1998 .578 18

1749 2.093 1 1799 1.209 3 1849 -.363 7 1899 -.923 11 1949 -.934 18 1999 1.029 18

PART 3: Master Dating Series: 13:48 Thu 08 Jun 2017 Page 4

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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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2000 -.572 18

2001 1.465 18

2002 .623 18

2003 .748 18

2004 -.408 18

2005 .523 18

2006 .716 18

2007 -1.180 18

2008 -.522 18

2009 -.891 18

2010 1.415 18

2011 -1.128 18 2

2012 -2.069 18 2

2013 .374 18

2014 .625 18

2015 -.046 18

2016 1.011 18

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PART 4: Master Bar Plot: 13:48 Thu 08 Jun 2017 Page 5

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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

1750----------J 1800------B 1850---b 1900---------D 1950----------F 2000---b

1751---------E 1801--------D 1851----------F 1901f 1951---------E 2001----------F

1752------A 1802--------C 1852---------D 1902g 1952g 2002-------B

1753----------K 1803--------D 1853--------C 1903-------B 1953--d 2003--------C

1754-----@ 1804g 1854--------C 1904-------B 1954-d 2004---b

1755-e 1805-e 1855-------C 1905-----@ 1955----------F 2005-------B

1756-----@ 1806-e 1856f 1906------A 1956-------B 2006--------C

1757-------B 1807-f 1857----a 1907-------B 1957-----@ 2007-e

1758---b 1808---b 1858-----@ 1908-----@ 1958------B 2008---b

1759--------C 1809---c 1859-----@ 1909--d 1959-------B 2009--d

1760---b 1810--------C 1860--c 1910---b 1960----a 2010----------F

1761f 1811------B 1861-----@ 1911-d 1961---b 2011-e

1762---b 1812----a 1862---------E 1912---------D 1962-------B 2012h

1763-e 1813------A 1863-----@ 1913--------C 1963-e 2013------A

1764-d 1814---b 1864---b 1914-e 1964---b 2014-------C

1765---b 1815---------D 1865-e 1915----------H 1965--c 2015-----@

1766g 1816--------C 1866-------C 1916----------F 1966-e 2016---------D

1767f 1817----------G 1867-------B 1917-------C 1967--d

1768---b 1818----------F 1868-------B 1918----a 1968--------D

1769---b 1819------B 1869----------G 1919-----@ 1969----------G

1770---------E 1820-----@ 1870--d 1920----a 1970--------C

1771------B 1821-----@ 1871----a 1921-d 1971------B

1772----------F 1822---b 1872--d 1922--c 1972-------B

1773--------C 1823---------D 1873g 1923----a 1973----a

1724--c 1774----------G 1824---------D 1874-d 1924----------F 1974---------E

1725-------B 1775---------E 1825---b 1875--------C 1925---b 1975------A

1726----a 1776------B 1826-----@ 1876------B 1926-------C 1976---b

1727j 1777--------D 1827---b 1877------A 1927---------D 1977-e

1728----------G 1778---b 1828------A 1878---b 1928------A 1978--c

1729----------I 1779---------E 1829--c 1879--c 1929-----@ 1979----a

1730----------F 1780---b 1830--c 1880----------F 1930-d 1980--------D

1731---------E 1781-----@ 1831--d 1881-----@ 1931i 1981-----@

1732-----@ 1782g 1832--c 1882-----@ 1932------B 1982----------F

1733-----a 1783f 1833---b 1883---------E 1933---b 1983-----@

1734l 1784---b 1834--------D 1884-----@ 1934-e 1984g

1735----------F 1785-e 1835------A 1885---c 1935---------D 1985---------D

1736--------D 1786----a 1836------A 1886-------C 1936--c 1986--------D

1737f 1787----a 1837----a 1887----a 1937-e 1987-d

1738-----@ 1788-e 1838f 1888--d 1938----------F 1988h

1739---------E 1789-----A 1839g 1889----------G 1939---------E 1989f

1740g 1790---b 1840-----@ 1890---b 1940--c 1990---b

1741------A 1791------A 1841f 1891---------D 1941-----A 1991--------C

1742g 1792-e 1842------B 1892------A 1942--------D 1992-------B

1743-f 1793-------B 1843-----@ 1893-----@ 1943--------C 1993---------E

1744----a 1794--------D 1844-------B 1894-----@ 1944-e 1994------A

1745---b 1795---------D 1845-------B 1895----b 1945--d 1995---------E

1746----a 1796------A 1846------B 1896------B 1946-------C 1996-d

1747--c 1797---b 1847-------B 1897----------F 1947----------F 1997---b

1748-d 1798----b 1848-----@ 1898-e 1948-----A 1998-------B

1749----------H 1799---------E 1849----a 1899--d 1949--d 1999---------D

PART 5: CORRELATION OF SERIES BY SEGMENTS: 13:48 Thu 08 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 1750 1775 1800 1825 1850 1875 1900 1925 1950 1975

1799 1824 1849 1874 1899 1924 1949 1974 1999 2024

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

1 HUB01A 1948 2016 .77 .77 .75

2 HUB01B 1940 2016 .54 .65 .66

3 HUB02A 1724 2016 .32A .31A .31B .41 .58 .50 .56 .67 .75 .72

4 HUB02B 1865 2016 .66 .59 .57 .58 .64 .70

5 HUB03A 1800 2016 .38 .49 .58 .71 .78 .78 .76 .63

6 HUB03B 1804 2016 .42 .44 .54 .63 .55 .55 .70 .56

7 HUB04A 1933 2016 .76 .77 .66

8 HUB04B 1922 2016 .72 .70 .73 .64

9 HUB06A 1940 2016 .53 .52 .59

10 HUB06B 1930 2016 .67 .59 .54

11 HUB07A 1829 2016 .46 .65 .70 .71 .54 .29A .53

12 HUB07B 1795 2016 .25A .25A .49 .71 .78 .74 .69 .65 .63

13 HUB08A 1896 2016 .42 .38 .39 .51 .22A

14 HUB08B 1851 2016 .63 .66 .69 .76 .67 .68

15 HUB09A 1900 2016 .34 .54 .59 .61

16 HUB09C 1812 2016 .23B .35 .40 .45 .56 .51 .49 .55

17 HUB10A 1771 2016 .26A .25B .24B .29A .49 .65 .58 .47 .66 .79

18 HUB10B 1854 2016 .73 .61 .57 .32A .34 .44

Av segment correlation .29 .27 .30 .42 .60 .61 .60 .60 .62 .61

PART 6: POTENTIAL PROBLEMS: 13:48 Thu 08 Jun 2017 Page 6

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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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HUB01A 1948 to 2016 69 years Series 1

[B] Entire series, effect on correlation ( .751) is:

Lower 2011> -.029 1966> -.018 2013< -.012 1979< -.012 1997> -.006 1976< -.006 Higher 2012 .014 1984 .011

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HUB01B 1940 to 2016 77 years Series 2

[B] Entire series, effect on correlation ( .582) is:

Lower 1942< -.051 1963> -.029 2012> -.026 1980< -.022 1948< -.017 2001< -.016 Higher 2011 .029 1984 .022

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HUB02A 1724 to 2016 293 years Series 3

[\*] Early part of series cannot be checked from 1724 to 1770 -- 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

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1771 1820 0 .01 -.04 -.34 -.11 -.55 -.10 -.37 -.10 .11 .06 .32\* .00 .26 .09 .32 .21 .11 .27 .10 -.16 -.12

1775 1824 0 .03 .02 -.28 -.01 -.44 .02 -.34 -.09 .05 .07 .31\*-.03 .20 .01 .31 .16 .11 .18 .07 -.15 -.05

1800 1849 2 -.01 .02 .08 .00 -.17 .01 -.29 -.10 -.11 .04 .31| .13 .34\* .10 .03 .12 -.05 .10 .17 -.02 -.08

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

Lower 1870> -.013 1931> -.012 1836< -.010 1883< -.010 1796> -.009 1822> -.008 Higher 1901 .014 2012 .007

1771 to 1820 segment:

Lower 1796> -.045 1771> -.035 1789> -.034 1790> -.029 1786> -.028 1776< -.026 Higher 1804 .062 1782 .041

1775 to 1824 segment:

Lower 1796> -.047 1822> -.040 1789> -.036 1790> -.031 1786> -.030 1776< -.028 Higher 1804 .067 1782 .044

1800 to 1849 segment:

Lower 1836< -.057 1822> -.055 1839> -.040 1800< -.022 1843> -.019 1820> -.016 Higher 1804 .071 1815 .025

[E] Outliers 5 3.0 SD above or -4.5 SD below mean for year

1786 +3.1 SD; 1789 +3.6 SD; 1790 +4.1 SD; 1870 +3.2 SD; 1931 +3.1 SD

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HUB02B 1865 to 2016 152 years Series 4

[B] Entire series, effect on correlation ( .633) is:

Lower 1954> -.015 1907< -.013 1946< -.013 1996> -.009 1922> -.009 1920> -.007 Higher 1901 .016 2012 .010

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

1922 +3.0 SD; 1954 +3.7 SD

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HUB03A 1800 to 2016 217 years Series 5

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

Lower 1882< -.021 2011> -.015 1804> -.010 2004> -.010 1872> -.010 1822> -.009 Higher 1901 .013 1898 .007

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

1872 +3.3 SD; 1882 -5.7 SD

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HUB03B 1804 to 2016 213 years Series 6

[B] Entire series, effect on correlation ( .538) is:

Lower 1945< -.048 2011> -.014 2013< -.012 1809> -.010 1882< -.009 1837> -.008 Higher 1915 .010 1889 .008

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

1944 1945 -4.8 SD 1945 1946 4.1 SD

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

1809 +3.6 SD; 1837 +3.1 SD; 1945 -9.0 SD

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HUB04A 1933 to 2016 84 years Series 7

[B] Entire series, effect on correlation ( .747) is:

Lower 2003< -.025 1977> -.012 1933> -.010 2004> -.007 1997< -.006 1975> -.006 Higher 2011 .015 1952 .015

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

2011 -1.128 18 2

2012 -2.069 18 2

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HUB04B 1922 to 2016 95 years Series 8

[B] Entire series, effect on correlation ( .681) is:

Lower 2009> -.017 2000> -.014 1936> -.013 1967> -.012 2014< -.011 2007> -.011 Higher 1952 .016 1984 .012

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HUB06A 1940 to 2016 77 years Series 9

[B] Entire series, effect on correlation ( .594) is:

Lower 1975< -.057 1966> -.033 2012> -.013 1977> -.012 1967> -.011 1962< -.010 Higher 2011 .026 1952 .026

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

1966 +3.3 SD

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HUB06B 1930 to 2016 87 years Series 10

[B] Entire series, effect on correlation ( .597) is:

Lower 2000< -.030 1961> -.013 2004> -.013 1991< -.011 2007> -.011 1990< -.009 Higher 2011 .015 1938 .012

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HUB07A 1829 to 2016 188 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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1950 1999 0 -.20 .02 .13 -.18 -.18 .27 .10 .00 -.22 -.05 .29\*-.03 .01 .02 .22 -.30 .22 .08 .17 -.03 -.13

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

Lower 1957< -.071 1829> -.019 1980< -.017 1985< -.014 1982< -.009 1909> -.009 Higher 1931 .012 1915 .011

1950 to 1999 segment:

Lower 1957< -.195 1980< -.044 1985< -.038 1982< -.022 1987> -.020 1978> -.014 Higher 1952 .043 1955 .031

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

1956 1957 -4.7 SD 1957 1958 4.0 SD

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

1829 +4.0 SD; 1957 -8.2 SD

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HUB07B 1795 to 2016 222 years Series 12

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

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

1795 1844 0 .15 .12 .11 .00 -.05 .02 .08 .07 .15 .01 .25\*-.16 -.08 -.27 -.10 .03 -.08 .02 .09 -.03 .07

1800 1849 0 .16 .14 .11 .10 -.05 .01 .04 .14 .21 .03 .25\*-.20 -.07 -.19 -.15 .11 -.15 -.03 -.09 -.05 .03

[B] Entire series, effect on correlation ( .593) is:

Lower 1796< -.017 1816< -.016 1993< -.009 2000> -.009 1804> -.008 1962< -.008 Higher 2011 .009 1915 .009

1795 to 1844 segment:

Lower 1796< -.071 1816< -.068 1806> -.026 1805> -.023 1835> -.020 1828< -.013 Higher 1839 .032 1817 .030

1800 to 1849 segment:

Lower 1816< -.075 1806> -.027 1847< -.026 1805> -.025 1835> -.021 1809< -.015 Higher 1817 .034 1839 .034

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

1806 +3.3 SD

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HUB08A 1896 to 2016 121 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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1967 2016 0 .10 .00 -.12 -.08 -.14 .03 -.22 .10 -.05 .02 .22\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .440) is:

Lower 2007> -.023 2001< -.021 1980< -.020 1925> -.019 1934> -.015 1937> -.014 Higher 1901 .032 2011 .025

1967 to 2016 segment:

Lower 2007> -.054 2001< -.045 1980< -.040 2000> -.027 1999< -.020 1973< -.018 Higher 2011 .062 1996 .045

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

1996 -1.022 18 1

2011 -1.128 18 2

2012 -2.069 18 2

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

1934 +3.3 SD; 1937 +3.2 SD; 1996 -6.4 SD; 2007 +3.3 SD

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HUB08B 1851 to 2016 166 years Series 14

[B] Entire series, effect on correlation ( .674) is:

Lower 1901> -.014 1906< -.014 1984> -.011 1925> -.011 1888> -.009 1996< -.006 Higher 1931 .009 1952 .008

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HUB09A 1900 to 2016 117 years Series 15

[B] Entire series, effect on correlation ( .479) is:

Lower 1901> -.048 1938< -.023 1909> -.018 2012> -.015 1900< -.013 1937< -.009 Higher 1931 .019 2011 .019

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

1901 +3.7 SD; 1909 +3.2 SD; 1937 -4.9 SD; 2013 +3.1 SD

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HUB09C 1812 to 2016 205 years Series 16

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

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

1812 1861 -8 .15 -.11 .38\* .07 .26 -.02 -.11 .06 .06 .02 .23| .08 .08 -.20 -.18 -.09 -.17 .00 .04 .00 -.13

[B] Entire series, effect on correlation ( .458) is:

Lower 1901> -.018 1812< -.015 1902> -.013 1822< -.012 1889< -.010 1842< -.010 Higher 2011 .010 1931 .009

1812 to 1861 segment:

Lower 1842< -.041 1812< -.039 1860> -.034 1850> -.028 1822< -.024 1855< -.019 Higher 1841 .045 1839 .042

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

1812 -4.6 SD; 1902 +4.1 SD

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HUB10A 1771 to 2016 246 years Series 17

[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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1771 1820 0 -.07 -.04 .04 .25 .10 .08 .21 -.10 .19 -.05 .26\* .02 .11 .09 -.24 .02 -.23 -.01 -.05 -.12 -.02

1775 1824 -7 -.07 -.02 .07 .27\* .08 .06 .13 -.15 .13 -.05 .25|-.01 .13 .04 -.13 -.04 -.14 -.05 .08 -.14 .05

1800 1849 3 .02 -.09 .09 .17 -.03 -.17 -.05 -.29 .00 -.15 .24| .17 .18 .27\*-.03 -.11 -.01 -.05 .26 .06 .14

1825 1874 0 .16 .18 .18 .13 -.05 -.02 -.08 -.19 -.06 -.14 .29\*-.03 -.01 .00 -.03 -.17 .11 .10 .27 .17 -.04

[B] Entire series, effect on correlation ( .472) is:

Lower 1937> -.016 1876< -.015 1829< -.011 1789< -.009 1807> -.008 1839> -.008 Higher 1901 .015 1952 .012

1771 to 1820 segment:

Lower 1807> -.032 1789< -.029 1771< -.028 1800> -.026 1786< -.023 1776> -.020 Higher 1804 .052 1782 .034

1775 to 1824 segment:

Lower 1807> -.035 1789< -.029 1800> -.027 1786< -.023 1776> -.022 1823< -.021 Higher 1804 .054 1782 .034

1800 to 1849 segment:

Lower 1807> -.043 1839> -.042 1823< -.027 1800> -.026 1829< -.018 1835< -.017 Higher 1804 .083 1817 .040

1825 to 1874 segment:

Lower 1829< -.047 1839> -.042 1860> -.038 1835< -.025 1866< -.023 1826< -.020 Higher 1870 .042 1851 .036

[E] Outliers 5 3.0 SD above or -4.5 SD below mean for year

1804 -4.9 SD; 1829 -6.2 SD; 1860 +3.0 SD; 1876 -5.0 SD; 1937 +4.6 SD

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HUB10B 1854 to 2016 163 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

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1925 1974 0 -.09 -.07 .21 .05 -.08 -.10 .25 .00 -.14 -.27 .32\*-.03 -.23 -.19 .02 .20 .10 -.02 .13 .07 .07

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

Lower 1971< -.042 1956< -.035 1909> -.022 2011> -.015 1937> -.012 1963> -.010 Higher 1901 .012 1870 .011

1925 to 1974 segment:

Lower 1971< -.092 1956< -.074 1937> -.034 1963> -.030 1936> -.018 1958< -.015 Higher 1950 .028 1938 .027

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

1909 +4.5 SD; 1937 +3.6 SD; 1956 -5.2 SD; 1971 -4.9 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 HUB01A 1948 2016 69 3 0 .751 1.50 3.31 .724 .674 .336 2.61 .605 -.029 1

2 HUB01B 1940 2016 77 3 0 .582 1.47 3.01 .607 .524 .313 2.69 .574 -.069 1

3 HUB02A 1724 2016 293 10 3 .530 1.18 3.91 .985 .889 .342 2.69 .430 .006 1

4 HUB02B 1865 2016 152 6 0 .633 2.09 5.32 .990 .736 .276 2.63 .480 .013 1

5 HUB03A 1800 2016 217 8 0 .631 1.48 3.87 .703 .697 .284 2.76 .437 .032 1

6 HUB03B 1804 2016 213 8 0 .538 1.45 4.51 .836 .690 .354 2.64 .319 .016 1

7 HUB04A 1933 2016 84 3 0 .747 1.52 2.95 .748 .802 .326 2.58 .506 .004 1

8 HUB04B 1922 2016 95 4 0 .681 .96 2.55 .456 .751 .255 2.56 .469 .026 1

9 HUB06A 1940 2016 77 3 0 .594 1.69 4.10 .813 .692 .320 2.71 .508 .038 2

10 HUB06B 1930 2016 87 3 0 .597 1.16 4.11 .690 .688 .288 2.67 .488 -.019 2

11 HUB07A 1829 2016 188 7 1 .542 1.60 4.11 .877 .762 .326 2.56 .335 -.015 1

12 HUB07B 1795 2016 222 9 2 .593 1.50 6.55 1.181 .813 .318 2.84 .451 .011 1

13 HUB08A 1896 2016 121 5 1 .440 2.07 6.69 1.216 .739 .338 2.64 .379 .000 2

14 HUB08B 1851 2016 166 6 0 .674 1.87 5.78 .839 .642 .294 2.72 .467 -.004 1

15 HUB09A 1900 2016 117 4 0 .479 1.26 3.01 .646 .651 .338 2.82 .513 .056 2

16 HUB09C 1812 2016 205 8 1 .458 1.34 8.72 1.042 .691 .352 2.73 .465 -.020 1

17 HUB10A 1771 2016 246 10 4 .472 1.10 6.10 .819 .733 .339 2.72 .401 .032 2

18 HUB10B 1854 2016 163 6 1 .506 1.54 3.83 .714 .671 .283 2.69 .463 -.047 1

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Total or mean: 2792 106 13 .564 1.47 8.72 .865 .729 .319 2.84 .441 .004

- = [ COFECHA HUB COF ] = -