[] Dendrochronology Program Library Run ACRU Program COF 15:07 Tue 09 May 2017 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30081

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: ACRU\_LEMP13\_Corr3-50

File of DATED series: ACRU\_LEMP13\_Corr3

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 Y

8 Parts printed 1234567

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

Time span of Master dating series is 1888 to 2015 128 years

Continuous time span is 1888 to 2015 128 years

Portion with two or more series is 1888 to 2015 128 years

>> 161A 1998 absent in 1 of 31 series, but is not usually narrow: master index is 1.244

>> 173A 1989 absent in 1 of 31 series, but is not usually narrow: master index is 1.134

>> 175B 1954 absent in 1 of 31 series, but is not usually narrow: master index is .446

>> 175B 1987 absent in 1 of 31 series, but is not usually narrow: master index is .405

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

\*C\* Number of dated series 31 \*C\*

\*O\* Master series 1888 2015 128 yrs \*O\*

\*F\* Total rings in all series 2929 \*F\*

\*E\* Total dated rings checked 2929 \*E\*

\*C\* Series intercorrelation .533 \*C\*

\*H\* Average mean sensitivity .317 \*H\*

\*A\* Segments, possible problems 5 \*A\*

\*\*\* Mean length of series 94.5 \*\*\*

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

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

147B 1 absent rings: 1953

148A 1 absent rings: 2015

148B 1 absent rings: 2015

161A 2 absent rings: 1998 2003

173A 3 absent rings: 1989 1991 2003

173B 2 absent rings: 1953 2003

175B 2 absent rings: 1954 1987

209A 2 absent rings: 2003 2015

209B 1 absent rings: 2015

210A 2 absent rings: 2003 2006

221B 1 absent rings: 1952

18 absent rings .615%

1900 1.999 4 1950 .371 29 2000 .420 31

1901 1.895 8 1951 .003 29 2001 .821 31

1902 .449 9 1952 -.844 29 1 2002 -.416 31

1903 .598 10 1953 -2.200 30 2 2003 -1.988 31 5

1904 .006 11 1954 .446 31 1<< 2004 -.656 31

1905 -.443 11 1955 1.034 31 2005 -.581 31

1906 -.177 11 1956 .185 31 2006 -.972 31 1

1907 -1.120 11 1957 -.766 31 2007 -.620 31

1908 -1.464 11 1958 -.741 31 2008 .731 31

1909 .032 11 1959 -.177 31 2009 .663 31

1910 1.309 12 1960 .897 31 2010 .289 31

1911 -.443 12 1961 1.136 31 2011 .304 31

1912 1.412 12 1962 -.433 31 2012 1.283 31

1913 .006 12 1963 .382 31 2013 1.162 31

1914 -1.692 12 1964 -.136 31 2014 1.317 31

1915 .083 12 1965 -1.403 31 2015 -2.525 31 4

1916 .443 12 1966 -1.716 31

1917 -1.391 12 1967 -1.067 31

1918 .744 12 1968 -.172 31

1919 .364 12 1969 -.057 31

1920 .926 12 1970 1.063 31

1921 .199 12 1971 .585 31

1922 .824 12 1972 1.427 31

1923 -1.320 12 1973 -.443 31

1924 -.506 12 1974 1.115 31

1925 .080 12 1975 .222 31

1926 -.279 14 1976 1.421 31

1927 -.248 14 1977 -1.208 31

1928 -1.379 14 1978 .196 31

1929 .325 15 1979 1.178 31

1930 .715 16 1980 .015 31

1931 1.705 17 1981 -.729 31

1932 1.147 19 1982 .114 31

1933 -.273 23 1983 -.483 31

1934 .704 24 1984 .849 31

1935 .081 25 1985 .001 31

1936 -.904 25 1986 .022 31

1937 -.554 26 1987 .405 31 1<<

1888 .589 2 1938 -.407 27 1988 -1.018 31

1889 1.075 2 1939 -.160 27 1989 1.134 31 1<<

1890 -2.593 2 1940 .524 27 1990 -1.865 31

1891 -2.254 2 1941 1.218 29 1991 -1.130 31 1

1892 -3.174 2 1942 .808 29 1992 .601 31

1893 -.463 2 1943 .012 29 1993 .021 31

1894 .987 2 1944 .556 29 1994 -.308 31

1895 .056 2 1945 -.099 29 1995 -1.118 31

1896 -.249 2 1946 .409 29 1996 1.109 31

1897 .591 2 1947 1.136 29 1997 .764 31

1898 -1.354 3 1948 -.540 29 1998 1.244 31 1<<

1899 1.060 4 1949 -1.335 29 1999 .592 31

PART 5: CORRELATION OF SERIES BY SEGMENTS: ACRU\_LEMP13\_Corr3-50 15:07 Tue 09 May 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 1875 1900 1925 1950 1975

1924 1949 1974 1999 2024

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

1 125A 1888 2015 .60 .51 .55 .51 .49

2 125B 1888 2015 .63 .51 .51 .40 .46

3 143A 1904 2015 .31A .49 .57 .71

4 143B 1910 2015 .53 .52 .58 .56

5 145A 1930 2015 .57 .59 .72

6 145B 1938 2015 .59 .65 .66

7 147A 1926 2015 .52 .51 .64

8 147B 1926 2015 .54 .58 .44

9 148A 1937 2015 .58 .64 .55

10 148B 1932 2015 .74 .67 .52

11 161A 1931 2015 .38 .42 .42

12 172A 1953 2015 .61 .65

13 172B 1954 2015 .62 .67

14 173A 1903 2015 .44 .50 .42 .59

15 173B 1898 2015 .56 .52 .53 .48 .49

16 174A 1935 2015 .43 .58 .70

17 174B 1933 2015 .34 .62 .81

18 175A 1901 2015 .48 .44 .48 .49

19 175B 1901 2015 .40 .25A .42 .69

20 209A 1899 2015 .41 .55 .44 .37 .37

21 209B 1901 2015 .57 .44 .35B .45

22 210A 1933 2015 .65 .53 .46

23 210B 1929 2015 .57 .57 .52

24 211A 1932 2015 .56 .68 .79

25 211B 1933 2015 .55 .57 .70

26 219A 1934 2015 .33A .53 .68

27 219B 1941 2015 .41 .34 .41

28 221A 1902 2015 .45 .31A .41 .53

29 221B 1901 2015 .61 .43 .51 .60

30 222A 1933 2015 .50 .57 .57

31 222B 1941 2015 .47 .46 .57

Av segment correlation .55 .49 .49 .52 .58

PART 6: POTENTIAL PROBLEMS: ACRU\_LEMP13\_Corr3-50 15:07 Tue 09 May 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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125A 1888 to 2015 128 years Series 1

[B] Entire series, effect on correlation ( .551) is:

Lower 1990> -.026 1948> -.015 1928> -.014 1973> -.013 1974< -.012 1981> -.011 Higher 1953 .020 1890 .017

125A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1888 39 47

1890 18 28 21 90 136 94 90 110 59 249

1900 273 263 197 116 148 112 102 69 39 65

1910 72 50 59 60 35 42 82 62 91 89

1920 103 65 146 85 60 176 160 186 231 258

1930 305 415 243 118 146 113 99 137 94 152

1940 161 130 170 104 153 139 189 264 226 83

1950 121 88 99 37 101 114 120 130 81 95

1960 115 162 78 117 95 89 64 79 163 128

1970 206 115 222 213 149 136 203 145 150 235

1980 197 274 247 143 185 212 238 289 130 306

1990 254 201 234 239 243 158 318 202 279 142

2000 127 119 98 35 69 66 88 70 58 75

2010 101 48 101 75 79 18

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125B 1888 to 2015 128 years Series 2

[B] Entire series, effect on correlation ( .515) is:

Lower 1990> -.034 1948> -.017 1978< -.014 1941< -.014 1981> -.013 1952> -.012 Higher 2003 .016 1931 .010

125B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1888 10 30

1890 10 11 7 25 64 62 63 103 55 192

1900 116 140 167 139 185 141 127 90 62 97

1910 115 72 79 74 35 106 130 67 143 112

1920 140 89 141 77 64 141 122 132 94 165

1930 187 305 185 111 127 99 92 98 83 87

1940 132 74 126 61 108 87 116 148 157 89

1950 102 69 106 52 90 81 42 36 27 26

1960 42 71 25 53 37 36 15 44 50 52

1970 81 56 94 83 84 57 110 68 63 132

1980 123 208 251 170 154 210 186 210 109 144

1990 180 138 139 154 131 79 137 107 162 108

2000 76 125 64 36 54 52 61 51 53 74

2010 61 42 91 100 105 25

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143A 1904 to 2015 112 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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1904 1953 0 -.29 .01 -.24 .03 .07 .15 .08 .24 .09 -.35 .31\*-.06 -.05 .01 .08 -.07 .12 -.15 .06 -.19 .14

[B] Entire series, effect on correlation ( .532) is:

Lower 1908> -.023 1973> -.018 1913< -.016 1979< -.013 1951< -.012 1960< -.011 Higher 2015 .101 1990 .023

1904 to 1953 segment:

Lower 1908> -.050 1936> -.021 1913< -.021 1951< -.018 1920< -.016 1910< -.013 Higher 1912 .037 1928 .029

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

1908 +3.1 SD; 2015 -4.5 SD

143A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1904 186 149 171 168 208 170

1910 159 103 191 116 137 212 221 193 199 187

1920 167 152 177 171 212 192 194 201 140 205

1930 227 219 250 197 251 220 206 143 136 97

1940 99 106 122 115 150 114 114 133 106 83

1950 121 53 56 55 134 217 210 114 161 160

1960 119 157 141 159 131 98 125 143 168 191

1970 224 195 245 254 265 166 152 78 114 80

1980 64 67 80 70 105 87 105 78 71 70

1990 13 47 68 64 74 45 121 219 263 238

2000 279 219 203 115 124 134 122 125 146 116

2010 122 121 131 164 118 28

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143B 1910 to 2015 106 years Series 4

[B] Entire series, effect on correlation ( .561) is:

Lower 1968< -.023 1948> -.020 1988> -.020 1995> -.015 1949> -.012 1977> -.011 Higher 1990 .034 2015 .023

143B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1910 129 67 138 103 78 122 132 126 133 191

1920 209 217 219 169 217 226 205 231 188 251

1930 231 236 269 184 214 192 159 149 108 92

1940 99 110 138 99 126 81 118 134 173 145

1950 205 132 105 70 101 153 119 76 137 135

1960 132 147 106 117 109 72 66 84 64 83

1970 117 110 129 92 123 114 122 132 152 178

1980 159 146 163 178 199 192 260 247 250 229

1990 144 151 224 176 240 261 281 200 265 215

2000 235 165 162 106 96 119 108 112 113 67

2010 70 63 116 109 95 16

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145A 1930 to 2015 86 years Series 5

[B] Entire series, effect on correlation ( .648) is:

Lower 1986< -.037 1955< -.025 1954< -.024 1948> -.011 2002< -.010 1991> -.008 Higher 2015 .061 1990 .027

145A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 296 291 341 243 306 301 218 197 170 147

1940 157 182 153 174 155 132 135 141 119 57

1950 125 111 76 45 35 31 66 35 51 44

1960 76 119 66 96 89 60 64 73 100 153

1970 177 152 162 123 152 107 135 87 106 108

1980 78 64 76 87 74 67 35 42 30 66

1990 31 58 77 91 63 43 74 78 75 81

2000 52 83 37 41 48 63 62 59 96 87

2010 82 91 97 138 114 37

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145B 1938 to 2015 78 years Series 6

[B] Entire series, effect on correlation ( .624) is:

Lower 2002< -.028 1954< -.014 1955< -.013 1948> -.012 1980> -.011 1963< -.011 Higher 1953 .020 2015 .013

145B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1938 276 194

1940 255 235 203 166 156 179 170 199 150 79

1950 96 96 43 10 12 9 8 4 12 6

1960 17 17 7 6 7 10 24 40 131 129

1970 165 141 179 121 237 205 251 139 176 232

1980 244 181 164 133 250 195 258 227 118 239

1990 123 122 150 150 90 64 98 92 99 89

2000 68 86 46 53 66 80 66 65 109 160

2010 136 139 152 168 177 75

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147A 1926 to 2015 90 years Series 7

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

Lower 1965> -.022 2000< -.018 1966> -.015 1979< -.013 1976< -.013 1954< -.013 Higher 2015 .032 1953 .029

147A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1926 60 79 31 79

1930 140 106 155 88 126 121 75 99 84 113

1940 83 125 94 65 65 32 43 101 35 27

1950 30 52 34 3 15 39 36 11 10 17

1960 28 40 36 80 72 82 77 51 163 75

1970 110 61 84 21 46 33 51 26 61 59

1980 149 89 134 128 299 178 271 220 67 181

1990 66 80 143 123 197 64 188 157 205 88

2000 29 93 48 30 67 78 45 38 98 119

2010 80 84 74 90 90 17

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147B 1926 to 2015 90 years Series 8

[B] Entire series, effect on correlation ( .497) is:

Lower 2015> -.056 2000< -.020 1931< -.018 1972< -.014 1977> -.010 1932< -.008 Higher 1953 .029 1988 .011

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

1953 -2.200 30 2

147B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1926 16 28 12 21

1930 86 43 38 36 100 41 40 39 50 90

1940 123 133 113 74 72 62 33 75 10 17

1950 20 37 11 0 23 42 57 29 37 42

1960 52 62 51 92 62 43 16 22 23 40

1970 75 63 55 31 56 48 91 86 122 111

1980 120 147 206 135 286 192 234 192 75 171

1990 89 90 131 106 82 49 133 102 131 56

2000 28 47 21 28 23 21 18 28 16 46

2010 18 25 15 18 31 12

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148A 1937 to 2015 79 years Series 9

[B] Entire series, effect on correlation ( .627) is:

Lower 1965< -.038 1977> -.028 1973> -.015 1967> -.010 2014< -.009 2003> -.009 Higher 2015 .045 1953 .028

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

2015 -2.525 31 4

>> WARNING: Last ring in series is ABSENT

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

1965 -5.2 SD

148A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 171 249 222

1940 300 314 252 246 190 177 160 171 149 127

1950 207 174 115 60 140 128 105 102 94 97

1960 135 133 76 100 94 26 62 129 102 141

1970 163 112 191 183 222 175 199 178 181 201

1980 158 98 129 97 116 104 104 95 97 137

1990 56 45 81 66 78 95 191 185 214 136

2000 214 153 92 84 96 68 103 79 89 99

2010 49 75 112 105 58 0

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148B 1932 to 2015 84 years Series 10

[B] Entire series, effect on correlation ( .654) is:

Lower 2014< -.020 1990> -.017 1977> -.013 2006> -.012 2000> -.008 1969> -.007 Higher 2015 .026 1949 .009

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

2015 -2.525 31 4

>> WARNING: Last ring in series is ABSENT

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

1953 -4.7 SD

148B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 292 197 203 165 134 170 218 184

1940 258 285 211 212 182 181 176 178 129 96

1950 139 120 93 49 97 101 91 81 72 67

1960 99 85 54 58 46 16 25 74 90 199

1970 199 179 211 149 221 159 201 147 163 179

1980 99 69 80 63 103 86 73 56 47 75

1990 63 30 47 42 62 77 144 127 168 119

2000 180 123 84 64 60 64 92 52 83 61

2010 41 25 76 95 42 0

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161A 1931 to 2015 85 years Series 11

[B] Entire series, effect on correlation ( .363) is:

Lower 1998< -.054 1953> -.035 1949> -.023 1973> -.022 1988> -.020 2002> -.016 Higher 1977 .044 2003 .042

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

1998 1.244 31 1 >> WARNING: Ring is not usually narrow

2003 -1.988 31 5

161A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 471 357 297 375 271 226 245 231 216

1940 349 274 267 322 246 312 238 242 128 234

1950 195 124 119 188 206 148 141 146 122 136

1960 119 82 64 58 67 43 74 150 92 117

1970 86 72 89 117 116 73 84 18 42 82

1980 38 36 46 85 69 51 62 58 70 63

1990 12 45 89 54 27 24 35 47 0 36

2000 46 9 43 0 13 20 12 21 25 28

2010 17 19 30 11 31 12

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172A 1953 to 2015 63 years Series 12

[B] Entire series, effect on correlation ( .647) is:

Lower 1981> -.032 1953> -.023 2002> -.014 2014< -.013 1963< -.011 1970< -.009 Higher 2015 .028 1977 .020

172A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1953 121 169 250 136 69 73 86

1960 162 115 77 59 48 40 39 41 164 89

1970 96 127 158 129 143 132 193 73 111 261

1980 213 315 219 173 291 221 259 148 115 304

1990 103 69 131 93 114 78 228 148 158 179

2000 210 143 146 81 97 118 67 61 159 76

2010 73 68 109 100 44 11

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172B 1954 to 2015 62 years Series 13

[B] Entire series, effect on correlation ( .657) is:

Lower 1993< -.028 1969< -.023 1982< -.022 1981> -.016 2014< -.014 1987< -.014 Higher 2015 .047 2003 .023

172B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1954 191 254 158 172 164 197

1960 261 230 121 93 103 73 60 89 111 73

1970 115 112 143 116 138 141 163 96 128 183

1980 124 131 83 84 113 84 87 66 78 125

1990 74 54 122 61 106 85 209 184 197 131

2000 188 132 98 39 76 75 67 129 224 144

2010 197 210 209 213 121 33

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173A 1903 to 2015 113 years Series 14

[B] Entire series, effect on correlation ( .380) is:

Lower 1989< -.141 1951< -.016 1990> -.015 1948> -.012 1996< -.011 1909< -.009 Higher 2003 .026 2015 .024

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

1988 1989 -6.3 SD 1989 1990 6.0 SD

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

1989 1.134 31 1 >> WARNING: Ring is not usually narrow

1991 -1.130 31 1

2003 -1.988 31 5

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

1989 -7.4 SD; 1991 -4.5 SD

173A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1903 95 57 95 70 40 31 28

1910 149 154 211 117 104 145 170 143 160 195

1920 212 236 199 140 146 131 101 150 141 185

1930 236 310 245 158 165 123 117 178 209 237

1940 260 237 153 112 125 146 141 150 175 101

1950 179 94 139 133 153 148 151 100 128 136

1960 176 170 115 137 132 108 88 78 76 92

1970 120 161 194 130 180 123 154 79 95 132

1980 74 71 82 76 74 69 56 47 47 0

1990 22 0 18 35 40 29 20 28 25 40

2000 33 50 28 0 25 25 36 34 82 117

2010 85 96 111 89 81 26

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173B 1898 to 2015 118 years Series 15

[B] Entire series, effect on correlation ( .527) is:

Lower 1989< -.030 1990> -.017 1914> -.017 2003< -.015 1911> -.009 1968< -.009 Higher 1953 .020 1977 .010

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

2003 2004 5.0 SD

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

1953 -2.200 30 2

2003 -1.988 31 5

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

2003 -7.5 SD

173B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1898 14 114

1900 174 117 120 82 88 55 36 25 25 71

1910 149 181 252 185 195 192 197 171 197 192

1920 258 180 187 135 158 124 95 114 107 151

1930 142 209 155 119 124 114 119 142 173 172

1940 272 319 248 220 241 168 179 186 172 102

1950 120 39 59 0 52 80 67 53 78 97

1960 118 127 99 129 100 78 63 80 55 84

1970 103 105 113 101 139 159 195 114 145 174

1980 98 81 115 104 134 121 143 141 84 54

1990 71 81 95 88 54 60 69 75 78 66

2000 56 78 49 0 69 64 83 56 97 85

2010 85 74 166 186 113 42

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174A 1935 to 2015 81 years Series 16

[B] Entire series, effect on correlation ( .578) is:

Lower 1949> -.033 1951> -.020 1999< -.016 1947< -.013 1979< -.013 1956< -.011 Higher 2015 .112 1990 .036

174A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1935 145 162 148 150 198

1940 193 229 210 176 154 137 130 112 70 207

1950 97 371 202 181 256 306 128 156 89 157

1960 166 150 140 150 139 128 112 118 122 179

1970 198 252 245 212 258 192 277 172 239 158

1980 161 139 149 142 194 116 144 130 95 111

1990 50 46 90 101 100 97 131 150 174 105

2000 200 205 188 159 196 193 164 197 146 137

2010 132 122 140 139 209 33

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174B 1933 to 2015 83 years Series 17

[B] Entire series, effect on correlation ( .626) is:

Lower 1953> -.034 1933> -.033 1951> -.025 1947< -.012 1966> -.012 1968< -.012 Higher 2015 .065 1990 .028

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

1951 +3.2 SD

174B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 285 214 161 164 143 133 148

1940 159 188 192 144 137 121 131 149 133 191

1950 201 514 307 279 271 403 213 210 140 256

1960 304 256 210 243 219 188 220 167 158 164

1970 194 209 240 204 276 204 230 132 163 186

1980 167 143 175 142 176 117 145 171 112 158

1990 49 80 197 125 147 77 136 128 149 114

2000 109 110 94 69 86 91 92 83 123 110

2010 102 93 105 80 88 23

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175A 1901 to 2015 115 years Series 18

[B] Entire series, effect on correlation ( .497) is:

Lower 2010< -.027 1952> -.016 1986< -.012 1949> -.012 1988> -.011 1984< -.011 Higher 2015 .038 1953 .030

175A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1901 497 290 265 268 223 264 249 244 250

1910 334 255 321 283 182 203 173 165 233 168

1920 197 159 206 142 174 156 181 146 138 126

1930 113 159 148 155 203 133 56 49 57 82

1940 56 68 118 84 88 71 78 99 91 79

1950 98 63 81 38 55 60 48 24 27 46

1960 41 53 47 61 42 34 30 80 60 107

1970 104 85 55 22 57 61 81 44 45 35

1980 40 17 19 37 28 29 14 47 64 80

1990 45 57 81 52 59 105 206 185 250 138

2000 138 156 104 64 60 83 82 103 79 85

2010 32 93 102 106 87 32

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175B 1901 to 2015 115 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

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1925 1974 0 -.06 .04 .02 -.08 -.25 -.05 .04 -.04 .02 .07 .25\* .13 .13 -.16 -.35 -.02 .11 .04 .12 .04 -.08

[B] Entire series, effect on correlation ( .397) is:

Lower 1954< -.112 1950< -.023 1953> -.020 1949> -.020 1987< -.019 1948> -.010 Higher 2015 .094 1990 .018

1925 to 1974 segment:

Lower 1954< -.179 1950< -.041 1949> -.035 1953> -.029 1948> -.018 1972< -.012 Higher 1936 .042 1931 .030

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

1953 1954 -6.6 SD

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

1954 .446 31 1 >> WARNING: Ring is not usually narrow

1987 .405 31 1 >> WARNING: Ring is not usually narrow

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

1954 -6.8 SD; 1987 -4.6 SD

175B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1901 414 272 234 178 169 170 193 156 239

1910 238 200 270 238 162 193 177 147 162 149

1920 141 124 127 97 152 152 140 97 86 131

1930 112 138 107 105 129 136 52 41 36 65

1940 67 74 87 55 68 44 52 41 54 61

1950 21 13 28 43 0 42 37 23 38 62

1960 59 98 68 83 76 68 70 81 84 92

1970 92 83 68 57 70 59 74 50 70 70

1980 65 57 43 54 66 39 23 0 39 67

1990 20 41 61 34 8 62 128 111 164 96

2000 113 95 82 38 48 56 46 77 83 69

2010 45 66 57 48 63 30

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209A 1899 to 2015 117 years Series 20

[B] Entire series, effect on correlation ( .457) is:

Lower 1899< -.037 1996< -.024 2013< -.017 1953> -.013 1952> -.013 1976< -.013 Higher 2003 .029 2015 .022

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

2003 -1.988 31 5

2015 -2.525 31 4

>> WARNING: Last ring in series is ABSENT

209A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1899 112

1900 661 425 233 258 195 202 253 206 205 292

1910 260 185 220 175 148 134 145 75 110 86

1920 76 81 98 52 50 50 79 70 67 135

1930 184 231 225 208 240 170 168 108 102 119

1940 103 153 112 157 129 108 63 97 42 24

1950 71 142 174 127 223 213 142 67 52 78

1960 108 100 86 90 89 80 95 82 106 74

1970 80 76 119 46 48 57 37 19 45 56

1980 18 19 39 28 26 9 7 16 18 49

1990 15 35 72 31 22 29 10 18 13 25

2000 19 23 18 0 15 9 7 18 21 21

2010 21 24 28 4 25 0

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

209B 1901 to 2015 115 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

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

1950 1999 4 -.17 .10 .10 .01 -.08 -.02 -.03 -.01 -.12 -.30 .35|-.04 .11 -.35 .37\*-.11 -.10 .13 .06 .01 -.01

[B] Entire series, effect on correlation ( .523) is:

Lower 1973< -.029 1953> -.026 1986< -.023 1984< -.020 1988> -.011 1946< -.010 Higher 2015 .052 1990 .014

1950 to 1999 segment:

Lower 1953> -.047 1984< -.037 1986< -.033 1988> -.019 1991> -.018 1995> -.016 Higher 1990 .041 1977 .031

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

2015 -2.525 31 4

>> WARNING: Last ring in series is ABSENT

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

1986 -4.6 SD

209B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1901 488 302 279 201 212 243 216 217 294

1910 268 234 301 249 182 165 163 96 182 138

1920 123 128 94 62 66 50 71 48 47 105

1930 123 150 161 138 195 154 104 81 82 122

1940 106 126 95 103 89 77 46 92 44 25

1950 47 29 83 113 169 145 138 86 80 149

1960 171 168 113 155 133 106 88 86 124 91

1970 86 80 152 47 65 77 67 41 72 80

1980 51 39 48 37 24 33 13 23 35 39

1990 23 45 72 40 38 45 50 50 40 54

2000 51 52 37 26 36 30 21 29 35 35

2010 25 31 46 32 34 0

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

210A 1933 to 2015 83 years Series 22

[B] Entire series, effect on correlation ( .535) is:

Lower 1998< -.037 1952> -.016 1988> -.014 1957> -.013 1973> -.012 1935> -.012 Higher 1990 .045 1953 .030

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

2003 -1.988 31 5

2006 -.972 31 1

210A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 223 269 291 190 194 204 156

1940 166 179 166 133 159 126 169 184 125 85

1950 185 178 195 80 204 171 168 175 136 102

1960 152 130 73 77 69 52 70 75 99 76

1970 137 160 199 184 212 205 238 120 149 154

1980 125 93 111 113 110 93 136 151 118 93

1990 38 62 68 64 76 62 49 42 18 30

2000 13 19 19 0 23 24 0 29 52 54

2010 78 73 61 28 37 7

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

210B 1929 to 2015 87 years Series 23

[B] Entire series, effect on correlation ( .537) is:

Lower 1969< -.025 1957> -.021 1929< -.020 2013< -.016 1996< -.016 1992< -.011 Higher 1990 .045 1953 .021

210B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1929 89

1930 170 432 303 176 217 229 185 212 199 150

1940 165 177 149 155 185 148 166 189 154 91

1950 164 91 69 42 103 160 157 201 186 146

1960 200 151 81 119 101 83 63 71 89 37

1970 95 101 138 128 186 196 242 116 142 184

1980 180 126 150 141 158 128 144 129 103 88

1990 46 65 63 62 61 54 48 72 60 59

2000 39 67 27 29 51 41 53 37 62 47

2010 89 57 77 36 57 23

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211A 1932 to 2015 84 years Series 24

[B] Entire series, effect on correlation ( .680) is:

Lower 1982< -.034 1957> -.017 1936> -.017 1953> -.012 1932< -.011 1937> -.006 Higher 2015 .062 2003 .013

211A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 408 361 408 424 438 459 448 415

1940 381 457 324 356 287 280 284 282 153 85

1950 202 263 178 174 299 316 240 292 277 243

1960 339 267 185 187 178 152 153 190 234 253

1970 258 253 286 228 295 275 290 215 275 252

1980 237 233 167 163 249 211 232 215 146 244

1990 167 153 259 221 258 210 383 255 291 223

2000 229 197 158 112 125 167 128 115 140 123

2010 139 128 121 136 149 54

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211B 1933 to 2015 83 years Series 25

[B] Entire series, effect on correlation ( .641) is:

Lower 1970< -.021 1995> -.021 1957> -.016 1971< -.013 1994> -.012 1937> -.010 Higher 2015 .085 1949 .011

211B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 394 389 392 368 410 399 379

1940 320 368 280 244 219 288 323 307 187 118

1950 169 143 109 110 205 218 193 255 255 223

1960 368 307 227 276 221 216 176 190 258 228

1970 192 167 230 167 238 186 261 185 201 203

1980 195 135 157 145 193 155 176 169 124 174

1990 129 107 149 159 265 277 388 257 287 194

2000 202 146 137 101 109 106 92 102 156 128

2010 129 117 107 125 157 60

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

219A 1934 to 2015 82 years Series 26

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

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

1934 1983 0 .16 -.04 .09 -.02 .15 -.07 .14 -.26 .02 .16 .33\*-.26 .02 -.07 .18 -.04 .04 -.15 .02 .19 .01

[B] Entire series, effect on correlation ( .487) is:

Lower 1934< -.112 1990> -.035 1955< -.019 1960< -.015 1980> -.013 1951> -.009 Higher 2015 .040 1953 .039

1934 to 1983 segment:

Lower 1934< -.176 1955< -.031 1960< -.024 1980> -.021 1951> -.014 1935> -.010 Higher 1953 .106 1972 .029

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

1934 1935 4.1 SD

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

1934 -4.8 SD

219A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1934 136 292 221 255 291 261

1940 279 231 212 116 176 154 199 218 116 91

1950 133 191 114 16 57 33 38 37 23 17

1960 25 76 72 107 88 75 77 51 102 100

1970 162 158 207 155 170 122 174 125 136 134

1980 173 129 130 122 148 158 166 133 85 165

1990 143 111 156 125 75 60 92 97 130 109

2000 81 84 50 30 45 35 20 30 37 49

2010 46 42 58 70 100 20

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219B 1941 to 2015 75 years Series 27

[B] Entire series, effect on correlation ( .438) is:

Lower 1990> -.049 1952> -.021 1994< -.020 1972< -.013 1998< -.013 1977> -.012 Higher 1953 .049 2003 .034

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

1948 -4.7 SD

219B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1941 263 185 130 162 129 133 116 25 53

1950 67 101 112 28 77 59 57 51 21 20

1960 49 53 36 48 42 44 36 27 38 33

1970 42 52 55 47 86 89 159 146 205 284

1980 270 256 248 185 221 180 180 203 107 150

1990 170 119 122 143 48 32 42 50 36 57

2000 40 71 49 6 19 16 9 26 15 23

2010 43 65 87 75 93 17

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221A 1902 to 2015 114 years Series 28

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

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

1925 1974 0 .12 .10 .03 -.02 -.05 -.05 -.03 .18 .09 -.02 .31\* .12 -.20 -.34 -.06 .07 .15 -.12 -.14 -.09 .23

[B] Entire series, effect on correlation ( .484) is:

Lower 1996< -.020 2003> -.015 1990> -.015 2002> -.013 1930< -.012 1931< -.011 Higher 2015 .089 1977 .013

1925 to 1974 segment:

Lower 1930< -.029 1962> -.027 1972< -.023 1931< -.023 1965> -.019 1948> -.018 Higher 1952 .030 1970 .025

221A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1902 295 528 368 381 371 226 190 281

1910 391 268 258 198 183 237 258 218 328 315

1920 333 323 268 228 193 215 197 183 158 128

1930 101 109 104 91 120 92 85 118 93 139

1940 195 220 214 165 255 226 256 255 201 126

1950 158 98 40 65 116 128 93 73 78 65

1960 75 69 84 105 86 80 78 50 49 80

1970 97 85 74 67 84 86 119 82 88 133

1980 79 62 91 94 134 100 92 94 91 140

1990 110 97 110 105 83 58 54 59 65 79

2000 75 97 110 96 95 94 55 61 91 84

2010 93 57 55 63 69 23

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221B 1901 to 2015 115 years Series 29

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

Lower 1952< -.047 1965> -.017 1953> -.014 1928> -.011 1990> -.011 1997< -.008 Higher 1977 .016 1931 .011

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

1952 1953 5.2 SD

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

1952 -.844 29 1

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

1952 -6.9 SD

221B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1901 516 423 451 304 239 199 141 163 219

1910 303 225 265 219 164 212 184 141 182 187

1920 258 274 235 191 200 260 213 176 204 226

1930 172 265 164 123 154 100 78 139 110 153

1940 173 200 166 144 201 137 139 164 121 84

1950 111 74 0 55 77 79 48 51 46 48

1960 65 66 72 97 84 90 72 54 73 85

1970 120 98 88 62 92 90 108 73 97 152

1980 109 108 162 115 142 122 99 109 89 161

1990 121 109 141 139 123 88 93 79 101 83

2000 71 92 88 74 73 57 72 52 80 86

2010 69 48 67 71 58 30

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222A 1933 to 2015 83 years Series 30

[B] Entire series, effect on correlation ( .500) is:

Lower 2003> -.040 1952< -.023 1935< -.016 1933> -.016 1953> -.014 1963< -.014 Higher 1990 .040 2015 .024

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

2003 +3.2 SD

222A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 269 223 144 174 169 202 283

1940 239 279 287 260 258 201 273 285 157 139

1950 172 202 85 125 202 209 143 106 122 123

1960 107 142 124 76 84 61 44 61 96 95

1970 164 157 198 115 132 99 109 71 75 84

1980 40 51 91 64 71 76 59 91 81 127

1990 61 72 69 69 54 65 148 95 98 91

2000 114 98 114 124 134 98 74 65 78 67

2010 64 51 95 125 112 37

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222B 1941 to 2015 75 years Series 31

[B] Entire series, effect on correlation ( .486) is:

Lower 1952< -.060 1947< -.018 1953> -.013 1963< -.012 1977> -.011 1998< -.011 Higher 1996 .015 1989 .015

222B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1941 402 314 263 278 219 269 205 185 210

1950 253 297 116 192 242 287 216 186 211 263

1960 228 222 179 172 229 169 174 265 266 218

1970 303 333 314 203 311 281 252 212 188 205

1980 195 154 168 107 157 142 120 159 139 266

1990 108 147 119 95 84 81 198 107 80 83

2000 129 84 64 61 59 45 43 52 76 82

2010 66 70 114 139 111 33

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PART 7: DESCRIPTIVE STATISTICS: ACRU\_LEMP13\_Corr3-50 15:07 Tue 09 May 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 ()

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1 125A 1888 2015 128 5 0 .551 1.37 4.15 .769 .686 .355 2.67 .493 -.075 2

2 125B 1888 2015 128 5 0 .515 .98 3.05 .530 .665 .374 2.85 .519 -.020 2

3 143A 1904 2015 112 4 1 .532 1.46 2.79 .586 .769 .239 2.45 .341 -.030 1

4 143B 1910 2015 106 4 0 .561 1.49 2.81 .580 .793 .218 2.61 .489 -.037 1

5 145A 1930 2015 86 3 0 .648 1.07 3.41 .682 .889 .277 2.57 .558 -.049 1

6 145B 1938 2015 78 3 0 .624 1.22 2.76 .773 .812 .330 2.67 .519 .022 2

7 147A 1926 2015 90 3 0 .594 .85 2.99 .571 .521 .511 2.77 .512 .017 1

8 147B 1926 2015 90 3 0 .497 .66 2.86 .545 .739 .473 2.74 .510 .055 2

9 148A 1937 2015 79 3 0 .627 1.33 3.14 .614 .761 .300 2.52 .412 .038 1

10 148B 1932 2015 84 3 0 .654 1.16 2.92 .655 .822 .323 2.50 .390 .033 1

11 161A 1931 2015 85 3 0 .363 1.15 4.71 1.046 .906 .454 2.60 .562 -.002 1

12 172A 1953 2015 63 2 0 .647 1.31 3.15 .698 .476 .390 2.68 .556 .119 1

13 172B 1954 2015 62 2 0 .657 1.30 2.61 .553 .599 .322 2.82 .724 -.039 1

14 173A 1903 2015 113 4 0 .380 1.14 3.10 .644 .830 .352 2.39 .352 -.047 1

15 173B 1898 2015 118 5 0 .527 1.18 3.19 .599 .785 .321 2.34 .284 .024 1

16 174A 1935 2015 81 3 0 .578 1.60 3.71 .568 .371 .252 2.65 .416 .018 2

17 174B 1933 2015 83 3 0 .626 1.68 5.14 .759 .635 .241 2.74 .418 -.007 1

18 175A 1901 2015 115 4 0 .497 1.14 4.97 .843 .876 .298 2.63 .535 -.057 1

19 175B 1901 2015 115 4 1 .397 .93 4.14 .660 .880 .352 2.48 .374 -.031 1

20 209A 1899 2015 117 5 0 .457 .99 6.61 .944 .748 .409 2.76 .415 -.055 1

21 209B 1901 2015 115 4 1 .523 1.02 4.88 .788 .885 .301 2.64 .371 -.045 1

22 210A 1933 2015 83 3 0 .535 1.13 2.91 .676 .840 .357 2.52 .423 -.079 1

23 210B 1929 2015 87 3 0 .537 1.21 4.32 .692 .741 .302 2.60 .440 -.017 1

24 211A 1932 2015 84 3 0 .680 2.41 4.59 .926 .799 .199 2.80 .515 .074 1

25 211B 1933 2015 83 3 0 .641 2.12 4.10 .874 .814 .203 2.68 .453 .005 2

26 219A 1934 2015 82 3 1 .487 1.16 2.92 .688 .809 .316 2.55 .484 -.035 1

27 219B 1941 2015 75 3 0 .438 .91 2.84 .720 .871 .374 2.51 .473 -.070 1

28 221A 1902 2015 114 4 1 .484 1.43 5.28 .936 .877 .215 2.66 .441 .099 1

29 221B 1901 2015 115 4 0 .505 1.36 5.16 .837 .878 .260 2.44 .318 .037 1

30 222A 1933 2015 83 3 0 .500 1.26 2.87 .669 .812 .256 2.76 .458 .001 1

31 222B 1941 2015 75 3 0 .486 1.77 4.02 .841 .768 .247 2.70 .381 -.020 1

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Total or mean: 2929 107 5 .533 1.27 6.61 .720 .770 .317 2.85 .448 -.008

- = [ COFECHA ACRU COF ] = -