[] Dendrochronology Program Library Run LE16S Program COF 14:09 Fri 03 Feb 2017 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 29986

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: LEMP16\_ACSA\_Corr1-50

File of DATED series: LEMP16\_ACSA\_Corr1

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 1924 to 2016 93 years

Continuous time span is 1924 to 2016 93 years

Portion with two or more series is 1927 to 2016 90 years

>> 1777B 1978 absent in 1 of 38 series, but is not usually narrow: master index is .504

>> 1777B 1984 absent in 1 of 38 series, but is not usually narrow: master index is .126

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

\*C\* Number of dated series 38 \*C\*

\*O\* Master series 1924 2016 93 yrs \*O\*

\*F\* Total rings in all series 3070 \*F\*

\*E\* Total dated rings checked 3067 \*E\*

\*C\* Series intercorrelation .598 \*C\*

\*H\* Average mean sensitivity .282 \*H\*

\*A\* Segments, possible problems 1 \*A\*

\*\*\* Mean length of series 80.8 \*\*\*

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

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

1777B 3 absent rings: 1978 1983 1984

3 absent rings .098%

1950 -1.323 37 2000 -.611 38

1951 .592 37 2001 -1.218 38

1952 -.408 37 2002 -.883 38

1953 -3.591 37 2003 -.419 38

1954 1.077 37 2004 .978 38

1955 1.397 37 2005 .421 38

1956 1.253 37 2006 .191 38

1957 .733 37 2007 .494 38

1958 1.107 38 2008 1.543 38

1959 -.195 38 2009 1.313 38

1960 1.121 38 2010 -1.276 38

1961 1.029 38 2011 -.419 38

1962 .539 38 2012 .354 38

1963 -1.199 38 2013 .655 38

1964 .618 38 2014 .512 38

1965 -2.193 38 2015 1.058 38

1966 -1.096 38 2016 -2.491 38

1967 -.198 38

1968 -.486 38

1969 .458 38

1970 .175 38

1971 .051 38

1972 .505 38

1973 -.744 38

1924 -2.205 1 1974 -.043 38

1925 -1.520 1 1975 .347 38

1926 1.510 1 1976 -.061 38

1927 .195 4 1977 .953 38

1928 1.499 5 1978 .504 38 1<<

1929 .801 5 1979 -.975 38

1930 -.003 9 1980 .943 38

1931 .258 14 1981 -.419 38

1932 .505 18 1982 .480 38

1933 .893 19 1983 -2.232 38 1

1934 -.035 19 1984 .126 38 1<<

1935 1.583 22 1985 -.277 38

1936 .246 22 1986 1.477 38

1937 -.383 24 1987 .100 38

1938 -.323 27 1988 -1.586 38

1939 -.768 28 1989 .036 38

1940 -1.363 28 1990 .012 38

1941 .225 28 1991 1.022 38

1942 -.136 29 1992 .608 38

1943 .125 32 1993 .582 38

1944 .279 32 1994 .699 38

1945 -.196 32 1995 .068 38

1946 -.417 33 1996 .733 38

1947 -.067 33 1997 -.907 38

1948 -.217 33 1998 .447 38

1949 -.334 33 1999 -2.214 38

PART 5: CORRELATION OF SERIES BY SEGMENTS: LEMP16\_ACSA\_Corr1-50 14:09 Fri 03 Feb 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 1925 1950 1975

1974 1999 2024

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

1 1582A 1930 2016 .45 .55 .47

2 1582B 1932 2016 .54 .63 .67

3 1583A 1927 2016 .43 .60 .41

4 1583B 1927 2016 .56 .67 .38

5 1585A 1950 2016 .75 .76

6 1585B 1930 2016 .39 .52 .50

7 1586A 1931 2016 .69 .71 .63

8 1586B 1931 2016 .71 .80 .72

9 1587A 1950 2016 .58 .46

10 1587B 1931 2016 .45 .49 .52

11 1771A 1932 2016 .31A .42 .54

12 1771B 1932 2016 .59 .67 .65

13 1772A 1943 2016 .61 .66 .68

14 1772B 1933 2016 .48 .62 .72

15 1773A 1937 2016 .67 .70 .64

16 1773B 1938 2016 .76 .72 .63

17 1774A 1924 2016 .55 .71 .60

18 1774B 1935 2016 .57 .66 .64

19 1775A 1935 2016 .45 .65 .62

20 1775B 1931 2016 .60 .65 .54

21 1776A 1939 2016 .75 .73 .60

22 1776B 1935 2016 .58 .71 .61

23 1777A 1942 2016 .55 .57 .43

24 1777B 1943 2016 .68 .63 .47

25 1778A 1950 2016 .81 .72

26 1778B 1938 2016 .67 .72 .60

27 1779A 1946 2016 .50 .53 .36

28 1779B 1943 2016 .68 .67 .63

29 1780A 1927 2016 .47 .53 .54

30 1780B 1932 2016 .43 .47 .55

31 1781A 1938 2016 .57 .62 .68

32 1781B 1928 2016 .50 .49 .46

33 1793A 1930 2016 .55 .69 .71

34 1793B 1930 2016 .64 .69 .72

35 1794A 1958 2016 .40 .57

36 1794B 1950 2016 .51 .65

37 1795A 1931 2016 .76 .77 .56

38 1795B 1937 2016 .76 .83 .72

Av segment correlation .57 .63 .59

PART 6: POTENTIAL PROBLEMS: LEMP16\_ACSA\_Corr1-50 14:09 Fri 03 Feb 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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1582A 1930 to 2016 87 years Series 1

[B] Entire series, effect on correlation ( .576) is:

Lower 1974< -.042 1975< -.038 1973> -.023 2003< -.017 1941< -.015 1977< -.013 Higher 1953 .067 2010 .027

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

1975 -4.5 SD

1582A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 123 241 172 240 157 244 139 142 93 63

1940 83 72 100 196 133 184 198 145 231 278

1950 248 352 239 120 304 303 314 327 346 225

1960 298 255 236 199 194 128 188 217 203 135

1970 95 172 155 207 73 48 120 91 120 101

1980 120 125 173 122 163 113 332 233 107 160

1990 193 205 243 230 165 195 266 156 143 69

2000 96 84 147 48 139 137 95 145 227 267

2010 61 97 136 100 89 82 38

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1582B 1932 to 2016 85 years Series 2

[B] Entire series, effect on correlation ( .658) is:

Lower 1974< -.038 1950> -.023 1977< -.014 1983> -.008 1964< -.007 1949> -.006 Higher 1953 .024 1965 .022

1582B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 209 215 173 268 167 172 154 93

1940 95 119 125 156 138 133 219 174 216 335

1950 378 440 386 222 345 369 416 323 320 370

1960 440 341 338 260 247 171 273 428 312 376

1970 308 303 338 200 108 144 161 139 240 166

1980 184 163 225 149 139 108 266 215 79 200

1990 138 229 239 159 170 130 227 83 102 54

2000 80 65 88 76 93 120 143 118 210 227

2010 77 51 83 107 75 107 52

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1583A 1927 to 2016 90 years Series 3

[B] Entire series, effect on correlation ( .421) is:

Lower 2010> -.055 1935< -.017 1927> -.015 2008< -.015 1942< -.013 1982< -.011 Higher 1983 .066 1965 .028

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

1983 -5.3 SD

1583A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 124 115 82

1930 109 79 82 74 63 61 85 54 74 106

1940 47 95 52 79 153 120 148 106 191 224

1950 183 244 184 151 283 365 344 340 286 376

1960 338 385 263 189 201 128 195 225 137 190

1970 179 180 217 186 229 239 190 221 232 175

1980 235 243 132 41 187 177 213 215 137 224

1990 229 187 116 219 117 166 152 136 154 77

2000 128 97 91 110 174 228 66 129 73 114

2010 231 50 133 37 147 150 37

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1583B 1927 to 2016 90 years Series 4

[B] Entire series, effect on correlation ( .460) is:

Lower 2010> -.061 1992< -.045 1927> -.019 1982< -.015 2013< -.011 2008< -.010 Higher 1983 .053 1953 .037

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

2010 +3.2 SD

1583B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 99 89 49

1930 61 56 45 44 58 61 79 67 61 51

1940 45 75 68 99 168 123 190 129 198 197

1950 151 263 177 102 257 388 350 376 245 306

1960 294 305 211 176 201 123 214 234 153 204

1970 209 260 289 238 339 279 276 346 313 163

1980 212 261 142 86 192 200 263 192 120 190

1990 183 207 112 194 171 141 189 156 163 102

2000 171 160 134 138 194 210 67 165 100 107

2010 253 38 104 37 161 120 47

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1585A 1950 to 2016 67 years Series 5

[B] Entire series, effect on correlation ( .760) is:

Lower 1973> -.018 2003< -.015 1963> -.014 1988> -.013 1957< -.010 1953> -.008 Higher 2016 .026 1965 .020

1585A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 92 202 132 90 237 293 303 204 250 193

1960 391 422 455 353 333 194 225 273 316 368

1970 350 334 390 387 314 402 301 393 350 277

1980 345 302 341 220 269 282 444 294 262 237

1990 238 313 299 311 335 272 284 183 217 158

2000 136 123 117 102 165 188 190 178 266 267

2010 177 171 210 255 291 340 123

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1585B 1930 to 2016 87 years Series 6

[B] Entire series, effect on correlation ( .474) is:

Lower 1938< -.049 1949< -.017 1976< -.016 1937> -.016 1970< -.015 1988> -.013 Higher 2010 .036 2016 .017

1585B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 125 124 85 83 88 101 61 90 26 57

1940 41 50 32 37 60 50 61 58 105 40

1950 77 158 132 83 281 254 338 238 279 204

1960 380 413 347 244 273 202 218 311 330 314

1970 213 265 255 278 237 307 214 271 262 215

1980 297 306 325 254 252 192 286 214 236 226

1990 278 357 333 287 266 210 206 191 192 167

2000 139 166 180 151 231 301 277 226 286 273

2010 85 130 262 284 236 219 99

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1586A 1931 to 2016 86 years Series 7

[B] Entire series, effect on correlation ( .662) is:

Lower 1991< -.036 2010> -.027 2002< -.015 1940> -.010 1944< -.009 1981> -.008 Higher 2016 .053 1953 .018

1586A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 65 108 92 68 130 96 66 75 84

1940 99 140 130 124 88 94 118 108 106 96

1950 116 188 150 110 287 222 290 274 301 211

1960 326 284 366 207 254 165 251 247 210 300

1970 199 204 241 179 249 187 156 162 151 149

1980 234 208 157 78 276 187 270 196 98 207

1990 66 58 137 148 113 68 126 58 171 63

2000 131 114 68 103 195 178 222 259 332 367

2010 299 413 288 328 384 411 131

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1586B 1931 to 2016 86 years Series 8

[B] Entire series, effect on correlation ( .713) is:

Lower 2010> -.038 1946< -.016 1991< -.016 1931< -.011 1939> -.009 1941< -.007 Higher 2016 .044 1953 .015

1586B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 58 129 168 127 181 113 79 110 110

1940 80 75 76 91 88 71 55 115 83 103

1950 109 157 113 82 236 237 268 230 342 236

1960 341 340 370 149 260 139 195 207 209 332

1970 249 224 254 132 230 183 224 258 170 138

1980 203 160 144 83 213 137 229 147 71 221

1990 74 84 208 187 146 116 129 56 148 39

2000 84 94 53 68 180 164 253 252 286 296

2010 297 333 235 287 336 373 110

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1587A 1950 to 2016 67 years Series 9

[B] Entire series, effect on correlation ( .579) is:

Lower 1994< -.044 1988> -.026 2010> -.023 1969< -.021 2005< -.018 1971< -.017 Higher 2016 .066 1953 .044

1587A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 100 196 202 93 188 181 225 186 192 133

1960 140 122 126 70 146 84 77 68 68 49

1970 63 42 60 69 94 135 99 102 74 66

1980 105 78 132 70 159 118 98 80 125 125

1990 182 237 179 141 75 117 185 128 179 108

2000 197 101 133 207 171 118 139 194 253 223

2010 200 286 292 255 208 192 91

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1587B 1931 to 2016 86 years Series 10

[B] Entire series, effect on correlation ( .520) is:

Lower 1973< -.021 2009< -.019 1992< -.014 1961< -.011 1988> -.010 1969< -.010 Higher 2016 .037 1953 .024

1587B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 44 159 94 97 140 129 55 64 71

1940 67 67 44 55 96 101 82 163 125 106

1950 115 218 195 104 242 200 243 209 236 195

1960 203 140 139 142 156 122 127 110 94 85

1970 86 71 78 48 91 113 84 84 107 98

1980 120 72 94 73 155 150 154 102 111 135

1990 124 134 101 128 118 192 252 157 242 149

2000 175 163 140 201 244 236 224 197 215 162

2010 123 270 322 285 244 277 116

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1771A 1932 to 2016 85 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

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

1932 1981 0 - - .07 -.04 .02 -.22 -.02 .02 -.04 -.16 .31\*-.09 .03 .19 .09 -.04 .03 .01 -.14 -.11 .17

[B] Entire series, effect on correlation ( .436) is:

Lower 1953> -.024 1978< -.022 1965> -.020 1983> -.017 1935< -.013 1940< -.012 Higher 2010 .032 1988 .022

1932 to 1981 segment:

Lower 1953> -.039 1965> -.035 1978< -.029 1935< -.018 1961< -.016 1962< -.008 Higher 1954 .037 1950 .029

1771A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 83 143 94 86 94 93 87 90

1940 49 104 122 108 110 122 61 122 125 82

1950 50 110 93 82 189 156 111 130 128 81

1960 90 68 60 65 172 102 99 63 87 99

1970 78 65 100 60 72 69 100 84 42 62

1980 102 117 159 117 228 187 260 167 57 107

1990 105 107 89 112 84 54 84 71 94 67

2000 130 96 96 156 137 96 146 160 202 171

2010 71 110 134 235 168 204 109

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1771B 1932 to 2016 85 years Series 12

[B] Entire series, effect on correlation ( .646) is:

Lower 1965> -.026 1943< -.022 2013< -.022 1986< -.021 1974< -.018 1976> -.010 Higher 1953 .046 1999 .024

1771B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 76 178 91 109 92 68 57 73

1940 50 65 74 51 94 102 72 85 146 131

1950 100 211 115 65 184 172 123 150 164 116

1960 192 145 147 97 235 156 147 110 137 181

1970 117 150 147 102 72 169 218 230 177 135

1980 177 88 107 73 85 105 90 100 82 110

1990 97 147 162 169 182 173 181 129 147 82

2000 188 131 116 216 277 256 246 242 341 326

2010 122 207 212 108 157 220 97

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1772A 1943 to 2016 74 years Series 13

[B] Entire series, effect on correlation ( .628) is:

Lower 2005< -.046 1953> -.024 1973> -.018 1981< -.012 1951< -.009 1960< -.009 Higher 2016 .039 1983 .033

1772A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 128 158 71 67 36 11 11

1950 15 20 29 5 151 325 236 270 293 190

1960 137 197 145 123 164 126 150 173 171 152

1970 204 237 193 209 213 186 174 170 159 123

1980 186 120 198 118 217 182 255 179 123 176

1990 143 193 156 173 187 174 238 160 147 100

2000 110 168 179 212 204 120 223 223 203 213

2010 129 209 253 259 254 247 93

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1772B 1933 to 2016 84 years Series 14

[B] Entire series, effect on correlation ( .608) is:

Lower 1953> -.026 1960< -.012 2005< -.011 1936> -.011 1940> -.009 1951< -.009 Higher 2016 .029 1988 .019

1772B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1933 151 124 151 136 110 132 116

1940 118 95 134 97 94 36 25 6 17 11

1950 17 20 23 10 163 404 357 307 348 144

1960 146 172 167 139 177 142 132 150 144 192

1970 228 251 237 235 218 271 224 270 254 172

1980 212 133 223 137 264 188 213 144 92 127

1990 109 181 125 148 137 122 193 116 170 101

2000 156 133 179 195 224 147 149 258 340 306

2010 123 236 295 286 258 263 116

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1773A 1937 to 2016 80 years Series 15

[B] Entire series, effect on correlation ( .682) is:

Lower 1986< -.037 1997> -.015 1989< -.015 2011< -.013 1937> -.012 1945< -.011 Higher 1953 .056 2016 .038

1773A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 146 145 108

1940 124 132 125 138 179 94 88 119 93 100

1950 93 143 120 72 157 194 138 138 145 109

1960 154 202 141 144 195 121 156 198 185 181

1970 215 174 197 166 161 208 192 236 239 186

1980 213 205 214 104 192 128 105 110 87 96

1990 213 278 295 282 350 301 288 302 306 235

2000 206 243 232 221 310 290 286 265 313 326

2010 199 149 273 264 206 211 103

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1773B 1938 to 2016 79 years Series 16

[B] Entire series, effect on correlation ( .685) is:

Lower 1989< -.081 1945< -.012 1962< -.011 1940> -.011 1973> -.010 1942> -.009 Higher 1953 .064 1983 .025

1773B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1938 155 141

1940 151 149 175 161 179 125 141 173 139 151

1950 114 180 145 83 186 207 155 161 163 144

1960 204 202 132 114 154 121 135 203 219 224

1970 245 239 228 221 207 232 209 234 216 179

1980 213 156 185 141 172 189 234 224 181 143

1990 189 226 223 228 252 246 221 217 267 187

2000 223 211 219 261 303 317 300 265 278 250

2010 79 108 202 228 132 148 70

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1774A 1924 to 2016 93 years Series 17

[\*] Early part of series cannot be checked from 1924 to 1926 -- not matched by another series

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

Lower 1927< -.041 1933< -.040 1937> -.013 1963> -.013 1966< -.010 1973> -.009 Higher 1953 .082 1965 .026

1774A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1924 149 165 235 167 218 270

1930 233 244 286 192 252 328 236 311 238 212

1940 217 306 326 355 322 313 246 188 148 151

1950 107 183 133 45 122 156 179 154 192 141

1960 162 154 106 119 130 71 51 82 100 118

1970 99 100 113 130 155 156 143 202 147 138

1980 150 113 187 118 91 98 224 171 61 104

1990 118 128 151 169 100 113 89 105 124 72

2000 72 70 107 70 97 92 90 130 214 218

2010 91 104 88 64 85 128 68

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1774B 1935 to 2016 82 years Series 18

[B] Entire series, effect on correlation ( .635) is:

Lower 1984< -.036 1964< -.030 1954< -.022 1936< -.019 1937> -.017 1997> -.010 Higher 1953 .078 2010 .021

1774B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1935 292 167 283 229 180

1940 161 244 251 224 282 295 271 254 192 200

1950 149 199 148 64 101 150 192 176 232 139

1960 195 182 159 123 78 75 76 100 98 126

1970 128 116 119 131 148 149 118 223 178 140

1980 204 135 198 134 83 126 193 154 90 103

1990 131 139 156 183 128 104 91 109 133 78

2000 68 70 96 89 149 103 78 99 127 137

2010 62 60 86 92 107 176 88

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1775A 1935 to 2016 82 years Series 19

[B] Entire series, effect on correlation ( .503) is:

Lower 1939< -.101 1951< -.036 2010> -.023 1940> -.017 1984< -.011 2006< -.007 Higher 1953 .046 2016 .031

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

1938 1939 -4.3 SD 1939 1940 4.6 SD

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

1939 -5.6 SD

1775A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1935 302 272 242 269 144

1940 227 230 206 220 256 208 190 205 175 189

1950 160 85 83 49 142 157 179 175 191 149

1960 241 239 222 161 156 84 150 175 170 250

1970 215 138 196 64 112 131 151 204 222 151

1980 150 139 161 90 72 79 141 144 74 116

1990 101 156 123 162 150 139 122 127 126 90

2000 94 70 112 116 164 254 106 137 230 208

2010 170 136 93 107 148 143 33

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1775B 1931 to 2016 86 years Series 20

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

Lower 1931< -.024 1951< -.017 1997> -.017 1937> -.017 2006< -.016 1971< -.015 Higher 1953 .083 2016 .033

1775B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 84 137 172 140 236 194 237 234 210

1940 158 187 171 170 171 158 163 191 129 154

1950 124 102 93 55 124 152 159 144 160 122

1960 193 221 190 160 150 80 101 140 132 176

1970 177 83 127 50 100 91 77 95 97 76

1980 85 40 61 46 34 49 100 96 56 70

1990 87 150 158 199 164 149 173 176 148 100

2000 101 103 111 84 128 171 90 104 139 128

2010 108 94 91 106 137 207 81

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1776A 1939 to 2016 78 years Series 21

[B] Entire series, effect on correlation ( .705) is:

Lower 1975< -.024 1996< -.023 2008< -.009 2016> -.009 1984< -.008 1945> -.007 Higher 1953 .073 2010 .019

1776A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1939 191

1940 184 247 229 241 229 240 227 220 138 150

1950 140 183 136 77 184 197 189 149 160 145

1960 223 180 200 128 226 137 190 215 197 261

1970 231 218 249 198 217 140 192 201 305 178

1980 304 198 182 96 128 148 293 140 106 113

1990 110 203 226 109 206 94 63 116 157 71

2000 177 88 97 81 150 176 113 112 115 138

2010 48 108 153 152 174 217 76

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1776B 1935 to 2016 82 years Series 22

[B] Entire series, effect on correlation ( .587) is:

Lower 1936< -.041 2004< -.025 1945> -.024 1975< -.020 1988> -.019 1997> -.011 Higher 1983 .027 1999 .026

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

1945 +3.3 SD

1776B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1935 211 147 205 214 179

1940 161 205 236 227 301 585 298 146 127 133

1950 118 129 142 72 219 230 246 197 235 224

1960 253 225 212 103 172 97 121 138 112 175

1970 196 174 209 164 189 113 126 182 219 116

1980 215 144 188 112 151 194 330 206 203 235

1990 158 273 247 150 290 217 210 203 224 79

2000 199 68 137 96 79 166 240 172 243 166

2010 56 157 114 198 225 209 79

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1777A 1942 to 2016 75 years Series 23

[B] Entire series, effect on correlation ( .533) is:

Lower 1977< -.044 2016> -.034 1973> -.022 1950< -.015 2011< -.011 1952> -.010 Higher 1953 .089 1988 .023

1777A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1942 206 255 311 288 237 396 333 300

1950 114 269 361 133 347 294 299 302 216 197

1960 268 296 278 181 183 134 141 131 69 133

1970 162 208 256 296 297 201 224 33 51 53

1980 135 136 116 48 45 79 153 108 42 131

1990 87 94 79 86 129 124 125 116 148 85

2000 105 110 94 165 266 185 102 132 134 144

2010 74 55 89 127 108 181 125

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1777B 1943 to 2016 74 years Series 24

[B] Entire series, effect on correlation ( .610) is:

Lower 1978< -.033 2010> -.031 1982< -.018 1986< -.018 1988> -.016 1997> -.014 Higher 1953 .107 2016 .071

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

1978 .504 38 1 >> WARNING: Ring is not usually narrow

1983 -2.232 38 1

1984 .126 38 1 >> WARNING: Ring is not usually narrow

1777B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 512 403 330 294 263 201 183

1950 145 189 194 61 212 215 266 264 265 218

1960 287 278 309 204 250 149 193 171 139 277

1970 267 236 217 239 283 144 188 185 0 80

1980 154 122 15 0 0 17 12 28 54 135

1990 132 198 185 179 243 203 82 148 102 65

2000 71 67 104 100 254 306 169 203 244 263

2010 266 238 313 332 265 281 76

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1778A 1950 to 2016 67 years Series 25

[B] Entire series, effect on correlation ( .786) is:

Lower 2010> -.033 1983> -.014 1950> -.011 1987< -.010 1974< -.009 2003> -.009 Higher 1953 .053 2016 .030

1778A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 90 106 70 22 118 140 114 102 166 123

1960 127 131 151 92 139 89 111 137 126 137

1970 128 143 124 107 93 110 115 159 139 86

1980 140 115 141 86 213 133 165 58 25 82

1990 157 174 141 142 161 130 160 82 162 108

2000 158 179 159 217 204 196 189 189 234 240

2010 211 210 269 227 222 235 74

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1778B 1938 to 2016 79 years Series 26

[B] Entire series, effect on correlation ( .668) is:

Lower 1983> -.020 1966< -.018 1989< -.017 2010> -.016 1944< -.011 1939> -.010 Higher 1953 .081 2016 .017

1778B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1938 49 79

1940 56 65 89 95 49 75 73 84 98 68

1950 64 93 98 25 117 109 122 86 114 108

1960 97 109 96 68 91 69 67 105 92 100

1970 106 121 100 126 110 128 144 147 128 97

1980 185 150 203 121 257 166 204 102 36 96

1990 175 202 168 166 167 143 210 129 264 149

2000 232 194 165 257 254 203 233 217 268 250

2010 210 230 271 211 272 316 81

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1779A 1946 to 2016 71 years Series 27

[B] Entire series, effect on correlation ( .464) is:

Lower 2010> -.056 1962< -.033 1988> -.025 1978< -.021 1996< -.011 1973> -.011 Higher 2016 .043 1999 .030

1779A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 76 101 113 83

1950 53 145 93 63 151 174 124 114 101 70

1960 108 134 82 79 125 90 117 124 112 139

1970 106 135 151 148 156 183 166 162 91 75

1980 104 64 143 102 235 176 213 191 176 185

1990 161 171 132 158 124 95 102 80 144 106

2000 189 180 199 311 284 201 283 242 215 197

2010 324 288 363 259 172 184 87

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1779B 1943 to 2016 74 years Series 28

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

Lower 2010> -.045 1996< -.023 1973> -.019 1962< -.012 1960< -.010 1991< -.008 Higher 2016 .058 1953 .024

1779B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 70 69 82 70 102 110 76

1950 60 106 88 49 142 143 102 88 95 89

1960 89 93 74 75 144 74 102 114 95 123

1970 114 108 127 126 110 130 98 129 112 92

1980 111 77 118 78 196 142 139 144 58 138

1990 107 113 111 137 129 126 98 96 243 123

2000 171 151 151 224 207 222 254 263 283 221

2010 237 187 223 199 178 183 69

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1780A 1927 to 2016 90 years Series 29

[B] Entire series, effect on correlation ( .531) is:

Lower 1973< -.025 1998< -.011 1944< -.011 1950> -.010 1943< -.010 1936> -.009 Higher 2010 .030 1988 .017

1780A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 141 196 202

1930 153 165 128 109 100 139 146 70 76 68

1940 66 79 65 53 52 100 85 71 132 118

1950 136 196 152 85 275 221 211 210 157 111

1960 134 140 141 125 190 135 153 151 147 135

1970 167 167 167 104 147 171 157 142 150 114

1980 175 120 173 113 112 109 136 96 78 187

1990 214 149 167 147 157 163 140 101 91 105

2000 113 115 129 79 123 134 85 103 156 166

2010 71 93 120 142 133 109 80

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1780B 1932 to 2016 85 years Series 30

[B] Entire series, effect on correlation ( .504) is:

Lower 1965> -.034 1988> -.023 1962< -.016 1969< -.016 1980< -.010 2005< -.010 Higher 2010 .039 2016 .019

1780B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1932 97 95 93 138 136 72 64 88

1940 78 101 69 77 69 102 105 166 148 159

1950 113 164 134 99 218 182 218 189 194 130

1960 134 133 91 70 152 144 154 132 123 96

1970 139 133 117 84 111 120 117 129 106 95

1980 103 86 105 106 150 143 253 186 186 238

1990 180 223 192 177 200 160 197 153 168 150

2000 152 125 156 138 123 99 85 127 184 190

2010 85 122 128 171 128 114 73

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1781A 1938 to 2016 79 years Series 31

[B] Entire series, effect on correlation ( .612) is:

Lower 1978< -.033 1988> -.031 1947< -.027 1999> -.023 1953> -.019 1950> -.013 Higher 2016 .059 1965 .030

1781A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1938 84 77

1940 66 100 68 58 68 61 157 43 122 211

1950 190 224 161 119 313 305 241 249 272 181

1960 179 227 232 164 208 120 141 154 154 168

1970 155 157 163 119 137 144 123 154 103 106

1980 168 117 172 112 175 208 221 153 210 211

1990 216 236 241 247 254 222 234 180 263 236

2000 196 198 243 260 301 217 258 250 284 238

2010 184 220 246 236 211 239 98

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1781B 1928 to 2016 89 years Series 32

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

Lower 1953> -.025 1986< -.023 1981< -.017 2009< -.016 1972< -.015 1999> -.014 Higher 1983 .044 1965 .027

1781B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1928 159 117

1930 105 136 152 132 90 107 106 47 33 70

1940 64 111 64 75 79 78 79 137 160 147

1950 75 146 108 103 163 210 176 140 198 160

1960 174 203 232 188 203 128 116 119 144 170

1970 154 160 124 106 172 215 194 206 152 184

1980 184 118 171 116 210 197 164 165 189 261

1990 304 376 295 285 297 307 305 208 177 201

2000 184 159 182 194 414 366 420 382 372 182

2010 77 104 135 191 144 160 99

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1793A 1930 to 2016 87 years Series 33

[B] Entire series, effect on correlation ( .644) is:

Lower 1936< -.037 1993< -.021 1981> -.013 1980< -.012 1975< -.011 1930< -.009 Higher 1965 .029 2010 .021

1793A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 354 444 375 398 370 444 262 298 342 392

1940 364 567 533 448 305 182 259 238 187 233

1950 219 335 284 187 254 333 337 338 381 295

1960 447 371 355 214 243 163 248 216 230 284

1970 299 297 337 299 288 227 274 388 379 230

1980 221 322 279 199 252 215 334 308 162 241

1990 180 250 271 147 169 187 306 164 157 104

2000 119 135 104 108 188 181 162 197 279 247

2010 95 120 117 176 146 195 86

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1793B 1930 to 2016 87 years Series 34

[B] Entire series, effect on correlation ( .699) is:

Lower 1993< -.020 1995< -.013 1981> -.011 1954< -.010 1942> -.009 1967< -.009 Higher 2010 .015 2016 .015

1793B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 284 306 370 314 300 354 249 226 207 206

1940 206 278 372 407 327 260 232 139 126 115

1950 163 244 216 114 173 248 296 251 306 253

1960 400 406 433 229 269 176 200 171 207 221

1970 258 238 296 296 285 294 279 368 434 266

1980 415 386 259 164 166 144 307 353 139 187

1990 198 235 222 127 172 105 167 128 154 91

2000 146 97 112 108 225 146 111 180 217 213

2010 62 105 142 200 152 201 75

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1794A 1958 to 2016 59 years Series 35

[B] Entire series, effect on correlation ( .555) is:

Lower 1988> -.065 1976< -.023 1983> -.015 1965> -.014 1972< -.012 1981> -.012 Higher 2016 .075 2010 .038

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

1988 +3.3 SD

1794A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1958 207 184

1960 173 136 124 105 169 126 167 202 187 163

1970 115 135 113 103 141 217 142 198 202 168

1980 275 254 272 213 322 263 335 244 340 298

1990 252 245 246 217 331 258 287 170 209 149

2000 233 185 212 256 294 227 291 201 247 249

2010 161 213 300 341 366 371 90

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1794B 1950 to 2016 67 years Series 36

[B] Entire series, effect on correlation ( .568) is:

Lower 1988> -.040 1951< -.037 1953> -.037 2007< -.013 1963> -.012 1975< -.009 Higher 1983 .039 1999 .034

1794B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 112 58 106 99 209 184 189 154 142 128

1960 161 159 168 160 209 143 129 151 162 167

1970 177 155 159 143 162 160 158 204 256 222

1980 278 254 214 173 285 265 324 246 301 303

1990 318 274 274 265 312 266 317 184 226 156

2000 235 224 231 303 263 208 241 183 302 351

2010 158 279 246 218 264 267 127

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1795A 1931 to 2016 86 years Series 37

[B] Entire series, effect on correlation ( .668) is:

Lower 1932< -.031 2012< -.017 2016> -.017 1938> -.012 1997> -.011 1981> -.011 Higher 1953 .060 1965 .027

1795A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 264 214 243 230 319 283 276 327 255

1940 206 264 271 242 219 208 186 280 313 328

1950 218 300 248 148 313 319 332 337 322 238

1960 344 340 324 223 253 151 154 201 193 249

1970 218 181 228 217 233 247 216 295 248 220

1980 266 258 223 127 100 94 113 104 99 82

1990 114 173 131 89 125 146 161 130 101 50

2000 53 56 24 52 123 119 140 105 118 99

2010 18 67 34 97 81 89 56

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1795B 1937 to 2016 80 years Series 38

[B] Entire series, effect on correlation ( .744) is:

Lower 1937< -.022 2012< -.015 1984< -.014 1981> -.013 1948< -.012 1979> -.008 Higher 1953 .059 1983 .019

1795B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1937 218 275 270

1940 243 297 304 315 311 255 275 273 208 235

1950 205 299 280 154 289 291 273 287 306 260

1960 322 298 286 183 185 133 109 192 189 261

1970 204 181 195 163 165 211 165 247 246 229

1980 281 298 287 138 117 198 272 248 148 128

1990 170 191 188 187 217 208 176 133 119 49

2000 52 55 63 44 78 91 136 125 154 158

2010 71 80 40 117 73 111 36

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PART 7: DESCRIPTIVE STATISTICS: LEMP16\_ACSA\_Corr1-50 14:09 Fri 03 Feb 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 1582A 1930 2016 87 3 0 .576 1.69 3.52 .765 .565 .351 2.85 .577 .010 1

2 1582B 1932 2016 85 3 0 .658 2.01 4.40 1.040 .769 .301 2.66 .559 -.032 1

3 1583A 1927 2016 90 3 0 .421 1.64 3.85 .814 .686 .365 2.41 .371 -.008 1

4 1583B 1927 2016 90 3 0 .460 1.69 3.88 .870 .684 .343 2.60 .499 -.014 1

5 1585A 1950 2016 67 2 0 .760 2.65 4.55 .899 .648 .225 2.75 .510 -.004 1

6 1585B 1930 2016 87 3 0 .474 2.02 4.13 .971 .795 .270 2.56 .475 -.125 1

7 1586A 1931 2016 86 3 0 .662 1.82 4.13 .915 .664 .334 2.54 .472 -.016 2

8 1586B 1931 2016 86 3 0 .713 1.75 3.73 .873 .619 .357 2.51 .480 -.054 2

9 1587A 1950 2016 67 2 0 .579 1.39 2.92 .607 .652 .314 2.66 .569 -.076 1

10 1587B 1931 2016 86 3 0 .520 1.42 3.22 .641 .695 .256 2.59 .445 -.041 1

11 1771A 1932 2016 85 3 1 .436 1.10 2.60 .444 .471 .321 2.71 .429 -.026 1

12 1771B 1932 2016 85 3 0 .646 1.41 3.41 .610 .545 .318 2.78 .558 -.052 1

13 1772A 1943 2016 74 3 0 .628 1.64 3.25 .682 .652 .307 2.66 .571 -.070 1

14 1772B 1933 2016 84 3 0 .608 1.67 4.04 .849 .706 .318 2.87 .428 -.018 3

15 1773A 1937 2016 80 3 0 .682 1.87 3.50 .695 .759 .211 2.63 .553 -.004 1

16 1773B 1938 2016 79 3 0 .685 1.90 3.17 .520 .648 .190 2.43 .511 .004 1

17 1774A 1924 2016 93 3 0 .583 1.56 3.55 .724 .777 .263 2.66 .479 .016 1

18 1774B 1935 2016 82 3 0 .635 1.47 2.95 .597 .682 .256 2.69 .472 .080 1

19 1775A 1935 2016 82 3 0 .503 1.58 3.02 .573 .587 .268 2.41 .354 -.046 1

20 1775B 1931 2016 86 3 0 .586 1.30 2.37 .487 .676 .255 2.54 .487 -.068 1

21 1776A 1939 2016 78 3 0 .705 1.69 3.05 .577 .367 .317 2.45 .403 .010 1

22 1776B 1935 2016 82 3 0 .587 1.84 5.85 .734 .369 .348 2.93 .566 -.099 1

23 1777A 1942 2016 75 3 0 .533 1.69 3.96 .899 .679 .334 2.72 .457 -.049 1

24 1777B 1943 2016 74 3 0 .610 1.88 5.12 1.009 .746 .400 2.39 .395 -.074 1

25 1778A 1950 2016 67 2 0 .786 1.41 2.69 .513 .563 .303 2.46 .439 .034 1

26 1778B 1938 2016 79 3 0 .668 1.40 3.16 .679 .662 .298 2.48 .428 .045 1

27 1779A 1946 2016 71 3 0 .464 1.52 3.63 .670 .712 .279 2.74 .687 -.007 1

28 1779B 1943 2016 74 3 0 .654 1.29 2.83 .543 .671 .247 2.55 .392 -.041 1

29 1780A 1927 2016 90 3 0 .531 1.32 2.75 .422 .516 .228 2.67 .428 -.048 1

30 1780B 1932 2016 85 3 0 .504 1.34 2.53 .430 .613 .213 2.78 .511 -.010 1

31 1781A 1938 2016 79 3 0 .612 1.83 3.13 .648 .682 .229 2.53 .533 -.034 1

32 1781B 1928 2016 89 3 0 .486 1.73 4.20 .830 .806 .238 2.50 .539 -.009 1

33 1793A 1930 2016 87 3 0 .644 2.63 5.67 1.009 .708 .242 2.70 .593 -.065 1

34 1793B 1930 2016 87 3 0 .699 2.28 4.34 .913 .675 .271 2.61 .491 -.075 1

35 1794A 1958 2016 59 2 0 .555 2.19 3.71 .712 .543 .240 2.68 .658 -.045 3

36 1794B 1950 2016 67 2 0 .568 2.11 3.51 .657 .613 .203 2.62 .540 -.024 1

37 1795A 1931 2016 86 3 0 .668 1.91 3.44 .903 .845 .255 2.62 .524 -.020 1

38 1795B 1937 2016 80 3 0 .744 1.94 3.22 .811 .804 .233 2.37 .441 -.038 1

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Total or mean: 3070 109 1 .598 1.72 5.85 .727 .656 .282 2.93 .493 -.029

- = [ COFECHA LE16SCOF ] = -