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[] P R O G R A M C O F E C H A Version 6.06P 30577

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: TNCBH\_THOC\_CORR1-50

File of DATED series: TNCBH\_THOC\_CORR1.rwl

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 1902 to 2018 117 years

Continuous time span is 1902 to 2018 117 years

Portion with two or more series is 1902 to 2018 117 years

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

\*C\* Number of dated series 32 \*C\*

\*O\* Master series 1902 2018 117 yrs \*O\*

\*F\* Total rings in all series 2295 \*F\*

\*E\* Total dated rings checked 2295 \*E\*

\*C\* Series intercorrelation .671 \*C\*

\*H\* Average mean sensitivity .232 \*H\*

\*A\* Segments, possible problems 0 \*A\*

\*\*\* Mean length of series 71.7 \*\*\*

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

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

6A 1 absent rings: 2013

1 absent rings .044%

1950 -2.745 11 2000 -.407 32

1951 -.359 12 2001 -.161 32

1902 -2.343 2 1952 .129 12 2002 .600 32

1903 -.053 2 1953 -.303 14 2003 .461 32

1904 1.127 2 1954 .547 15 2004 1.689 32

1905 1.923 2 1955 .542 15 2005 .693 32

1906 -.605 4 1956 .020 15 2006 -1.255 32

1907 -.044 4 1957 .426 16 2007 .456 32

1908 -.120 4 1958 1.604 20 2008 1.077 32

1909 -.358 6 1959 .030 20 2009 1.811 32

1910 1.041 6 1960 -.681 21 2010 .418 32

1911 -1.602 6 1961 .546 22 2011 -3.191 32

1912 1.208 6 1962 -.517 23 2012 .448 32

1913 .872 6 1963 -1.300 24 2013 -.850 32 1

1914 .873 6 1964 .232 24 2014 1.114 32

1915 .508 7 1965 .646 24 2015 .664 32

1916 .866 8 1966 -.328 25 2016 -.341 32

1917 -.277 8 1967 -.010 25 2017 .386 32

1918 -.257 8 1968 1.747 25 2018 -1.180 32

1919 -1.659 8 1969 .662 27

1920 -.145 8 1970 -.115 29

1921 -.564 8 1971 -.791 29

1922 .623 8 1972 .042 29

1923 -.402 8 1973 1.346 31

1924 -.070 8 1974 .052 31

1925 .387 8 1975 -2.333 31

1926 -.066 8 1976 -1.217 32

1927 .577 8 1977 .005 32

1928 .256 8 1978 -.824 32

1929 .507 8 1979 -.430 32

1930 -.136 8 1980 -.989 32

1931 .475 8 1981 .472 32

1932 .485 8 1982 1.133 32

1933 .201 8 1983 .619 32

1934 -2.956 8 1984 .579 32

1935 -.265 8 1985 1.224 32

1936 .318 8 1986 1.169 32

1937 -.802 8 1987 1.399 32

1938 .926 8 1988 -1.348 32

1939 -.261 8 1989 -.528 32

1940 .527 8 1990 1.206 32

1941 .725 8 1991 .413 32

1942 -1.078 8 1992 -.883 32

1943 -.397 10 1993 1.014 32

1944 -.253 10 1994 .490 32

1945 1.065 10 1995 -1.286 32

1946 .539 10 1996 -1.940 32

1947 -1.075 10 1997 -1.243 32

1948 .919 10 1998 .142 32

1949 -.041 10 1999 -1.817 32

PART 5: CORRELATION OF SERIES BY SEGMENTS: TNCBH\_THOC\_CORR1-50 07:55 Mon 17 Sep 2018 Page 5

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Correlations of 50-year dated segments, lagged 25 years

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

Seq Series Time\_span 1900 1925 1950 1975

1949 1974 1999 2024

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

1 1A 1953 2018 .53 .82

2 1B 1958 2018 .69 .84

3 2A 1958 2018 .89 .88

4 2B 1962 2018 .85 .87

5 3A 1957 2018 .57 .82

6 3B 1958 2018 .35 .70

7 4A 1906 2018 .66 .69 .73 .73

8 4B 1906 2018 .68 .75 .75 .69

9 5A 1909 2018 .60 .57 .83 .79

10 5B 1909 2018 .67 .65 .82 .83

11 6A 1902 2018 .45 .54 .81 .76

12 6B 1902 2018 .63 .68 .80 .79

13 7A 1915 2018 .48 .51 .72 .68

14 7B 1916 2018 .45 .45 .62 .56

15 8A 1943 2018 .42 .59 .74

16 8B 1943 2018 .49 .54 .74

17 9A 1951 2018 .61 .78

18 9B 1953 2018 .52 .63

19 10A 1950 2018 .57 .76

20 10B 1954 2018 .77 .84

21 11A 1963 2018 .74 .76

22 11B 1960 2018 .71 .67

23 12A 1966 2018 .55 .57

24 12B 1970 2018 .66

25 13A 1970 2018 .56

26 13B 1973 2018 .76

27 14A 1976 2018 .62

28 14B 1973 2018 .69

29 15A 1969 2018 .66

30 15B 1969 2018 .83

31 16A 1958 2018 .56 .75

32 16B 1961 2018 .79 .83

Av segment correlation .58 .57 .68 .75

PART 6: POTENTIAL PROBLEMS: TNCBH\_THOC\_CORR1-50 07:55 Mon 17 Sep 2018 Page 5

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

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

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

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

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

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

[D] Absent rings (zero values)

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

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1A 1953 to 2018 66 years Series 1

[B] Entire series, effect on correlation ( .696) is:

Lower 1953< -.050 1962> -.020 1985< -.016 1963> -.014 1970> -.012 1968< -.011 Higher 2011 .094 1975 .032

1A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1953 39 151 191 158 242 306 332

1960 267 346 386 326 459 325 259 266 276 255

1970 345 248 253 255 222 157 186 183 179 214

1980 196 239 291 253 221 178 171 176 165 164

1990 203 166 143 213 185 143 131 134 184 137

2000 149 170 196 161 242 190 137 193 205 229

2010 231 106 167 148 208 190 178 229 159

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1B 1958 to 2018 61 years Series 2

[B] Entire series, effect on correlation ( .768) is:

Lower 1963> -.027 1958< -.017 1960< -.012 1970> -.011 2018> -.010 1986< -.008 Higher 2011 .072 1975 .012

1B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1958 276 273

1960 217 326 270 311 393 285 204 254 300 303

1970 325 195 221 241 206 141 153 180 152 164

1980 157 229 301 287 267 277 224 293 192 215

1990 278 276 211 275 293 203 195 206 318 181

2000 191 181 218 226 297 209 137 202 260 224

2010 208 109 205 151 196 198 147 150 149

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2A 1958 to 2018 61 years Series 3

[B] Entire series, effect on correlation ( .883) is:

Lower 1997< -.021 2017< -.009 2013> -.008 1992> -.007 2009< -.005 2016> -.004 Higher 2011 .022 1975 .012

2A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1958 374 239

1960 246 298 192 171 222 213 205 184 339 205

1970 202 131 148 232 138 86 106 155 114 132

1980 125 142 191 175 154 150 177 198 118 151

1990 189 133 133 169 129 103 94 82 136 89

2000 137 148 141 142 188 195 119 192 250 199

2010 179 87 207 160 241 217 185 132 106

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2B 1962 to 2018 57 years Series 4

[B] Entire series, effect on correlation ( .838) is:

Lower 1967< -.014 1963> -.010 2013> -.010 1962> -.008 2017< -.007 1964> -.005 Higher 1975 .014 1988 .008

2B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1962 278 250 344 271 190 165 330 223

1970 200 160 183 260 180 106 144 193 161 203

1980 186 234 244 185 223 233 236 280 150 176

1990 217 198 158 208 173 140 130 144 201 166

2000 177 194 238 193 281 287 169 220 237 276

2010 230 133 232 215 230 255 186 149 112

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3A 1957 to 2018 62 years Series 5

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

Lower 1957< -.089 1987< -.011 1988> -.010 1992> -.008 1960> -.007 1963> -.006 Higher 2011 .095 1999 .014

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

1957 -4.8 SD

3A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1957 39 253 212

1960 250 320 245 202 347 263 194 263 364 260

1970 204 127 148 232 219 124 96 150 96 112

1980 98 173 224 211 214 211 199 147 120 113

1990 147 165 155 182 162 109 79 82 119 90

2000 112 134 147 138 128 119 107 121 122 137

2010 133 47 104 104 127 163 143 131 78

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3B 1958 to 2018 61 years Series 6

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

Lower 1958< -.089 1962> -.018 1974> -.012 1985< -.011 1963> -.010 2006> -.010 Higher 2011 .171 1995 .014

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

1958 -5.0 SD; 2011 -4.6 SD

3B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1958 33 181

1960 231 198 270 216 181 245 227 216 245 225

1970 178 164 179 234 275 173 159 179 143 156

1980 105 162 208 230 226 160 189 189 151 151

1990 151 136 131 145 173 81 84 97 139 103

2000 140 104 138 122 121 142 117 115 126 112

2010 110 57 100 91 96 94 93 90 80

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4A 1906 to 2018 113 years Series 7

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

Lower 2011> -.012 1942> -.011 1943> -.011 1936< -.009 1978> -.008 1980> -.007 Higher 1950 .014 1988 .010

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

1934 -6.4 SD

4A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1906 49 201 360 321

1910 422 275 544 465 468 402 372 259 316 240

1920 285 316 307 255 304 316 248 275 291 295

1930 283 319 243 191 93 175 164 173 192 165

1940 204 160 161 196 153 171 151 96 138 113

1950 69 88 112 120 134 127 84 141 190 107

1960 67 96 77 87 106 121 87 82 120 89

1970 84 77 100 135 82 60 86 115 117 127

1980 116 104 90 105 120 121 112 122 51 102

1990 124 110 55 117 108 65 61 65 111 92

2000 79 116 157 162 192 143 77 120 166 203

2010 184 98 147 108 152 192 126 207 118

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4B 1906 to 2018 113 years Series 8

[B] Entire series, effect on correlation ( .670) is:

Lower 2011> -.036 1999> -.024 1921> -.016 1923> -.010 1930> -.008 1966> -.007 Higher 1950 .028 1934 .027

4B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1906 52 190 316 280

1910 420 232 367 398 341 389 374 275 278 214

1920 266 359 317 347 290 304 292 268 247 280

1930 304 292 260 243 102 166 143 133 167 157

1940 175 166 113 121 141 145 154 115 118 116

1950 62 87 129 111 123 119 85 102 187 97

1960 66 113 98 97 95 108 126 89 146 109

1970 91 86 97 130 66 41 53 90 70 92

1980 71 95 83 110 94 124 101 121 44 82

1990 96 84 39 75 77 62 55 49 81 84

2000 73 76 112 88 120 101 47 76 113 137

2010 115 95 143 82 156 142 95 158 110

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5A 1909 to 2018 110 years Series 9

[B] Entire series, effect on correlation ( .706) is:

Lower 1934> -.042 1926< -.019 1939< -.008 1978> -.008 1947> -.007 1925< -.006 Higher 1950 .024 1975 .019

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

1934 +3.0 SD

5A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1909 278

1910 356 180 312 323 391 380 324 271 262 185

1920 267 191 266 166 150 141 108 166 184 184

1930 130 157 186 161 133 128 126 105 179 106

1940 123 151 103 138 145 171 183 146 159 148

1950 91 125 136 125 172 191 148 197 213 159

1960 126 174 134 106 131 146 124 102 184 158

1970 119 126 152 180 100 63 92 126 139 141

1980 128 147 134 137 135 166 152 157 60 114

1990 141 110 83 130 107 75 88 95 146 83

2000 99 103 134 149 202 202 137 189 262 309

2010 289 145 227 197 294 304 213 284 196

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5B 1909 to 2018 110 years Series 10

[B] Entire series, effect on correlation ( .728) is:

Lower 1935< -.031 1925> -.015 1919> -.009 1943> -.009 1929< -.008 2002< -.006 Higher 1934 .027 1950 .024

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

1925 +3.6 SD

5B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1909 319

1910 440 231 469 413 377 362 361 238 321 271

1920 248 213 263 224 315 469 283 228 240 166

1930 137 167 192 160 76 84 195 140 252 138

1940 140 159 143 186 161 144 162 113 171 180

1950 89 164 182 124 163 173 135 186 203 161

1960 110 187 144 114 139 136 124 119 159 180

1970 106 116 157 163 85 67 88 91 91 106

1980 83 111 94 109 103 132 130 141 63 99

1990 113 113 73 108 116 75 66 88 113 87

2000 104 93 103 135 232 145 117 204 195 254

2010 164 84 174 150 217 250 216 268 152

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6A 1902 to 2018 117 years Series 11

[B] Entire series, effect on correlation ( .562) is:

Lower 2013< -.030 1918< -.019 1934> -.016 1919> -.015 1925< -.014 1921> -.013 Higher 1950 .032 1975 .013

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

2013 -.850 32 1

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

2013 -5.6 SD

6A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1902 98 190 271 292 248 229 173 176

1910 222 151 208 179 182 195 193 186 119 152

1920 133 174 195 122 137 99 113 172 123 134

1930 144 142 126 114 88 98 108 56 74 75

1940 68 119 61 88 78 114 121 117 177 156

1950 53 104 125 139 166 194 170 302 306 214

1960 129 171 121 149 199 270 206 171 255 211

1970 201 216 280 329 210 152 157 285 261 304

1980 208 303 272 259 246 325 265 273 189 224

1990 255 233 188 252 290 149 170 160 220 152

2000 249 231 268 337 391 338 280 289 417 485

2010 389 233 333 0 301 473 301 344 188

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6B 1902 to 2018 117 years Series 12

[B] Entire series, effect on correlation ( .702) is:

Lower 1925< -.019 1906> -.016 1928< -.009 1918< -.008 1915< -.007 1937> -.007 Higher 1934 .020 1950 .020

6B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1902 79 250 316 405 336 244 171 202

1910 232 176 235 207 184 150 189 138 115 113

1920 150 124 132 115 135 105 129 138 104 122

1930 134 146 131 153 88 92 107 112 133 115

1940 134 131 90 106 98 98 96 96 137 119

1950 56 88 107 125 162 162 166 275 281 216

1960 160 246 225 197 246 280 233 266 290 259

1970 219 208 246 361 242 150 130 217 249 256

1980 206 265 288 241 251 252 236 273 143 180

1990 202 168 131 184 225 160 137 178 168 110

2000 138 209 280 276 375 381 284 315 429 428

2010 269 150 279 210 310 304 250 277 156

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7A 1915 to 2018 104 years Series 13

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

Lower 1934> -.022 1988> -.016 1947< -.014 1982< -.011 1993< -.011 1937> -.010 Higher 1950 .032 1975 .028

7A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1915 247 269 325 376 209

1920 239 192 279 284 238 289 270 251 195 173

1930 124 117 116 106 110 191 192 161 132 128

1940 145 111 98 101 103 140 97 49 101 88

1950 54 73 87 82 99 96 114 118 139 92

1960 72 101 77 56 89 105 74 88 93 69

1970 52 41 50 67 63 36 54 61 50 54

1980 49 61 52 56 60 63 91 83 73 68

1990 80 59 64 59 61 44 47 50 108 73

2000 142 167 186 167 226 219 99 130 170 226

2010 164 80 115 82 137 115 89 103 100

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7B 1916 to 2018 103 years Series 14

[B] Entire series, effect on correlation ( .499) is:

Lower 2011> -.036 1988> -.020 1934> -.014 2012< -.013 1930< -.012 1921< -.011 Higher 1975 .032 1919 .020

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

1935 +3.4 SD; 2011 +3.2 SD

7B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1916 430 373 422 263

1920 357 231 273 259 208 297 251 206 224 210

1930 148 145 153 155 133 211 184 127 146 132

1940 142 126 97 99 94 159 103 59 112 86

1950 80 94 112 115 147 142 131 181 202 94

1960 74 88 66 44 62 84 76 72 84 63

1970 48 34 59 80 89 48 39 54 52 66

1980 57 69 62 71 73 88 88 84 87 77

1990 99 67 89 87 73 47 55 64 78 52

2000 105 151 171 174 219 187 149 177 183 220

2010 163 134 103 79 120 103 101 95 85

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8A 1943 to 2018 76 years Series 15

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

Lower 1950> -.073 1943< -.054 1947> -.018 2014< -.014 1965< -.013 1982< -.013 Higher 1975 .038 1988 .014

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

1950 +3.5 SD

8A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 43 98 221 176 208 281 185

1950 232 304 240 262 267 187 201 180 433 289

1960 249 217 173 126 179 153 145 137 265 180

1970 188 188 221 280 165 77 93 149 131 154

1980 122 157 122 125 142 153 173 195 98 130

1990 170 119 85 131 108 67 67 76 109 81

2000 135 109 114 113 143 88 61 115 120 153

2010 113 73 122 100 88 96 122 103 95

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8B 1943 to 2018 76 years Series 16

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

Lower 1947> -.031 1963< -.030 1950> -.023 1964< -.015 1992< -.014 1971> -.009 Higher 2011 .039 1968 .010

8B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 43 115 233 211 272 234 130

1950 141 248 244 220 186 181 228 250 262 192

1960 176 188 162 97 111 188 149 127 184 134

1970 117 147 153 154 115 98 94 136 107 134

1980 100 118 118 134 139 188 166 187 102 103

1990 131 96 39 94 72 59 54 67 77 68

2000 93 92 108 111 132 76 50 96 91 111

2010 93 53 111 77 117 88 100 82 65

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9A 1951 to 2018 68 years Series 17

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

Lower 1996> -.026 2014< -.024 1980> -.020 1954< -.018 1960> -.015 1956> -.014 Higher 2011 .093 1975 .024

9A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1951 208 205 227 191 286 358 256 302 220

1960 257 187 127 144 158 185 162 204 282 200

1970 184 136 171 232 169 90 106 166 130 234

1980 250 215 174 175 163 260 292 242 113 155

1990 182 206 154 250 153 140 166 164 206 140

2000 181 138 179 163 226 179 134 172 218 201

2010 152 82 170 158 162 198 190 189 152

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9B 1953 to 2018 66 years Series 18

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

Lower 1999> -.042 1997> -.020 2004< -.015 1966> -.013 2005< -.011 1969< -.009 Higher 2011 .044 2009 .015

9B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1953 282 249 260 242 231 369 240

1960 202 213 145 176 165 239 256 222 254 166

1970 159 130 147 217 197 157 131 188 208 236

1980 204 292 360 270 272 273 244 207 158 131

1990 202 191 109 168 126 99 67 161 167 160

2000 154 129 180 166 146 123 114 172 194 277

2010 173 125 220 175 235 232 206 207 190

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10A 1950 to 2018 69 years Series 19

[B] Entire series, effect on correlation ( .652) is:

Lower 1957< -.034 1950> -.029 2018> -.023 1964< -.017 1980< -.011 1959< -.011 Higher 2011 .064 1968 .011

10A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 315 430 354 333 369 371 317 229 353 229

1960 257 311 314 209 219 276 274 295 452 320

1970 372 326 364 469 365 274 338 448 329 298

1980 228 345 330 342 346 358 310 343 222 214

1990 310 318 267 258 192 162 114 168 198 147

2000 195 264 213 200 250 262 166 251 247 311

2010 188 82 166 106 195 140 102 134 150

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10B 1954 to 2018 65 years Series 20

[B] Entire series, effect on correlation ( .819) is:

Lower 1971> -.017 1957< -.013 2010> -.012 2001> -.010 1970> -.009 2003< -.007 Higher 2011 .052 1999 .016

10B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1954 390 358 349 330 412 332

1960 363 369 306 310 412 360 281 323 457 440

1970 454 430 412 432 299 232 256 304 229 246

1980 203 301 314 287 277 332 251 296 185 192

1990 253 216 198 241 220 171 138 164 196 123

2000 185 231 174 149 211 198 135 195 232 235

2010 256 77 186 135 214 138 124 127 117

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11A 1963 to 2018 56 years Series 21

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

Lower 1975> -.039 1972< -.022 1966> -.012 1971< -.009 1967> -.008 2008< -.006 Higher 2011 .053 1996 .010

11A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1963 237 270 271 304 340 314 241

1970 255 187 177 299 285 231 222 203 205 203

1980 224 269 304 300 314 248 229 262 128 162

1990 249 195 157 234 179 138 105 148 163 125

2000 156 129 151 145 183 151 103 137 132 160

2010 148 87 121 112 158 118 97 104 94

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11B 1960 to 2018 59 years Series 22

[B] Entire series, effect on correlation ( .671) is:

Lower 2011> -.063 1972< -.031 1994< -.016 1961< -.012 1997> -.009 1981< -.007 Higher 1999 .021 2009 .011

11B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1960 253 243 246 226 278 278 232 260 305 280

1970 257 206 189 322 254 178 215 241 199 235

1980 203 206 257 209 230 268 247 252 177 191

1990 268 236 178 199 154 136 128 190 172 123

2000 181 167 192 178 201 130 107 142 157 199

2010 116 99 190 115 135 124 83 118 81

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12A 1966 to 2018 53 years Series 23

[B] Entire series, effect on correlation ( .541) is:

Lower 1966< -.037 1988> -.034 2011> -.025 2013> -.015 2016> -.012 2015< -.012 Higher 1999 .034 2009 .016

12A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1966 24 169 221 264

1970 157 207 214 265 261 167 171 206 195 167

1980 159 180 277 270 224 253 271 312 291 229

1990 352 314 235 283 306 202 180 174 208 132

2000 132 147 199 212 250 242 133 205 189 238

2010 175 142 174 168 154 128 162 158 102

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12B 1970 to 2018 49 years Series 24

[B] Entire series, effect on correlation ( .663) is:

Lower 1981< -.037 1979< -.035 1996> -.017 2018> -.013 1983< -.012 2016> -.011 Higher 2011 .091 1999 .030

12B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1970 167 170 255 230 206 152 160 217 218 139

1980 174 171 224 199 204 327 295 231 167 154

1990 284 256 189 251 279 180 169 170 232 158

2000 196 196 256 224 230 210 152 184 216 243

2010 160 61 114 143 168 188 178 115 103

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13A 1970 to 2018 49 years Series 25

[B] Entire series, effect on correlation ( .563) is:

Lower 1991< -.061 1975> -.042 2010< -.040 1970< -.027 1992> -.019 1984< -.016 Higher 2011 .083 1999 .032

13A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1970 17 97 233 305 239 175 175 200 152 160

1980 197 242 261 222 187 227 241 263 210 241

1990 281 204 216 234 212 199 193 184 191 171

2000 169 188 236 285 315 267 235 245 232 339

2010 216 134 280 253 374 357 309 276 206

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13B 1973 to 2018 46 years Series 26

[B] Entire series, effect on correlation ( .763) is:

Lower 2006> -.025 1983< -.024 1979< -.018 1974> -.015 1992> -.012 1990< -.011 Higher 2011 .085 1975 .021

13B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1973 253 277 162 205 214 202 164

1980 193 217 316 188 216 200 231 210 171 187

1990 198 215 216 241 206 198 198 192 213 184

2000 198 216 248 303 293 294 277 318 283 325

2010 224 132 263 187 299 243 225 270 186

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14A 1976 to 2018 43 years Series 27

[B] Entire series, effect on correlation ( .621) is:

Lower 1998< -.057 1978< -.049 1976> -.026 1995> -.024 1983< -.011 1988> -.009 Higher 2011 .043 1999 .034

14A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1976 246 224 172 186

1980 204 228 250 213 221 246 302 256 193 171

1990 235 204 222 320 259 217 140 171 133 137

2000 174 234 261 206 253 223 176 187 282 311

2010 245 103 194 144 228 233 161 207 125

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14B 1973 to 2018 46 years Series 28

[B] Entire series, effect on correlation ( .691) is:

Lower 1976> -.032 2006> -.029 2018> -.025 1995> -.019 1996> -.015 2015< -.013 Higher 2011 .066 1975 .041

14B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1973 188 223 156 254 233 188 153

1980 160 255 270 259 235 257 297 251 116 113

1990 193 215 196 344 308 233 187 143 180 150

2000 189 223 233 226 306 296 245 187 176 261

2010 172 93 133 113 198 146 116 131 133

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15A 1969 to 2018 50 years Series 29

[B] Entire series, effect on correlation ( .659) is:

Lower 1995> -.037 1996> -.021 1976> -.015 1972< -.015 1979< -.012 1971> -.009 Higher 2011 .079 1999 .018

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

1995 +3.1 SD

15A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1969 253

1970 172 208 168 222 207 175 233 217 198 176

1980 183 207 290 265 225 272 254 291 235 209

1990 253 253 237 274 293 278 236 223 200 121

2000 180 167 178 173 238 197 156 212 217 221

2010 153 90 192 153 213 165 133 138 107

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15B 1969 to 2018 50 years Series 30

[B] Entire series, effect on correlation ( .835) is:

Lower 1973< -.030 1971> -.017 1994> -.012 2006> -.008 2008< -.008 2013> -.007 Higher 2011 .055 1975 .015

15B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1969 328

1970 269 287 286 193 173 134 207 196 173 167

1980 168 249 297 215 254 278 268 294 178 200

1990 308 233 192 300 361 219 204 220 255 167

2000 241 243 248 227 358 271 229 274 229 265

2010 215 139 233 199 306 206 159 182 134

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16A 1958 to 2018 61 years Series 31

[B] Entire series, effect on correlation ( .619) is:

Lower 1958< -.112 2016< -.047 1966> -.010 2002< -.009 2018> -.009 1995> -.008 Higher 2011 .089 1999 .033

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

1958 -4.9 SD

16A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1958 70 131

1960 187 268 214 193 272 282 313 357 367 321

1970 235 142 150 158 121 80 104 91 90 116

1980 122 178 236 185 210 231 236 232 171 240

1990 326 266 187 265 259 214 156 175 210 140

2000 192 228 175 174 219 177 128 180 205 179

2010 173 104 166 124 153 125 81 134 112

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16B 1961 to 2018 58 years Series 32

[B] Entire series, effect on correlation ( .828) is:

Lower 1991> -.011 1973< -.010 2016< -.009 2009< -.009 1967> -.007 2018> -.006 Higher 2011 .049 1975 .009

16B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1961 308 219 192 306 342 286 347 379 306

1970 258 165 184 185 135 102 138 140 146 168

1980 136 182 236 241 226 242 233 226 167 202

1990 273 270 175 192 191 150 134 148 186 140

2000 141 145 159 189 169 142 118 150 169 147

2010 118 87 155 111 138 117 95 128 107

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[\*] All segments correlate highest as dated with correlation with master series over .3281

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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 1A 1953 2018 66 2 0 .696 2.12 4.59 .709 .705 .205 2.60 .438 -.034 1

2 1B 1958 2018 61 2 0 .768 2.28 3.93 .592 .484 .209 2.55 .443 -.036 1

3 2A 1958 2018 61 2 0 .883 1.70 3.74 .581 .473 .257 2.84 .603 .036 1

4 2B 1962 2018 57 2 0 .838 2.06 3.44 .514 .332 .230 2.65 .567 .080 2

5 3A 1957 2018 62 2 0 .705 1.61 3.64 .685 .654 .254 2.38 .365 -.054 2

6 3B 1958 2018 61 2 0 .565 1.54 2.75 .550 .711 .199 2.29 .336 -.039 1

7 4A 1906 2018 113 4 0 .682 1.67 5.43 .998 .845 .264 2.49 .335 -.008 2

8 4B 1906 2018 113 4 0 .670 1.51 4.20 .938 .862 .267 2.66 .379 .032 1

9 5A 1909 2018 110 4 0 .706 1.68 3.91 .689 .729 .239 2.51 .462 -.019 1

10 5B 1909 2018 110 4 0 .728 1.72 4.69 .870 .734 .267 2.79 .474 -.015 2

11 6A 1902 2018 117 4 0 .562 2.01 4.85 .892 .651 .274 2.47 .363 -.032 1

12 6B 1902 2018 117 4 0 .702 1.96 4.29 .811 .760 .217 2.58 .425 .010 2

13 7A 1915 2018 104 4 0 .587 1.21 3.76 .716 .864 .225 2.59 .433 -.018 2

14 7B 1916 2018 103 4 0 .499 1.30 4.30 .802 .881 .217 2.77 .566 -.023 1

15 8A 1943 2018 76 3 0 .521 1.55 4.33 .689 .642 .269 2.89 .546 .100 2

16 8B 1943 2018 76 3 0 .594 1.32 2.71 .570 .744 .256 2.50 .450 .057 1

17 9A 1951 2018 68 2 0 .705 1.89 3.58 .514 .446 .245 2.48 .421 -.017 3

18 9B 1953 2018 66 2 0 .606 1.96 3.69 .586 .608 .215 2.89 .501 .062 1

19 10A 1950 2018 69 2 0 .652 2.70 4.69 .891 .682 .235 2.66 .594 .038 1

20 10B 1954 2018 65 2 0 .819 2.61 4.57 .967 .804 .207 2.47 .478 -.056 1

21 11A 1963 2018 56 2 0 .748 1.94 3.40 .689 .791 .192 2.69 .551 -.050 2

22 11B 1960 2018 59 2 0 .671 1.97 3.22 .580 .683 .203 2.61 .546 .068 2

23 12A 1966 2018 53 2 0 .541 2.05 3.52 .615 .566 .217 2.58 .551 -.011 1

24 12B 1970 2018 49 1 0 .663 1.95 3.27 .517 .454 .223 2.64 .535 -.098 2

25 13A 1970 2018 49 1 0 .563 2.25 3.74 .633 .561 .211 2.71 .659 .028 2

26 13B 1973 2018 46 1 0 .763 2.27 3.25 .463 .322 .177 2.83 .487 -.013 1

27 14A 1976 2018 43 1 0 .621 2.12 3.20 .496 .367 .228 2.65 .543 -.029 3

28 14B 1973 2018 46 1 0 .691 2.03 3.44 .607 .561 .230 2.69 .646 -.025 2

29 15A 1969 2018 50 1 0 .659 2.06 2.93 .482 .581 .188 2.49 .462 .013 1

30 15B 1969 2018 50 1 0 .835 2.33 3.61 .554 .293 .224 2.71 .512 -.001 1

31 16A 1958 2018 61 2 0 .619 1.89 3.67 .695 .754 .231 2.61 .570 -.083 1

32 16B 1961 2018 58 2 0 .828 1.87 3.79 .680 .803 .185 2.65 .513 -.001 1

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Total or mean: 2295 75 0 .671 1.85 5.43 .710 .671 .232 2.89 .478 -.003

- = [ COFECHA THOC COF ] = -