[] Dendrochronology Program Library Run TEST Program COF 14:15 Fri 24 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 30007

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: ACRU\_MGF\_Corr2-50

File of DATED series: ACRU\_MGF\_Corr2

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 1940 to 2016 77 years

Continuous time span is 1940 to 2016 77 years

Portion with two or more series is 1941 to 2016 76 years

>> 1626A 2014 absent in 2 of 32 series, but is not usually narrow: master index is 1.049

>> 1626A 2015 absent in 2 of 32 series, but is not usually narrow: master index is .360

>> 1626A 2016 absent in 2 of 32 series, but is not usually narrow: master index is .710

>> 1626B 1998 absent in 1 of 32 series, but is not usually narrow: master index is 1.178

>> 1626B 1999 absent in 1 of 32 series, but is not usually narrow: master index is .525

>> 1626B 2000 absent in 1 of 32 series, but is not usually narrow: master index is .596

>> 1626B 2002 absent in 1 of 32 series, but is not usually narrow: master index is -.321

>> 1626B 2014 absent in 2 of 32 series, but is not usually narrow: master index is 1.049

>> 1626B 2015 absent in 2 of 32 series, but is not usually narrow: master index is .360

>> 1626B 2016 absent in 2 of 32 series, but is not usually narrow: master index is .710

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

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

\*O\* Master series 1940 2016 77 yrs \*O\*

\*F\* Total rings in all series 2237 \*F\*

\*E\* Total dated rings checked 2236 \*E\*

\*C\* Series intercorrelation .452 \*C\*

\*H\* Average mean sensitivity .200 \*H\*

\*A\* Segments, possible problems 9 \*A\*

\*\*\* Mean length of series 69.9 \*\*\*

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

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

1626A 4 absent rings: 2013 2014 2015 2016

1626B 8 absent rings: 1998 1999 2000 2001 2002 2014 2015 2016

12 absent rings .536%

1950 .958 25 2000 .596 32 1<<

1951 2.511 27 2001 -.746 32 1

1952 1.461 28 2002 -.321 32 1<<

1953 .305 29 2003 -.439 32

1954 -.690 29 2004 -.492 32

1955 .780 29 2005 -1.149 32

1956 .496 29 2006 -1.385 32

1957 1.204 31 2007 -.578 32

1958 .400 31 2008 .992 32

1959 .318 31 2009 1.992 32

1960 .657 31 2010 .461 32

1961 .576 31 2011 .110 32

1962 -.891 32 2012 .387 32

1963 -.711 32 2013 -.608 32 1

1964 .126 32 2014 1.049 32 2<<

1965 -.006 32 2015 .360 32 2<<

1966 -1.490 32 2016 .710 32 2<<

1967 -.761 32

1968 -1.121 32

1969 .079 32

1970 -1.425 32

1971 .944 32

1972 1.104 32

1973 -1.294 32

1974 -1.438 32

1975 .365 32

1976 .532 32

1977 .606 32

1978 1.099 32

1979 .323 32

1980 1.694 32

1981 .673 32

1982 .642 32

1983 -.466 32

1984 1.054 32

1985 .427 32

1986 -.920 32

1987 .177 32

1988 .929 32

1989 .739 32

1940 -1.652 1 1990 -1.065 32

1941 -2.483 2 1991 -1.788 32

1942 -1.911 3 1992 -.028 32

1943 -.207 5 1993 -.267 32

1944 -.462 11 1994 .525 32

1945 .273 15 1995 .425 32

1946 -.499 21 1996 .201 32

1947 .891 22 1997 -.714 32

1948 -1.842 23 1998 1.178 32 1<<

1949 -2.006 23 1999 .525 32 1<<

PART 5: CORRELATION OF SERIES BY SEGMENTS: test 14:15 Fri 24 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 1612A 1952 2016 .42 .44

2 1612B 1950 2016 .36 .41

3 1613B 1951 2016 .39 .29A

4 1616A 1957 2016 .40 .41

5 1616B 1962 2016 .44 .46

6 1616C 1957 2016 .28A .26A

7 1617A 1945 2016 .39 .43 .39

8 1617B 1944 2016 .58 .56 .54

9 1618A 1946 2016 .51 .46 .54

10 1618B 1943 2016 .47 .53 .60

11 1619A 1945 2016 .45 .36 .26B

12 1619B 1950 2016 .25B .19B

13 1620A 1943 2016 .39 .38 .35

14 1620B 1944 2016 .38 .54 .56

15 1621A 1944 2016 .37 .16B .40

16 1621B 1944 2016 .32B .39 .45

17 1622A 1944 2016 .54 .58 .47

18 1622B 1942 2016 .58 .65 .61

19 1624A 1946 2016 .59 .51 .57

20 1624B 1945 2016 .61 .49 .55

21 1625A 1945 2016 .50 .43 .48

22 1625B 1940 2016 .48 .59 .42

23 1626A 1946 2016 .75 .71 .67

24 1626B 1944 2016 .71 .67 .53

25 1627A 1941 2016 .50 .54 .35

26 1627B 1946 2016 .49 .38 .39

27 1628A 1948 2016 .51 .52 .48

28 1628B 1951 2016 .48 .31A

29 1629A 1947 2016 .60 .56 .53

30 1629B 1946 2016 .45 .48 .53

31 1630A 1946 2016 .61 .58 .53

32 1630B 1953 2016 .69 .56

Av segment correlation .51 .48 .45

PART 6: POTENTIAL PROBLEMS: test 14:15 Fri 24 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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1612A 1952 to 2016 65 years Series 1

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

Lower 2007< -.074 1960< -.053 1954> -.028 1997> -.015 1968> -.013 2010> -.007 Higher 1998 .021 2014 .020

1612A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1952 266 230 323 310 300 378 390 403

1960 232 310 271 251 286 373 293 326 357 431

1970 296 373 334 267 197 341 252 281 296 209

1980 275 193 191 154 196 190 174 195 230 191

1990 171 177 224 177 197 235 256 256 315 275

2000 291 210 228 203 179 103 119 51 115 137

2010 137 111 108 76 129 112 74

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

1612B 1950 to 2016 67 years Series 2

[B] Entire series, effect on correlation ( .344) is:

Lower 1960< -.078 2016< -.034 1994< -.025 1974> -.020 1954> -.016 1952< -.012 Higher 1962 .033 1951 .027

1612B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 330 385 277 269 297 351 304 316 284 275

1960 159 229 159 143 232 321 271 269 244 399

1970 271 341 369 308 354 451 312 357 416 285

1980 362 336 315 243 293 226 250 287 293 219

1990 220 196 237 206 168 184 183 230 340 274

2000 295 210 236 250 193 177 205 199 289 353

2010 280 312 289 266 248 292 221

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

1613B 1951 to 2016 66 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

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

1967 2016 0 -.10 -.24 .18 .02 -.06 -.11 .03 -.20 -.03 -.05 .29\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .325) is:

Lower 1983> -.027 2006> -.026 1971< -.023 1961< -.018 1970> -.018 1973> -.015 Higher 1951 .019 1986 .017

1967 to 2016 segment:

Lower 1983> -.032 2006> -.031 1971< -.031 1970> -.020 1973> -.015 2008< -.012 Higher 1986 .024 1991 .024

1613B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1951 284 296 195 154 254 215 214 186 182

1960 230 148 140 141 143 170 200 223 281 312

1970 326 284 303 316 324 504 455 505 534 510

1980 486 357 388 477 478 350 236 257 339 322

1990 254 189 201 243 297 351 335 271 277 304

2000 360 107 151 191 178 221 294 310 245 229

2010 207 215 212 167 229 214 294

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

1616A 1957 to 2016 60 years Series 4

[B] Entire series, effect on correlation ( .425) is:

Lower 1970> -.070 1997< -.049 1983> -.027 1991> -.012 1978< -.011 2008< -.011 Higher 1966 .041 1990 .038

1616A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1957 247 293 244

1960 220 175 187 186 173 224 126 182 193 239

1970 357 367 348 241 186 287 249 250 251 284

1980 323 344 342 354 375 361 287 260 255 281

1990 211 242 264 265 258 243 216 165 213 182

2000 180 159 160 157 157 141 133 126 122 140

2010 122 100 125 99 118 87 129

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

1616B 1962 to 2016 55 years Series 5

[B] Entire series, effect on correlation ( .445) is:

Lower 1970> -.057 1962> -.037 1976< -.034 1987< -.020 1988< -.019 2008< -.018 Higher 1966 .039 1990 .034

1616B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1962 200 196 188 217 121 179 179 223

1970 294 315 303 210 199 317 215 262 282 303

1980 335 339 358 328 375 368 281 243 236 263

1990 210 221 240 236 240 229 232 198 241 215

2000 244 194 167 185 185 144 113 91 91 126

2010 72 78 76 63 77 53 108

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

1616C 1957 to 2016 60 years Series 6

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

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

1957 2006 0 .18 -.16 .07 .02 .10 -.08 .11 -.29 -.27 .15 .28\*-.04 .01 .04 .01 .09 .14 .16 -.11 .05 -.06

1967 2016 0 .10 -.03 .14 .02 -.10 -.13 .02 -.22 -.20 .09 .26\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .290) is:

Lower 1970> -.045 1984< -.030 2015< -.025 2000< -.023 1991> -.023 1980< -.020 Higher 1974 .033 2001 .025

1957 to 2006 segment:

Lower 1970> -.053 1984< -.038 2000< -.031 1991> -.026 1980< -.025 1967< -.024 Higher 1974 .035 1957 .030

1967 to 2016 segment:

Lower 1970> -.051 1984< -.033 1991> -.026 2015< -.025 2000< -.025 1980< -.021 Higher 1974 .043 2001 .030

1616C Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1957 243 184 168

1960 196 176 148 185 151 190 168 118 123 189

1970 263 306 319 244 145 282 272 345 330 318

1980 258 225 227 204 190 281 240 271 258 233

1990 205 228 247 254 228 227 206 158 169 164

2000 137 125 158 178 222 186 193 195 191 205

2010 204 197 202 164 169 144 174

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1617A 1945 to 2016 72 years Series 7

[B] Entire series, effect on correlation ( .371) is:

Lower 1948> -.034 1966> -.034 2016< -.021 2010> -.019 1990> -.017 1974> -.017 Higher 1949 .036 1962 .019

1617A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1945 378 426 410 370 231

1950 386 473 361 260 311 343 360 392 335 266

1960 197 234 190 166 245 252 292 293 267 226

1970 194 278 288 199 198 232 202 172 152 126

1980 151 121 104 104 118 135 102 122 152 117

1990 95 49 65 71 74 77 73 66 75 58

2000 57 52 42 47 48 39 45 67 107 86

2010 100 89 88 79 82 82 68

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1617B 1944 to 2016 73 years Series 8

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

Lower 1966> -.026 1990> -.025 1948> -.020 1954> -.017 2016< -.010 1991> -.010 Higher 1973 .048 1951 .020

1617B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1944 337 388 371 434 390 338

1950 503 576 526 411 431 397 423 443 432 382

1960 374 358 290 282 347 325 306 279 224 215

1970 192 221 194 125 99 125 126 127 147 140

1980 153 122 119 130 179 178 159 190 222 191

1990 180 159 147 128 143 121 123 99 110 83

2000 75 73 68 55 74 65 50 72 74 71

2010 71 60 69 56 83 83 65

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1618A 1946 to 2016 71 years Series 9

[B] Entire series, effect on correlation ( .548) is:

Lower 1973> -.020 1959< -.019 1990> -.017 1949> -.014 1953> -.012 1982< -.012 Higher 1948 .054 1951 .025

1618A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 236 252 165 200

1950 253 341 209 224 179 196 198 173 170 134

1960 162 150 106 156 155 155 125 121 112 103

1970 79 129 118 109 63 96 132 181 178 131

1980 188 202 113 122 163 129 135 171 164 168

1990 152 104 153 198 146 166 136 113 156 139

2000 134 85 116 115 161 134 146 187 290 233

2010 155 187 200 170 199 196 203

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1618B 1943 to 2016 74 years Series 10

[B] Entire series, effect on correlation ( .493) is:

Lower 1949> -.048 1943< -.047 1952< -.029 1966> -.026 1944> -.019 1982< -.016 Higher 1948 .088 1951 .025

1618B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 161 252 227 223 307 178 276

1950 263 342 212 228 208 235 239 202 185 191

1960 228 234 159 212 233 207 201 197 145 139

1970 81 118 133 107 67 128 201 190 228 202

1980 242 229 130 119 218 262 196 234 179 171

1990 122 97 151 134 123 159 145 90 147 87

2000 69 42 62 68 103 99 80 137 162 161

2010 134 147 154 109 118 114 141

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1619A 1945 to 2016 72 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

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

1967 2016 -10 .43\* .10 -.16 -.02 -.20 -.10 -.05 -.05 -.15 -.06 .26| - - - - - - - - - -

[B] Entire series, effect on correlation ( .294) is:

Lower 2000< -.066 1998< -.039 1966> -.023 1949> -.017 1962> -.013 1984< -.009 Higher 1973 .054 1951 .019

1967 to 2016 segment:

Lower 2000< -.096 1998< -.059 1970> -.014 1984< -.014 2010> -.012 1991> -.011 Higher 1973 .094 1983 .040

1619A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1945 305 140 338 227 253

1950 304 347 290 204 175 193 187 234 207 230

1960 293 271 285 355 361 279 308 318 243 290

1970 250 369 272 84 84 81 102 138 174 151

1980 250 319 413 104 76 80 37 65 112 65

1990 54 66 66 79 86 96 108 84 39 76

2000 18 15 37 54 70 59 47 83 112 87

2010 83 62 59 47 48 17 15

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1619B 1950 to 2016 67 years Series 12

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

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

1950 1999 -10 .32\*-.05 -.13 -.29 .19 .07 -.08 -.23 -.08 -.22 .25|-.14 -.15 -.17 -.02 .05 -.09 .10 .31 -.12 .00

1967 2016 -10 .45\* .18 -.20 -.16 -.13 -.06 -.10 -.05 -.12 -.26 .19| - - - - - - - - - -

[B] Entire series, effect on correlation ( .222) is:

Lower 2000< -.040 1990> -.029 1966> -.025 1978< -.021 1974> -.017 2003> -.016 Higher 1954 .044 1983 .034

1950 to 1999 segment:

Lower 1990> -.039 1966> -.033 1978< -.027 1974> -.022 1962> -.020 1975< -.019 Higher 1954 .054 1983 .042

1967 to 2016 segment:

Lower 2000< -.064 1990> -.040 1978< -.032 1975< -.022 1974> -.022 2003> -.021 Higher 1983 .054 1971 .040

1619B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1950 306 294 212 233 147 263 274 295 218 248

1960 264 260 294 311 361 311 332 339 283 322

1970 301 434 391 251 280 173 137 185 107 107

1980 159 158 185 46 61 35 32 65 76 76

1990 94 87 72 74 75 100 89 80 92 83

2000 36 44 81 109 87 74 69 94 106 92

2010 50 39 64 53 76 48 34

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1620A 1943 to 2016 74 years Series 13

[B] Entire series, effect on correlation ( .385) is:

Lower 1948> -.057 1973> -.036 1996< -.017 1974> -.016 1959< -.014 1998< -.012 Higher 1949 .034 1966 .015

1620A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 625 627 721 650 723 672 442

1950 619 611 656 508 385 440 419 438 390 282

1960 403 434 352 261 287 336 218 198 145 197

1970 185 269 331 324 333 397 306 209 200 186

1980 266 268 223 217 228 214 196 285 281 306

1990 30 57 94 115 106 97 41 54 66 86

2000 103 85 102 99 92 92 88 108 140 143

2010 141 117 119 83 132 117 100

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1620B 1944 to 2016 73 years Series 14

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

Lower 1948> -.070 1949< -.068 1973> -.027 1954> -.015 1974> -.011 1977< -.011 Higher 1980 .022 1951 .019

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

1948 1949 -4.8 SD

1620B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1944 676 727 645 630 648 392

1950 576 661 631 489 524 567 499 479 473 488

1960 411 380 326 243 285 300 257 273 238 370

1970 308 355 454 429 435 440 434 352 410 404

1980 552 475 443 414 404 325 346 405 370 365

1990 283 229 231 198 210 189 154 120 138 107

2000 96 74 68 65 52 50 41 50 76 83

2010 70 71 81 72 88 74 66

1621A 1944 to 2016 73 years Series 15

[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 -3 -.11 -.01 -.08 .19 -.14 -.17 .08 .30\* .03 -.20 .16| .09 -.04 -.10 .14 -.14 .10 .15 .16 -.08 .01

[B] Entire series, effect on correlation ( .405) is:

Lower 1954> -.043 1955< -.035 1974> -.031 1995< -.023 1993< -.021 1946> -.018 Higher 1948 .113 2009 .022

1950 to 1999 segment:

Lower 1954> -.065 1955< -.051 1974> -.046 1995< -.028 1953> -.026 1977< -.013 Higher 1980 .033 1966 .033

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

1954 +3.3 SD

1621A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1944 265 273 317 304 222 220

1950 301 324 299 412 492 323 316 317 343 346

1960 352 300 271 208 222 167 137 115 117 173

1970 159 261 259 209 329 356 302 213 199 195

1980 298 270 216 210 282 265 251 305 288 220

1990 178 183 210 132 159 113 141 139 138 150

2000 189 141 141 84 78 99 110 117 182 257

2010 194 157 153 102 190 171 180

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1621B 1944 to 2016 73 years Series 16

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

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

1944 1993 4 - - - - - - -.10 .15 -.04 -.04 .32| .00 -.19 -.07 .37\* .28 -.11 .14 .12 .06 .00

[B] Entire series, effect on correlation ( .362) is:

Lower 1948> -.040 1974> -.026 1982< -.024 1955< -.023 1961< -.019 2012< -.018 Higher 1966 .025 1971 .020

1944 to 1993 segment:

Lower 1948> -.049 1974> -.034 1982< -.032 1955< -.029 1961< -.025 1973> -.020 Higher 1966 .034 1971 .030

1621B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1944 258 288 338 381 346 297

1950 377 387 358 361 333 275 325 278 281 257

1960 274 220 235 203 260 225 187 209 178 222

1970 215 350 318 275 323 275 281 288 298 289

1980 286 260 222 205 266 240 227 274 308 318

1990 259 274 345 250 371 330 304 269 340 332

2000 359 258 229 178 141 138 207 218 332 300

2010 267 301 181 114 225 267 299

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1622A 1944 to 2016 73 years Series 17

[B] Entire series, effect on correlation ( .468) is:

Lower 1948> -.045 2008< -.024 2003> -.018 2009< -.014 1990> -.014 1974> -.010 Higher 1973 .052 1970 .027

1622A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1944 265 334 297 310 323 211

1950 332 465 406 456 396 484 407 416 417 367

1960 312 426 340 281 266 295 196 220 195 276

1970 151 190 214 127 181 182 182 203 206 155

1980 191 221 280 211 184 173 102 137 206 214

1990 148 119 102 81 70 62 57 37 72 46

2000 43 42 32 55 23 24 8 33 19 23

2010 19 23 44 39 70 86 84

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1622B 1942 to 2016 75 years Series 18

[B] Entire series, effect on correlation ( .574) is:

Lower 1948> -.039 1943> -.018 2008< -.013 1954> -.012 1974> -.011 1984< -.009 Higher 1973 .041 1966 .019

1622B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1942 215 304 258 280 286 303 301 210

1950 316 457 461 386 398 626 475 410 489 462

1960 366 352 246 261 217 256 161 195 167 264

1970 183 227 211 110 143 179 192 203 171 123

1980 122 119 161 107 93 67 23 36 57 106

1990 85 66 148 149 132 198 180 112 140 108

2000 117 77 49 58 34 49 33 35 30 51

2010 28 31 32 26 29 27 20

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1624A 1946 to 2016 71 years Series 19

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

Lower 1954> -.023 2007< -.023 1997> -.016 1999< -.015 1961< -.014 1986> -.012 Higher 1948 .021 1951 .019

1624A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 356 389 266 223

1950 403 549 444 324 400 414 415 380 404 416

1960 365 283 297 258 307 284 266 297 268 233

1970 171 216 242 203 222 237 233 211 287 272

1980 434 269 350 228 232 291 258 285 211 173

1990 97 70 109 110 146 156 131 147 159 91

2000 113 106 119 134 114 68 69 48 115 182

2010 144 147 151 113 197 168 180

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1624B 1945 to 2016 72 years Series 20

[B] Entire series, effect on correlation ( .508) is:

Lower 1999< -.053 1966> -.027 2007< -.025 1959< -.021 1954> -.020 1977< -.014 Higher 1973 .039 1970 .023

1624B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1945 395 344 383 294 261

1950 454 481 431 339 386 403 408 343 285 181

1960 196 211 199 211 271 273 271 289 270 261

1970 149 199 207 128 159 199 222 157 194 222

1980 327 203 306 148 208 229 165 245 335 324

1990 184 148 196 152 205 210 166 168 162 83

2000 122 117 148 155 131 71 73 43 104 156

2010 101 100 102 97 136 163 182

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

1625A 1945 to 2016 72 years Series 21

[B] Entire series, effect on correlation ( .519) is:

Lower 1987< -.022 2013> -.020 1971< -.020 1962> -.020 1975< -.015 1977< -.014 Higher 1948 .077 1973 .052

1625A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1945 306 384 445 274 337

1950 491 634 535 470 518 693 586 582 538 443

1960 622 542 523 500 527 463 371 348 319 277

1970 144 164 273 106 123 109 145 95 93 88

1980 100 105 94 69 78 112 116 78 86 152

1990 109 121 212 148 191 144 187 168 246 174

2000 176 146 168 102 79 73 78 97 143 230

2010 135 143 141 195 209 175 157

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1625B 1940 to 2016 77 years Series 22

[\*] Early part of series cannot be checked from 1940 to 1940 -- not matched by another series

[B] Entire series, effect on correlation ( .409) is:

Lower 1948> -.043 1949> -.040 2012< -.031 2010< -.029 1971< -.016 1988< -.016 Higher 1973 .058 1941 .032

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

1949 +3.0 SD

1625B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1940 157 120 137 373 390 384 406 574 490 631

1950 668 675 520 246 338 502 419 432 349 295

1960 437 404 307 241 307 319 202 207 200 185

1970 126 137 204 93 119 120 164 129 143 119

1980 126 83 81 85 92 99 74 63 64 101

1990 73 72 104 101 88 74 87 76 108 121

2000 107 92 78 104 125 89 93 79 95 135

2010 67 85 67 82 93 99 102

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

1626A 1946 to 2016 71 years Series 23

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

Lower 1987< -.026 2006> -.013 1974> -.013 1969< -.013 1946> -.010 1999< -.008 Higher 1948 .051 1990 .010

[D] 4 Absent rings: Year Master N series Absent

2013 -.608 32 1

2014 1.049 32 2 >> WARNING: Ring is not usually narrow

2015 .360 32 2 >> WARNING: Ring is not usually narrow

2016 .710 32 2 >> WARNING: Ring is not usually narrow

>> WARNING: Last ring in series is ABSENT

1626A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 219 214 171 169

1950 230 255 272 213 198 230 246 299 301 283

1960 241 221 180 209 226 194 165 148 149 141

1970 124 200 208 167 190 208 260 263 246 224

1980 249 219 209 157 192 159 146 121 181 177

1990 127 103 139 115 124 144 130 92 154 91

2000 112 52 34 36 20 14 28 22 23 28

2010 5 6 6 0 0 0 0

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

1626B 1944 to 2016 73 years Series 24

[B] Entire series, effect on correlation ( .463) is:

Lower 1998< -.068 2014< -.039 2008< -.021 2003> -.015 1944> -.014 2013> -.014 Higher 1948 .071 1973 .061

[D] 8 Absent rings: Year Master N series Absent

1998 1.178 32 1 >> WARNING: Ring is not usually narrow

1999 .525 32 1 >> WARNING: Ring is not usually narrow

2000 .596 32 1 >> WARNING: Ring is not usually narrow

2001 -.746 32 1

2002 -.321 32 1 >> WARNING: Ring is not usually narrow

2014 1.049 32 2 >> WARNING: Ring is not usually narrow

2015 .360 32 2 >> WARNING: Ring is not usually narrow

2016 .710 32 2 >> WARNING: Ring is not usually narrow

>> WARNING: Last ring in series is ABSENT

1626B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1944 230 229 161 200 149 154

1950 200 260 303 233 221 257 268 257 246 212

1960 248 215 166 147 169 147 139 151 183 188

1970 158 215 200 102 118 148 200 178 170 171

1980 193 163 175 141 201 157 127 122 170 181

1990 118 89 120 122 134 159 141 93 0 0

2000 0 0 0 79 102 40 34 35 13 9

2010 13 17 16 17 0 0 0

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

1627A 1941 to 2016 76 years Series 25

[B] Entire series, effect on correlation ( .450) is:

Lower 1942> -.032 1946< -.031 1973> -.027 1949> -.025 1983> -.018 2005> -.017 Higher 1948 .042 1951 .034

1627A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1941 114 149 204 210 220 124 191 130 192

1950 236 404 334 270 222 216 222 245 209 220

1960 214 191 148 173 188 153 122 157 123 118

1970 77 145 172 192 138 174 211 246 331 309

1980 321 345 265 305 335 181 138 196 163 117

1990 104 88 85 94 116 85 91 94 94 140

2000 117 125 136 104 121 149 130 154 188 172

2010 124 99 89 74 97 73 76

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1627B 1946 to 2016 71 years Series 26

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

Lower 2001> -.033 1949> -.032 1988< -.031 1983> -.020 1957< -.019 1975< -.013 Higher 1948 .090 1973 .022

1627B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 131 206 123 211

1950 258 344 366 365 247 288 294 256 228 254

1960 294 347 313 368 357 269 262 297 261 249

1970 212 247 212 161 123 119 181 172 254 234

1980 279 212 237 255 297 214 152 169 104 106

1990 98 86 104 109 89 63 59 70 80 110

2000 138 154 135 88 76 82 52 72 70 92

2010 56 45 40 37 50 49 60

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1628A 1948 to 2016 69 years Series 27

[B] Entire series, effect on correlation ( .476) is:

Lower 1949> -.036 1974< -.031 2001> -.028 1950< -.024 1966> -.019 2014< -.012 Higher 1948 .048 1962 .017

1628A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1948 108 286

1950 212 337 375 352 233 320 236 341 287 373

1960 365 345 216 215 238 198 242 239 214 261

1970 224 289 250 221 161 223 212 229 239 204

1980 235 209 200 188 269 248 182 237 241 142

1990 121 73 101 114 145 112 96 102 133 128

2000 106 127 108 35 44 41 27 37 58 76

2010 64 56 66 67 55 75 80

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

1628B 1951 to 2016 66 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

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

1967 2016 0 -.03 -.04 -.33 -.09 .11 -.10 .05 -.09 -.09 .12 .31\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .393) is:

Lower 1956< -.045 1973> -.044 2001> -.030 2016< -.028 1992< -.028 1970> -.019 Higher 1954 .022 1962 .021

1967 to 2016 segment:

Lower 1973> -.049 1992< -.041 2016< -.041 2001> -.036 1970> -.019 2013> -.018 Higher 1971 .029 2009 .028

1628B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1951 523 532 327 208 384 215 267 209 250

1960 267 252 166 160 154 143 118 126 129 250

1970 250 377 361 334 235 356 342 383 378 304

1980 256 214 216 181 277 253 166 196 203 145

1990 106 107 70 96 128 88 87 108 179 236

2000 169 195 182 84 93 99 61 139 155 208

2010 194 161 190 198 193 198 186

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1629A 1947 to 2016 70 years Series 29

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

Lower 1949> -.040 1958< -.031 1974> -.028 2014< -.023 1964< -.015 1970> -.014 Higher 1948 .086 1966 .017

1629A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1947 270 130 224

1950 267 287 304 272 201 216 243 287 195 230

1960 236 236 193 216 183 185 158 161 185 204

1970 217 249 232 208 279 267 301 304 380 327

1980 354 288 283 235 296 173 128 158 176 146

1990 93 54 71 71 69 60 63 63 106 88

2000 104 80 61 56 43 44 33 65 84 114

2010 69 58 57 58 49 46 65

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1629B 1946 to 2016 71 years Series 30

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

Lower 1949> -.077 1983> -.027 1954< -.026 2010> -.015 1953> -.010 2013> -.010 Higher 1948 .062 1991 .014

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

1949 +3.5 SD

1629B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 215 238 146 301

1950 253 238 214 244 135 175 191 217 170 195

1960 215 223 180 203 183 163 159 166 180 182

1970 177 216 244 215 231 294 270 286 314 238

1980 282 222 249 280 277 228 190 207 199 181

1990 143 99 110 89 103 81 84 75 92 106

2000 100 71 61 30 34 45 40 51 72 85

2010 101 80 83 94 117 98 116

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1630A 1946 to 2016 71 years Series 31

[B] Entire series, effect on correlation ( .575) is:

Lower 2006> -.030 1949> -.025 1973> -.017 2012< -.014 1966< -.011 1989< -.010 Higher 1948 .048 1971 .011

1630A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1946 211 298 186 231

1950 247 307 314 294 191 204 192 263 222 312

1960 283 308 259 245 257 226 146 188 209 244

1970 215 303 279 261 234 306 307 323 300 313

1980 341 285 316 281 324 230 191 185 261 197

1990 197 164 217 236 299 227 170 125 160 128

2000 158 149 110 98 112 103 199 206 207 227

2010 172 142 99 87 129 115 131

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1630B 1953 to 2016 64 years Series 32

[B] Entire series, effect on correlation ( .589) is:

Lower 2013> -.032 2007< -.030 1972< -.029 2003> -.016 2011< -.015 1956< -.013 Higher 1966 .030 1990 .016

1630B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1953 256 195 232 198 270 250 297

1960 283 303 235 236 238 211 147 194 200 254

1970 211 270 198 158 140 204 256 308 331 336

1980 395 400 338 261 335 290 272 288 251 246

1990 205 192 243 214 276 290 272 222 250 247

2000 259 217 233 243 212 191 189 172 200 203

2010 204 185 206 223 221 206 212

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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 1612A 1952 2016 65 2 0 .359 2.34 4.31 .882 .785 .208 2.48 .441 -.054 1

2 1612B 1950 2016 67 2 0 .344 2.74 4.51 .659 .546 .184 2.66 .522 .014 1

3 1613B 1951 2016 66 2 1 .325 2.77 5.34 1.034 .812 .172 2.51 .345 .020 1

4 1616A 1957 2016 60 2 0 .425 2.20 3.75 .780 .865 .144 2.44 .400 -.085 1

5 1616B 1962 2016 55 2 0 .445 2.12 3.75 .842 .875 .166 2.56 .421 -.033 1

6 1616C 1957 2016 60 2 2 .290 2.10 3.45 .534 .713 .148 2.76 .576 .005 1

7 1617A 1945 2016 72 3 0 .371 1.78 4.72 1.163 .925 .172 2.55 .449 -.043 2

8 1617B 1944 2016 73 3 0 .542 2.11 5.76 1.393 .964 .134 2.64 .484 .059 1

9 1618A 1946 2016 71 3 0 .548 1.61 3.41 .485 .623 .205 2.81 .561 -.051 2

10 1618B 1943 2016 74 3 0 .493 1.69 3.42 .625 .717 .229 2.70 .517 -.056 1

11 1619A 1945 2016 72 3 1 .294 1.60 4.13 1.113 .810 .302 2.61 .509 -.040 1

12 1619B 1950 2016 67 2 2 .222 1.62 4.34 1.098 .907 .243 2.57 .480 -.005 1

13 1620A 1943 2016 74 3 0 .385 2.68 7.23 1.864 .928 .202 2.36 .361 -.011 1

14 1620B 1944 2016 73 3 0 .421 3.20 7.27 1.918 .948 .139 2.43 .296 -.092 1

15 1621A 1944 2016 73 3 1 .405 2.23 4.92 .849 .812 .180 2.64 .479 .027 1

16 1621B 1944 2016 73 3 1 .362 2.73 3.87 .604 .641 .159 2.85 .653 .031 1

17 1622A 1944 2016 73 3 0 .468 1.90 4.84 1.332 .925 .257 2.57 .494 -.108 1

18 1622B 1942 2016 75 3 0 .574 1.84 6.26 1.387 .912 .254 2.74 .499 -.062 1

19 1624A 1946 2016 71 3 0 .561 2.34 5.49 1.112 .847 .207 2.76 .503 .074 1

20 1624B 1945 2016 72 3 0 .508 2.20 4.81 1.001 .814 .228 2.59 .560 -.037 1

21 1625A 1945 2016 72 3 0 .519 2.53 6.93 1.771 .923 .224 2.56 .448 .020 1

22 1625B 1940 2016 77 3 0 .409 2.03 6.75 1.620 .909 .210 2.59 .481 -.072 2

23 1626A 1946 2016 71 3 0 .706 1.50 3.00 .867 .937 .224 2.77 .544 .046 1

24 1626B 1944 2016 73 3 0 .463 1.37 3.03 .824 .905 .260 2.52 .436 .002 2

25 1627A 1941 2016 76 3 0 .450 1.72 4.04 .755 .817 .200 2.90 .476 -.064 1

26 1627B 1946 2016 71 3 0 .448 1.79 3.68 .985 .909 .191 2.57 .569 -.036 1

27 1628A 1948 2016 69 3 0 .476 1.83 3.75 .962 .849 .220 2.48 .412 -.015 1

28 1628B 1951 2016 66 2 1 .393 2.12 5.32 1.010 .787 .221 2.60 .594 -.066 1

29 1629A 1947 2016 70 3 0 .587 1.70 3.80 .949 .906 .188 2.64 .413 -.071 1

30 1629B 1946 2016 71 3 0 .457 1.67 3.14 .759 .881 .172 2.60 .398 -.085 1

31 1630A 1946 2016 71 3 0 .575 2.20 3.41 .685 .763 .181 2.50 .405 .013 1

32 1630B 1953 2016 64 2 0 .589 2.42 4.00 .531 .737 .132 2.50 .593 -.053 1

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Total or mean: 2237 87 9 .452 2.08 7.27 1.023 .836 .200 2.90 .479 -.026

- = [ COFECHA TEST COF ] = -