[] Dendrochronology Program Library Run ACRU Program COF 12:25 Thu 07 Sep 2017 Page 1

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[] P R O G R A M C O F E C H A Version 6.06P 30202

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QUALITY CONTROL AND DATING CHECK OF TREE-RING MEASUREMENTS

Title of run: ACRU\_MMRB1400B\_CORR2-50

File of DATED series: ACRU\_MMRB1400B\_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 1884 to 2015 132 years

Continuous time span is 1884 to 2015 132 years

Portion with two or more series is 1884 to 2015 132 years

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

\*C\* Number of dated series 28 \*C\*

\*O\* Master series 1884 2015 132 yrs \*O\*

\*F\* Total rings in all series 2555 \*F\*

\*E\* Total dated rings checked 2555 \*E\*

\*C\* Series intercorrelation .501 \*C\*

\*H\* Average mean sensitivity .226 \*H\*

\*A\* Segments, possible problems 14 \*A\*

\*\*\* Mean length of series 91.3 \*\*\*

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

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

130A 1 absent rings: 2007

1 absent rings .039%

1900 -1.946 3 1950 .247 26 2000 .743 28

1901 -1.167 3 1951 .916 26 2001 -1.324 28

1902 -2.997 3 1952 .350 26 2002 .246 28

1903 -.561 3 1953 -.119 28 2003 .045 28

1904 -.397 4 1954 .366 28 2004 -.400 28

1905 1.304 4 1955 .915 28 2005 .004 28

1906 1.184 4 1956 .807 28 2006 .041 28

1907 1.448 5 1957 -1.202 28 2007 -1.563 28 1

1908 1.326 5 1958 .002 28 2008 .788 28

1909 1.723 5 1959 -1.318 28 2009 .427 28

1910 1.110 5 1960 .411 28 2010 -.849 28

1911 .834 5 1961 .621 28 2011 .413 28

1912 .432 5 1962 -.354 28 2012 1.425 28

1913 -.280 5 1963 .521 28 2013 -.594 28

1914 -.268 5 1964 -.279 28 2014 1.199 28

1915 -.183 5 1965 -.492 28 2015 -.852 28

1916 -2.429 5 1966 -1.889 28

1917 -2.789 5 1967 .057 28

1918 -2.396 5 1968 -.289 28

1919 -1.334 6 1969 1.269 28

1920 .720 6 1970 .457 28

1921 1.091 7 1971 .140 28

1922 1.305 7 1972 .159 28

1923 -.765 8 1973 .240 28

1924 .734 12 1974 -.165 28

1925 .276 12 1975 -1.319 28

1926 .433 13 1976 -.099 28

1927 -.447 15 1977 .744 28

1928 -1.825 16 1978 1.014 28

1929 .517 16 1979 -.413 28

1930 .286 19 1980 1.537 28

1931 1.213 20 1981 .633 28

1932 .787 20 1982 -.349 28

1933 -.800 20 1983 .046 28

1884 .245 2 1934 .653 20 1984 .173 28

1885 -.970 2 1935 .270 21 1985 .398 28

1886 1.309 2 1936 -1.805 22 1986 -1.656 28

1887 1.368 2 1937 .386 22 1987 .417 28

1888 1.656 3 1938 1.056 24 1988 .271 28

1889 1.466 3 1939 .177 24 1989 -.673 28

1890 -.201 3 1940 -.726 24 1990 -.077 28

1891 1.158 3 1941 .184 24 1991 -1.151 28

1892 -.323 3 1942 1.688 25 1992 -.762 28

1893 .102 3 1943 .791 26 1993 -.260 28

1894 -1.252 3 1944 .676 26 1994 .579 28

1895 -.445 3 1945 -2.105 26 1995 .577 28

1896 1.286 3 1946 -1.512 26 1996 .387 28

1897 -.506 3 1947 .160 26 1997 .050 28

1898 -1.254 3 1948 -1.279 26 1998 -.056 28

1899 -.581 3 1949 -.089 26 1999 1.148 28

PART 5: CORRELATION OF SERIES BY SEGMENTS: ACRU\_MMRB1400B\_CORR2-50 12:25 Thu 07 Sep 2017 Page 5

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Correlations of 50-year dated segments, lagged 25 years

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

Seq Series Time\_span 1875 1900 1925 1950 1975

1924 1949 1974 1999 2024

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

1 107A 1930 2015 .35 .29A .47

2 107B 1928 2015 .37 .48 .57

3 130A 1924 2015 .50 .49 .38 .21A

4 130B 1927 2015 .58 .48 .54

5 315A 1930 2015 .47 .50 .53

6 315B 1923 2015 .59 .60 .55 .48

7 316A 1907 2015 .57 .64 .60 .51

8 316B 1919 2015 .61 .62 .57 .41

9 317A 1938 2015 .35 .38 .47

10 317B 1938 2015 .24B .37 .50

11 318A 1935 2015 .34 .44 .68

12 318B 1936 2015 .53 .32A .54

13 319A 1943 2015 .65 .54 .61

14 319B 1942 2015 .70 .61 .59

15 320A 1884 2015 .49 .30B .07B .24A .49

16 320B 1884 2015 .41 .34B .14B .19B .34

17 321A 1904 2015 .45 .39 .39 .49

18 321B 1888 2015 .55 .65 .51 .44 .46

19 699A 1930 2015 .71 .49 .58

20 699B 1921 2015 .50 .64 .63 .64

21 700A 1953 2015 .30B .23A

22 700B 1953 2015 .26B .22B

23 1063A 1924 2015 .73 .80 .62 .56

24 1063B 1924 2015 .78 .77 .78 .82

25 1064A 1931 2015 .72 .53 .73

26 1064B 1927 2015 .51 .37 .45

27 1178A 1926 2015 .56 .36 .49

28 1178B 1924 2015 .74 .69 .45 .44

Av segment correlation .49 .56 .52 .45 .50

PART 6: POTENTIAL PROBLEMS: ACRU\_MMRB1400B\_CORR2-50 12:25 Thu 07 Sep 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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107A 1930 to 2015 86 years Series 1

[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 0 -.17 .20 .05 .03 .01 .25 .04 -.06 .16 -.24 .29\*-.05 -.18 -.05 .02 -.13 -.04 .02 -.20 -.01 -.04

[B] Entire series, effect on correlation ( .428) is:

Lower 1945> -.039 1995< -.035 1957> -.033 1986> -.030 1971< -.022 1970< -.019 Higher 2007 .026 1948 .023

1950 to 1999 segment:

Lower 1957> -.069 1986> -.062 1995< -.061 1971< -.032 1970< -.029 1969< -.009 Higher 1959 .072 1991 .053

107A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 165 153 189 120 123 128 135 140 175 168

1940 177 188 237 246 218 218 216 248 182 222

1950 205 223 230 194 214 218 206 231 224 160

1960 229 209 204 212 185 177 139 159 138 133

1970 78 56 94 108 91 90 136 165 170 157

1980 227 160 141 150 162 207 180 174 149 146

1990 136 94 117 122 125 88 141 135 173 170

2000 167 129 163 144 122 114 159 93 184 184

2010 118 174 219 158 177 125

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107B 1928 to 2015 88 years Series 2

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

Lower 1928> -.027 1957> -.027 2007< -.020 1970< -.016 1945> -.014 1971< -.014 Higher 1942 .014 1980 .013

107B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1928 157 156

1930 145 150 171 92 98 91 86 98 119 141

1940 135 140 194 179 162 150 166 202 165 180

1950 181 212 201 161 175 172 185 195 195 161

1960 215 199 163 178 152 150 126 154 159 147

1970 103 90 130 148 109 116 149 157 167 141

1980 188 138 117 110 134 136 118 180 175 164

1990 186 134 139 154 181 174 151 146 152 154

2000 143 118 129 124 104 127 146 64 115 116

2010 109 136 148 104 121 79

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

130A 1924 to 2015 92 years Series 3

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

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1966 2015 0 -.10 .03 -.12 -.02 -.04 -.03 -.08 .07 .02 -.13 .21\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .449) is:

Lower 2015> -.041 1966> -.038 2012< -.021 1936> -.015 1928< -.014 1937< -.009 Higher 1945 .055 1986 .026

1966 to 2015 segment:

Lower 2015> -.091 1966> -.076 2012< -.050 1987< -.017 1979> -.015 1982> -.014 Higher 1986 .097 2001 .073

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

2007 -1.563 28 1

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

1928 -6.1 SD

130A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1924 245 181 226 189 106 209

1930 199 243 224 208 226 217 202 181 230 216

1940 179 223 236 192 185 116 133 123 125 178

1950 167 150 132 142 145 148 132 88 106 77

1960 98 105 126 190 184 170 216 241 243 207

1970 205 187 137 120 110 113 159 143 168 160

1980 168 112 122 100 76 71 36 40 60 46

1990 46 40 40 35 29 19 43 64 52 64

2000 68 23 28 18 29 16 12 0 13 12

2010 15 31 14 13 24 55

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130B 1927 to 2015 89 years Series 4

[B] Entire series, effect on correlation ( .590) is:

Lower 1948> -.020 1966> -.019 1951< -.015 1935< -.012 1946> -.010 1930< -.009 Higher 1945 .058 1986 .026

130B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 175 166 182

1930 169 221 243 211 253 198 187 218 252 235

1940 214 265 275 243 259 151 177 187 194 237

1950 203 144 122 128 133 139 124 70 99 67

1960 113 111 118 165 187 160 170 196 241 247

1970 243 229 245 206 203 196 237 221 225 210

1980 259 216 210 138 113 127 69 95 99 116

1990 115 115 147 128 127 145 182 196 137 126

2000 210 103 93 75 86 54 56 29 45 77

2010 21 82 79 53 87 46

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315A 1930 to 2015 86 years Series 5

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

Lower 1996< -.039 1948> -.034 1933< -.024 1969< -.017 1967< -.014 1936> -.013 Higher 1945 .045 1986 .029

315A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 318 299 274 178 259 257 225 247 226 184

1940 220 195 247 182 212 128 154 229 266 260

1950 155 217 180 182 269 233 264 85 155 176

1960 292 288 263 261 186 185 107 85 117 117

1970 131 129 161 256 301 145 211 266 298 219

1980 265 248 205 218 225 217 162 249 257 234

1990 238 195 200 222 219 204 159 179 182 244

2000 225 200 217 221 224 322 291 243 320 381

2010 299 299 352 278 330 184

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315B 1923 to 2015 93 years Series 6

[B] Entire series, effect on correlation ( .547) is:

Lower 1986> -.032 1928> -.025 2013> -.020 1977< -.017 1924< -.013 1969< -.013 Higher 1945 .042 1936 .035

315B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1923 167 198 257 228 220 254 335

1930 287 313 232 222 304 305 123 212 196 178

1940 162 176 214 197 201 119 175 274 224 144

1950 164 289 274 197 249 283 343 162 244 200

1960 323 342 234 241 271 309 196 255 271 224

1970 185 210 231 252 223 159 251 222 281 206

1980 404 374 281 401 397 378 329 295 227 203

1990 262 170 212 220 254 351 269 177 155 188

2000 206 166 141 133 153 219 201 149 197 221

2010 180 227 327 341 342 225

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316A 1907 to 2015 109 years Series 7

[B] Entire series, effect on correlation ( .547) is:

Lower 1986> -.022 2010< -.017 2015> -.017 1910< -.015 2007> -.015 1936> -.011 Higher 1945 .015 1966 .014

316A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1907 140 154 176

1910 95 115 87 99 85 72 56 42 22 83

1920 99 180 211 171 194 187 185 164 126 148

1930 133 156 127 118 194 199 175 202 213 218

1940 181 201 227 184 199 142 132 186 126 134

1950 143 187 151 111 173 164 178 142 131 108

1960 186 172 153 162 147 122 118 138 160 186

1970 175 187 164 172 164 150 153 172 202 154

1980 216 164 132 123 122 116 119 138 88 67

1990 95 60 46 43 52 41 39 56 55 72

2000 46 29 59 43 23 29 39 32 45 21

2010 4 18 26 12 12 13

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316B 1919 to 2015 97 years Series 8

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

Lower 2015> -.031 2001> -.023 1963< -.019 2007> -.015 2009< -.014 1952< -.013 Higher 1936 .039 1928 .020

316B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1919 154

1920 205 398 267 220 268 219 215 188 131 177

1930 185 205 202 205 250 208 132 192 244 256

1940 225 249 275 190 212 129 106 155 127 94

1950 151 215 113 110 154 184 191 122 130 118

1960 203 188 192 140 156 187 156 222 191 248

1970 229 167 163 164 200 164 189 195 222 158

1980 224 196 112 122 126 97 77 104 105 94

1990 109 112 79 75 125 104 134 120 101 114

2000 75 80 96 72 38 44 26 33 32 11

2010 3 13 19 5 7 9

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317A 1938 to 2015 78 years Series 9

[B] Entire series, effect on correlation ( .358) is:

Lower 1947< -.081 1974< -.035 1995< -.027 1945> -.025 1957> -.022 2007> -.011 Higher 1966 .034 1986 .032

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

1946 1947 -4.1 SD

317A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1938 420 341

1940 314 349 369 315 323 277 272 108 109 195

1950 219 290 394 380 355 466 342 353 393 294

1960 354 340 298 274 236 283 205 282 243 316

1970 338 297 307 356 195 231 289 394 358 217

1980 274 243 293 321 277 274 185 301 359 257

1990 276 253 224 306 223 123 163 156 98 215

2000 203 166 254 292 260 313 265 222 295 224

2010 167 171 200 120 194 139

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317B 1938 to 2015 78 years Series 10

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

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1938 1987 -2 -.29 -.06 -.09 .14 -.11 -.28 -.04 -.09 .42\* .03 .24| .05 -.10 -.07 -.21 .05 .00 -.09 -.19 .15 .20

[B] Entire series, effect on correlation ( .317) is:

Lower 1947< -.172 1945> -.032 1995< -.021 1991> -.017 1977< -.016 2007> -.014 Higher 1966 .038 2001 .027

1938 to 1987 segment:

Lower 1947< -.255 1945> -.043 1977< -.021 1957> -.018 1980< -.014 1976< -.006 Higher 1966 .062 1959 .036

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

1946 1947 -4.6 SD

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

1947 -7.3 SD

317B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1938 472 381

1940 335 339 356 338 335 302 240 36 73 197

1950 248 287 352 347 317 458 347 346 449 277

1960 360 355 371 361 291 334 185 429 434 573

1970 511 415 377 393 351 304 217 159 191 153

1980 179 148 197 239 245 239 163 277 374 341

1990 319 319 222 282 271 176 239 203 209 252

2000 240 180 199 209 190 209 173 191 245 213

2010 186 221 250 123 201 115

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318A 1935 to 2015 81 years Series 11

[B] Entire series, effect on correlation ( .471) is:

Lower 1952< -.045 1959> -.032 1951< -.025 1936> -.025 1946> -.015 1954< -.010 Higher 1986 .037 1966 .015

318A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1935 367 349 371 397 271

1940 243 271 336 276 298 198 232 292 175 183

1950 156 114 78 161 138 216 262 166 149 234

1960 217 175 122 209 196 124 137 248 264 344

1970 276 274 235 292 266 225 231 313 303 279

1980 327 311 289 258 283 293 186 237 221 160

1990 169 184 178 166 210 223 201 184 128 197

2000 185 132 177 148 124 118 104 98 137 142

2010 56 74 107 81 123 58

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318B 1936 to 2015 80 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

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1950 1999 0 -.21 .16 -.09 .02 -.07 -.19 -.02 -.09 -.24 -.10 .32\* .03 .04 .02 .14 .31 -.07 .11 .14 .05 .05

[B] Entire series, effect on correlation ( .546) is:

Lower 1936> -.041 1991> -.031 1959> -.028 1961< -.008 1954< -.007 1992> -.007 Higher 1945 .076 1957 .015

1950 to 1999 segment:

Lower 1991> -.078 1959> -.064 1961< -.020 1954< -.018 1985< -.016 1992> -.016 Higher 1957 .077 1986 .071

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

2001 -5.7 SD

318B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1936 537 645 479 417

1940 321 387 412 381 370 176 238 401 270 309

1950 292 285 216 289 226 300 333 207 226 310

1960 267 237 184 306 280 213 239 355 393 482

1970 479 458 419 520 425 342 392 486 398 306

1980 336 184 105 110 88 85 43 106 142 168

1990 219 272 220 175 207 168 143 134 135 135

2000 126 49 120 109 114 154 160 117 171 195

2010 171 178 221 164 287 158

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319A 1943 to 2015 73 years Series 13

[B] Entire series, effect on correlation ( .625) is:

Lower 1959> -.019 1978< -.019 1962< -.019 1976< -.014 2002< -.012 2007> -.012 Higher 1945 .070 1957 .019

319A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1943 253 285 190 246 221 220 255

1950 279 299 319 271 266 235 265 179 185 193

1960 195 218 155 211 206 223 158 197 172 210

1970 187 164 175 133 141 100 110 129 120 134

1980 172 163 142 164 182 190 156 185 186 154

1990 168 125 135 177 163 238 230 203 237 236

2000 209 170 165 183 199 182 208 190 220 180

2010 201 228 266 206 264 152

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319B 1942 to 2015 74 years Series 14

[B] Entire series, effect on correlation ( .616) is:

Lower 1988< -.012 1998> -.011 1967< -.011 1959> -.011 1992> -.010 2007> -.010 Higher 1945 .043 1966 .028

319B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1942 386 316 352 226 257 257 250 262

1950 302 315 327 276 271 285 280 216 183 196

1960 205 206 154 222 172 142 87 120 184 249

1970 233 256 230 189 201 165 176 191 259 182

1980 201 180 159 204 207 187 115 157 136 128

1990 163 148 190 177 163 209 173 173 219 199

2000 181 157 174 211 196 160 182 155 159 165

2010 138 126 128 102 142 60

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320A 1884 to 2015 132 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

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1900 1949 -1 .19 -.18 -.20 -.13 -.24 -.16 -.17 -.13 .03 .35\* .30| .17 .34 -.17 -.11 -.01 -.07 -.06 .02 -.16 .00

1925 1974 -1 .15 -.14 .00 .06 .04 -.14 -.12 -.09 -.14 .31\* .07| .09 .20 -.27 -.15 .02 -.01 .02 .16 -.08 -.03

1950 1999 0 -.21 -.20 .08 .20 .17 -.33 .05 .06 -.11 -.06 .24\* .05 -.14 -.18 -.07 .05 -.07 .03 .21 -.10 -.02

[B] Entire series, effect on correlation ( .323) is:

Lower 1945> -.035 1887> -.030 1936> -.030 1904> -.016 1951< -.014 1978< -.014 Higher 1916 .022 1902 .019

1900 to 1949 segment:

Lower 1945> -.067 1936> -.056 1946< -.040 1904> -.028 1937< -.024 1938< -.023 Higher 1916 .047 1902 .041

1925 to 1974 segment:

Lower 1945> -.073 1936> -.064 1951< -.029 1937< -.021 1938< -.020 1933> -.018 Higher 1946 .083 1942 .033

1950 to 1999 segment:

Lower 1951< -.052 1978< -.051 1960< -.029 1991> -.022 1961< -.016 1999< -.014 Higher 1969 .040 1975 .034

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

1945 1946 -4.8 SD

320A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1884 112 102 114 168 141 174

1890 115 160 122 151 106 143 177 136 131 144

1900 145 171 120 229 272 306 269 309 300 286

1910 247 218 229 211 207 238 137 89 105 141

1920 244 321 284 214 355 254 246 213 205 256

1930 295 263 271 251 216 150 207 143 120 133

1940 124 116 141 120 80 104 38 87 65 65

1950 88 47 34 38 68 80 67 46 46 40

1960 31 35 92 97 120 134 105 212 177 247

1970 209 159 87 83 34 16 48 88 34 36

1980 55 34 45 52 48 53 35 48 49 26

1990 21 29 13 11 25 47 57 38 42 34

2000 30 18 34 42 48 61 40 33 65 75

2010 67 71 102 56 62 34

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320B 1884 to 2015 132 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

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1900 1949 2 .28 -.20 -.18 -.01 -.21 -.21 -.21 .00 -.04 .32 .34| .11 .46\*-.13 -.15 -.01 -.14 -.22 -.09 -.25 .02

1925 1974 -10 .24\*-.15 -.07 .17 .00 -.18 -.07 -.15 -.14 .22 .14|-.11 .23 -.17 -.20 .11 -.03 .07 -.05 -.03 .05

1950 1999 7 -.01 -.12 .05 .11 .13 -.25 .07 -.11 -.04 -.05 .19| .05 -.05 -.13 .08 -.12 -.17 .22\*-.06 .00 -.02

[B] Entire series, effect on correlation ( .305) is:

Lower 1945> -.039 1887< -.034 1972< -.024 1986> -.018 1934< -.014 1936> -.014 Higher 2001 .021 1916 .020

1900 to 1949 segment:

Lower 1945> -.091 1934< -.038 1936> -.030 1926< -.026 1904> -.024 1935< -.012 Higher 1916 .046 1942 .030

1925 to 1974 segment:

Lower 1945> -.100 1972< -.037 1936> -.034 1966> -.033 1934< -.029 1926< -.019 Higher 1957 .049 1946 .049

1950 to 1999 segment:

Lower 1986> -.068 1972< -.051 1966> -.050 1961< -.024 1991> -.015 1998> -.014 Higher 1957 .073 1959 .070

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

1945 +3.6 SD

320B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1884 101 94 131 102 106 124

1890 119 131 121 100 79 78 122 101 100 123

1900 74 78 78 131 179 203 210 261 257 211

1910 236 236 195 194 173 142 92 109 124 154

1920 236 333 243 197 258 203 133 158 121 174

1930 136 143 161 142 111 102 118 108 117 119

1940 95 104 131 103 108 115 69 106 86 72

1950 98 76 69 58 86 70 66 37 34 19

1960 35 33 86 94 96 122 139 176 179 206

1970 161 183 78 160 127 76 170 206 152 133

1980 135 132 139 208 232 216 220 226 188 93

1990 89 106 56 33 56 89 101 58 120 70

2000 50 16 46 39 34 25 22 13 49 46

2010 40 24 36 20 38 13

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321A 1904 to 2015 112 years Series 17

[B] Entire series, effect on correlation ( .433) is:

Lower 1904< -.085 1957> -.029 1945> -.025 1946> -.015 1973< -.015 2010> -.013 Higher 1916 .035 1936 .034

321A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1904 81 140 139 154 151 191

1910 190 173 172 139 160 170 109 119 156 147

1920 223 265 216 156 205 161 178 188 217 278

1930 332 405 336 273 313 299 209 310 302 264

1940 250 278 338 384 357 321 354 374 238 258

1950 288 270 254 229 186 185 237 325 364 235

1960 307 307 250 244 149 105 80 90 103 130

1970 123 111 118 82 143 115 105 133 108 97

1980 136 107 104 108 102 115 89 103 98 85

1990 106 97 120 131 163 142 91 114 144 177

2000 118 80 88 69 85 80 77 66 73 66

2010 95 105 119 80 115 102

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321B 1888 to 2015 128 years Series 18

[B] Entire series, effect on correlation ( .501) is:

Lower 1965< -.043 2010> -.020 1894> -.018 1928> -.017 1984< -.013 1889< -.013 Higher 1936 .024 1902 .018

321B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1888 185 125

1890 102 116 89 104 108 115 138 93 68 76

1900 60 83 37 56 100 136 157 143 134 162

1910 171 150 148 100 108 133 85 93 96 123

1920 228 158 196 125 226 178 243 221 270 306

1930 347 289 323 289 306 345 209 274 300 280

1940 259 303 370 371 344 271 235 349 222 264

1950 264 272 260 222 200 231 205 176 143 122

1960 165 165 122 164 116 47 55 76 75 99

1970 79 70 83 60 88 76 69 92 71 54

1980 79 82 80 90 57 81 60 77 70 82

1990 95 70 81 87 104 142 124 90 76 124

2000 129 94 96 74 99 129 153 125 151 132

2010 191 163 179 121 156 122

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699A 1930 to 2015 86 years Series 19

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

Lower 1986> -.025 1982< -.023 1957> -.016 1999< -.008 1974> -.007 1977< -.006 Higher 1966 .022 2007 .016

699A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1930 212 239 236 171 238 227 185 222 243 204

1940 212 267 279 266 243 181 168 223 162 238

1950 228 301 268 291 301 297 292 270 324 207

1960 282 328 311 295 227 289 174 253 299 336

1970 288 257 331 393 348 166 200 207 268 190

1980 263 233 126 179 178 211 234 353 251 227

1990 305 242 236 287 318 283 242 220 204 223

2000 257 189 257 276 261 226 256 147 257 206

2010 163 159 163 113 169 99

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699B 1921 to 2015 95 years Series 20

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

Lower 1921< -.092 1986> -.025 1936> -.019 2010> -.015 1977< -.012 1963< -.006 Higher 1966 .021 2001 .019

699B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1921 140 232 187 205 207 197 185 191 252

1930 224 265 251 175 247 277 221 228 246 192

1940 161 171 225 230 189 168 156 231 174 187

1950 251 286 256 231 230 248 237 185 256 160

1960 242 266 234 217 202 204 178 265 258 307

1970 382 361 330 386 383 272 306 270 383 280

1980 383 375 285 289 275 333 314 395 316 253

1990 229 178 175 244 284 259 202 204 215 223

2000 207 146 250 223 171 151 159 113 199 176

2010 177 203 179 112 113 45

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700A 1953 to 2015 63 years Series 21

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

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

1953 2002 7 -.12 .27 -.27 -.01 -.19 -.21 -.02 .12 .04 -.16 .30|-.31 .19 .03 .00 -.07 .10 .35\*-.06 .17 -.12

1966 2015 0 -.09 .21 -.19 -.06 .00 -.20 -.03 .21 .03 -.15 .23\* - - - - - - - - - -

[B] Entire series, effect on correlation ( .299) is:

Lower 1968< -.044 2001> -.030 1966> -.026 1965> -.013 1960< -.013 2011< -.011 Higher 1957 .078 1986 .028

1953 to 2002 segment:

Lower 1968< -.050 2001> -.041 1966> -.036 1965> -.017 1960< -.016 1999< -.013 Higher 1957 .108 1986 .035

1966 to 2015 segment:

Lower 1968< -.056 2001> -.035 1966> -.027 2011< -.014 2006< -.013 1974> -.012 Higher 1986 .047 2014 .032

700A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1953 312 246 223 230 101 228 177

1960 180 254 216 265 247 302 258 303 114 239

1970 283 276 268 289 314 229 205 234 206 150

1980 201 221 84 117 115 131 93 140 166 131

1990 129 116 131 160 211 145 208 238 86 113

2000 103 170 242 213 100 147 71 117 142 157

2010 141 107 148 97 185 137

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

700B 1953 to 2015 63 years Series 22

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

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

1953 2002 7 -.04 .30 -.12 .16 -.05 -.30 -.13 -.02 .03 -.19 .26|-.23 .05 .19 -.14 -.09 .09 .32\*-.08 .24 -.12

1966 2015 -9 -.03 .27\*-.06 .07 .06 -.19 -.12 .08 -.02 -.20 .22| - - - - - - - - - -

[B] Entire series, effect on correlation ( .256) is:

Lower 1998< -.044 1968< -.029 2001> -.022 1966> -.018 2007> -.013 2010> -.012 Higher 1957 .050 1986 .028

1953 to 2002 segment:

Lower 1998< -.055 1968< -.036 2001> -.031 1966> -.026 1962> -.015 1991> -.014 Higher 1957 .065 1986 .035

1966 to 2015 segment:

Lower 1998< -.047 1968< -.029 2001> -.027 1966> -.022 2007> -.015 2010> -.015 Higher 1986 .035 2014 .033

700B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1953 164 96 101 67 8 61 62

1960 74 135 174 190 120 152 131 165 45 151

1970 152 173 113 114 120 128 132 200 206 153

1980 218 203 86 106 141 152 113 220 220 172

1990 233 203 211 258 263 169 178 214 66 145

2000 121 166 218 248 104 139 75 123 139 171

2010 142 96 108 82 187 100

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1063A 1924 to 2015 92 years Series 23

[B] Entire series, effect on correlation ( .634) is:

Lower 1924< -.042 1986> -.033 2014< -.022 1990< -.013 2013> -.012 1988< -.011 Higher 1945 .041 1966 .018

1063A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1924 272 292 277 271 247 293

1930 267 277 258 225 263 255 199 259 282 282

1940 177 229 288 189 225 139 197 225 166 190

1950 233 248 220 182 241 265 247 158 218 164

1960 277 296 212 226 145 202 127 185 174 255

1970 217 208 232 251 231 208 255 249 274 194

1980 278 239 205 161 203 234 191 222 90 64

1990 58 53 75 72 82 104 99 100 101 111

2000 93 68 88 97 89 118 88 41 97 89

2010 33 91 164 104 58 75

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1063B 1924 to 2015 92 years Series 24

[B] Entire series, effect on correlation ( .789) is:

Lower 1936> -.016 1933> -.010 1929< -.010 1963< -.010 1992> -.009 1990< -.006 Higher 1945 .029 1986 .012

1063B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1924 272 266 282 192 145 200

1930 197 301 276 262 319 308 235 380 378 272

1940 226 269 347 337 233 126 132 227 198 222

1950 255 279 262 183 242 261 252 139 234 193

1960 258 316 250 193 168 184 148 230 194 315

1970 256 286 259 271 258 212 291 296 304 225

1980 318 262 194 174 176 204 118 204 138 99

1990 104 103 136 136 121 120 98 94 82 102

2000 87 66 83 66 67 63 76 46 86 65

2010 51 87 147 81 96 56

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1064A 1931 to 2015 85 years Series 25

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

Lower 1959> -.037 1957> -.031 1982> -.012 1974> -.008 1983> -.007 1970< -.007 Higher 1945 .038 1936 .019

1064A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1931 175 164 128 126 113 58 171 211 166

1940 143 183 247 223 172 51 118 223 169 232

1950 258 280 272 250 255 367 300 320 353 370

1960 310 393 265 275 245 241 168 219 225 276

1970 218 220 235 263 290 220 248 256 263 188

1980 258 209 253 298 262 199 118 164 171 171

1990 166 136 140 128 168 180 127 107 99 184

2000 176 99 175 154 133 99 95 59 86 71

2010 58 81 122 63 106 61

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1064B 1927 to 2015 89 years Series 26

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

Lower 1960< -.023 1957> -.022 2001> -.021 2012< -.018 1959> -.018 2015> -.018 Higher 1936 .046 1986 .023

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

1986 -5.7 SD

1064B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1927 216 199 203

1930 189 212 194 167 171 187 112 204 224 208

1940 173 191 214 209 179 134 144 184 145 186

1950 155 180 198 179 199 261 211 244 262 272

1960 222 292 239 304 291 283 271 319 278 395

1970 305 324 377 394 335 351 383 392 436 368

1980 391 330 332 302 267 184 69 147 214 233

1990 220 162 173 147 165 167 166 162 158 175

2000 179 149 147 114 110 87 88 61 92 66

2010 15 68 37 49 86 69

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1178A 1926 to 2015 90 years Series 27

[B] Entire series, effect on correlation ( .550) is:

Lower 1948> -.024 1986> -.023 1973< -.020 1932< -.020 1933> -.019 2002< -.017 Higher 1945 .072 1936 .021

1178A Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1926 221 173 140 158

1930 176 177 138 184 214 195 132 210 233 200

1940 152 148 194 155 170 89 128 172 206 241

1950 208 260 236 226 191 168 183 154 186 165

1960 200 158 144 156 160 146 137 137 140 179

1970 164 155 142 88 66 59 99 130 140 123

1980 173 194 194 132 234 199 177 133 218 156

1990 133 96 124 156 189 180 187 117 161 147

2000 150 95 66 66 71 69 102 48 82 73

2010 42 57 61 26 64 26

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1178B 1924 to 2015 92 years Series 28

[B] Entire series, effect on correlation ( .629) is:

Lower 1974< -.025 1987< -.018 2002< -.016 1986> -.016 1966> -.010 1982> -.008 Higher 1945 .056 1936 .024

1178B Ring measurements

Annual values

Date 0 1 2 3 4 5 6 7 8 9

1924 182 158 180 136 126 149

1930 141 181 160 147 175 174 87 185 188 158

1940 143 121 165 144 158 68 100 131 131 174

1950 170 215 197 189 185 198 227 123 176 120

1960 148 118 89 123 135 113 108 117 140 138

1970 128 121 129 101 38 62 89 140 180 184

1980 234 215 208 183 205 146 118 67 131 101

1990 69 31 58 73 87 90 86 62 106 137

2000 129 85 53 78 73 100 119 66 103 100

2010 61 95 104 38 55 30

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PART 7: DESCRIPTIVE STATISTICS: ACRU\_MMRB1400B\_CORR2-50 12:25 Thu 07 Sep 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 107A 1930 2015 86 3 1 .428 1.64 2.48 .436 .695 .171 2.56 .488 -.053 2

2 107B 1928 2015 88 3 0 .479 1.46 2.15 .324 .634 .151 2.41 .319 -.027 1

3 130A 1924 2015 92 4 1 .449 1.22 2.45 .746 .924 .265 2.41 .331 -.037 1

4 130B 1927 2015 89 3 0 .590 1.59 2.75 .654 .855 .213 2.70 .516 -.095 1

5 315A 1930 2015 86 3 0 .508 2.23 3.81 .600 .544 .202 2.41 .411 -.038 1

6 315B 1923 2015 93 4 0 .547 2.38 4.04 .669 .508 .223 2.58 .434 -.075 2

7 316A 1907 2015 109 4 0 .547 1.23 2.27 .607 .882 .240 2.74 .423 .072 1

8 316B 1919 2015 97 4 0 .521 1.48 3.98 .738 .813 .259 2.71 .493 .028 1

9 317A 1938 2015 78 3 0 .358 2.69 4.66 .789 .634 .222 2.51 .495 -.005 1

10 317B 1938 2015 78 3 1 .317 2.77 5.73 1.018 .733 .227 2.38 .349 .015 1

11 318A 1935 2015 81 3 0 .471 2.09 3.97 .796 .789 .220 2.61 .585 .050 2

12 318B 1936 2015 80 3 1 .546 2.61 6.44 1.291 .844 .241 2.45 .376 -.013 1

13 319A 1943 2015 73 3 0 .625 1.96 3.19 .465 .688 .149 2.50 .509 -.071 3

14 319B 1942 2015 74 3 0 .616 1.99 3.86 .614 .786 .166 2.54 .484 -.007 1

15 320A 1884 2015 132 5 3 .323 1.23 3.55 .861 .898 .284 2.52 .352 -.054 1

16 320B 1884 2015 132 5 3 .305 1.19 3.33 .644 .849 .268 2.75 .508 -.043 1

17 321A 1904 2015 112 4 0 .433 1.78 4.05 .890 .894 .181 2.69 .452 -.059 1

18 321B 1888 2015 128 5 0 .501 1.52 3.71 .836 .891 .218 2.59 .397 .013 1

19 699A 1930 2015 86 3 0 .641 2.40 3.93 .570 .483 .200 2.63 .590 -.063 1

20 699B 1921 2015 95 4 0 .542 2.33 3.95 .679 .714 .178 2.58 .522 -.022 1

21 700A 1953 2015 63 2 2 .299 1.84 3.14 .668 .554 .288 2.45 .467 -.074 1

22 700B 1953 2015 63 2 2 .256 1.46 2.63 .555 .471 .352 2.54 .502 -.067 1

23 1063A 1924 2015 92 4 0 .634 1.84 2.96 .756 .802 .236 2.62 .503 -.015 1

24 1063B 1924 2015 92 4 0 .789 1.96 3.80 .867 .806 .226 2.72 .531 .034 1

25 1064A 1931 2015 85 3 0 .713 1.92 3.93 .802 .805 .242 2.42 .370 .039 1

26 1064B 1927 2015 89 3 0 .472 2.08 4.36 .937 .903 .199 2.37 .352 .013 1

27 1178A 1926 2015 90 3 0 .550 1.48 2.60 .535 .759 .230 2.55 .428 .050 1

28 1178B 1924 2015 92 4 0 .629 1.28 2.34 .485 .722 .262 2.47 .434 -.048 1

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Total or mean: 2555 97 14 .501 1.80 6.44 .713 .760 .226 2.75 .448 -.019

- = [ COFECHA ACRU COF ] = -