*Supplementary Information*

# Trends and uncertainties in Siberian indicators of 20 century warming

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*Tree-ring data*

The study area encompasses most of the plains and plateaus of Siberia including the Putorana and Chersky Mountains roughly separating western from eastern and northeastern Siberia. The area represents a significant portion of the circumpolar dendroclimatological dataset collected in the early 1990's by F.H. Schweingruber and colleagues including tree-ring width (TRW) and maximum latewood density (MXD) measurements (Schweingruber, 1993). The same data have previously been used to reconstruct spatial temperature patterns associated with pre-instrumental volcanic events (Briffa et al., 1998a), and to identify DP over larger regions (Briffa et al., 1998b). Generally, MXD derived timeseries correlate better than TRW with temperatures, contain less serial correlation -- i.e. are better high frequency indicators of summer temperature -- but might also be limited in reconstructing low frequency, multi-centennial climatic trends when using material from only living trees (Frank & Esper, 2005a, 2005b).

Tables S1 and S2 provide detail on the tree-ring clusters 1, 2, ...7 and the 78 site chronologies used in this study. The mean interseries correlation (Rbar) is a widely used measure of the internal coherence of tree-ring data (Cook and Kairiukstis, 1990). Higher Rbar scores often indicate datasets contain a stronger climatic signal. Measures of the lag-1 autocorrelation (AC(1)) are generally higher for TRW than MXD, and provide an idea of the memory or persistence of tree-ring timeseries. The 78 site records listed in Table S2 are a subset of all 97 datasets available in the study region. 19 of these datasets were discarded due to length requirements, i.e. records that start did not span the 1800 to 1970 period, or obvious lack of correlation with neighboring chronologies.

**Table S1** Tree-ring data statistics of clusters C1 to C7, their regional means C1-3 and C4-6, and the mean of all data C1-7. MTA is mean tree age, Rbar is mean interseries correlation, and AC(1) is first year autocorrelation. Rbar and AC(1) were derived from 32-year spline and RCS detrended data (since 1800 AD), respectively.

| | No. Sites | | | | | Ring Density | | | Ring Width | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Cluster | (Larch/Spruce/Pine) | Lon. | Lat. | No. Cores | MTA | Mean | Rbar | AC(1) | Mean | Rbar | AC(1) |
| C1 | 12 (4/5/3) | 67 | 66 | 501 | 182 | 0.73 | 0.56 | 0.32 | 0.53 | 0.55 | 0.51 |
| C2 | 13 (11/2/0) | 80 | 67 | 587 | 185 | 0.79 | 0.65 | 0.08 | 0.59 | 0.64 | 0.47 |
| C3 | 7 (4/2/1) | 92 | 70 | 350 | 203 | 0.76 | 0.61 | 0.04 | 0.37 | 0.62 | 0.37 |
| *C1–3* | *32 (19/9/4)* | *80* | *68* | *1438* | *190* | *0.76* | *0.61* | *0.15* | *0.49* | *0.60* | *0.45* |
| C4 | 10 (8/1/1) | 111 | 70 | 402 | 220 | 0.74 | 0.62 | 0.12 | 0.33 | 0.62 | 0.23 |
| C5 | 18 (18/0/0) | 146 | 69 | 620 | 277 | 0.76 | 0.61 | 0.18 | 0.32 | 0.61 | 0.23 |
| C6 | 11 (8/2/1) | 138 | 65 | 319 | 245 | 0.84 | 0.41 | 0.36 | 0.41 | 0.45 | 0.39 |
| *C4–6* | *39 (34/3/2)* | *132* | *68* | *1341* | *247* | *0.78* | *0.55* | *0.22* | *0.35* | *0.56* | *0.28* |
| C7 | 7 (7/0/0) | 154 | 62 | 296 | 309 | 0.78 | 0.58 | 0.18 | 0.36 | 0.61 | 0.27 |
| **C1–7** | **78 (60/12/6)** | **113** | **67** | **3075** | **232** | **0.77** | **0.58** | **0.18** | **0.41** | **0.59** | **0.35** |

**Table S2** Tree-ring site statistics.

| No. | Cluster | Site | Lon. | Lat. | Species | No. Cores | First Year | Last Year | MTA Mean | MTA STD | MXD Mean | MXD Rbar | MXD AC(1) | TRW Mean | TRW Rbar | TRW AC(1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | WLA65,5 | 60.6 | 65.5 | Larix | 32 | 1588 | 1990 | 297 | 66 | 0.79 | 0.73 | 0.20 | 0.42 | 0.76 | 0.16 |
| 2 | 1 | WPI62,9 | 76.4 | 62.9 | Pinus | 26 | 1726 | 1994 | 182 | 27 | 0.68 | 0.67 | 0.21 | 0.87 | 0.55 | 0.53 |
| 3 | 1 | WLA67,2 | 69.8 | 67.2 | Larix | 34 | 1782 | 1990 | 114 | 49 | 0.72 | 0.68 | 0.19 | 0.68 | 0.71 | 0.43 |
| 4 | 1 | WLA66,9 | 65.6 | 66.9 | Larix | 91 | 914 | 1990 | 163 | 106 | 0.74 | 0.63 | 0.32 | 0.51 | 0.68 | 0.51 |
| 5 | 1 | WLa66,8 | 65.5 | 66.8 | Larix | 34 | 1641 | 2001 | 227 | 100 | 0.85 | 0.69 | 0.35 | 0.51 | 0.72 | 0.63 |
| 6 | 1 | WPi67,8 | 60.2 | 67.8 | Picea | 101 | 1751 | 2000 | 82 | 61 | 0.77 | 0.57 | 0.36 | 0.50 | 0.48 | 0.73 |
| 7 | 1 | WPC66,9 | 65.6 | 66.9 | Picea | 32 | 1663 | 1990 | 194 | 76 | 0.67 | 0.36 | 0.46 | 0.32 | 0.34 | 0.64 |
| 8 | 1 | WPi66,8 | 65.5 | 66.8 | Pinus | 39 | 1550 | 2001 | 199 | 114 | 0.73 | 0.39 | 0.33 | 0.45 | 0.40 | 0.68 |
| 9 | 1 | WPC66,8 | 69.3 | 66.8 | Picea | 24 | 1710 | 1990 | 185 | 53 | 0.66 | 0.42 | 0.46 | 0.32 | 0.50 | 0.42 |
| 10 | 1 | WPI65,3 | 69.7 | 65.3 | Pinus | 26 | 1674 | 1991 | 183 | 80 | 0.64 | 0.57 | 0.49 | 0.71 | 0.51 | 0.78 |
| 11 | 1 | WPC65,4 | 69.5 | 65.4 | Picea | 34 | 1601 | 1991 | 214 | 96 | 0.77 | 0.49 | 0.21 | 0.50 | 0.43 | 0.23 |
| 12 | 1 | WPC66,1 | 71.7 | 66.1 | Picea | 28 | 1720 | 1990 | 146 | 63 | 0.68 | 0.52 | 0.27 | 0.52 | 0.55 | 0.37 |
| 13 | 2 | WLA65,4 | 72.9 | 65.4 | Larix | 29 | 1767 | 1990 | 185 | 32 | 0.82 | 0.64 | 0.12 | 0.73 | 0.62 | 0.71 |
| 14 | 2 | WPC66,7 | 82.3 | 66.7 | Picea | 31 | 1674 | 1990 | 263 | 40 | 0.75 | 0.44 | 0.08 | 0.46 | 0.50 | 0.36 |
| 15 | 2 | WPC66,0 | 77.7 | 66.1 | Picea | 26 | 1752 | 1990 | 153 | 43 | 0.66 | 0.57 | 0.12 | 0.72 | 0.45 | 0.55 |
| 16 | 2 | WLA66,0 | 77.7 | 66.1 | Larix | 27 | 1671 | 1990 | 159 | 59 | 0.88 | 0.64 | 0.08 | 0.71 | 0.63 | 0.49 |
| 17 | 2 | WLA66,1 | 77.7 | 66.1 | Larix | 26 | 1780 | 1990 | 141 | 41 | 0.82 | 0.65 | 0.05 | 0.59 | 0.65 | 0.60 |
| 18 | 2 | WLA68,0 | 88.9 | 68.0 | Larix | 20 | 1574 | 1990 | 285 | 80 | 0.79 | 0.71 | 0.09 | 0.55 | 0.71 | 0.41 |
| 19 | 2 | WLA67,5 | 76.8 | 67.5 | Larix | 27 | 1585 | 1990 | 256 | 94 | 0.80 | 0.72 | 0.06 | 0.41 | 0.72 | 0.45 |
| 20 | 2 | WLA68,2 | 80.2 | 68.3 | Larix | 26 | 1592 | 1990 | 232 | 90 | 0.73 | 0.75 | 0.10 | 0.45 | 0.74 | 0.29 |
| 21 | 2 | WLA66,6 | 82.3 | 66.7 | Larix | 80 | 1246 | 1990 | 177 | 62 | 0.75 | 0.63 | 0.09 | 0.59 | 0.56 | 0.50 |
| 22 | 2 | WLa68,3 | 87.8 | 68.3 | Larix | 81 | 1638 | 1998 | 149 | 67 | 0.92 | 0.65 | 0.13 | 0.52 | 0.66 | 0.48 |
| 23 | 2 | WLA69,1 | 84.5 | 69.1 | Larix | 37 | 1624 | 1990 | 187 | 108 | 0.81 | 0.75 | 0.06 | 0.41 | 0.72 | 0.32 |
| 24 | 2 | WLa69,0 | 83.7 | 69.0 | Larix | 57 | 1664 | 2000 | 84 | 93 | 0.75 | 0.64 | 0.03 | 0.61 | 0.64 | 0.42 |
| 25 | 2 | WLa67.3 | 70.0 | 67.3 | Larix | 120 | 1580 | 2005 | 136 | 97 | --- | --- | --- | 0.94 | 0.64 | 0.48 |
| 26 | 3 | WPC68,0 | 88.9 | 68.0 | Picea | 26 | 1661 | 1990 | 229 | 60 | 0.71 | 0.46 | -0.06 | 0.35 | 0.53 | 0.30 |
| 27 | 3 | WPC69,6 | 90.5 | 69.6 | Picea | 37 | 1640 | 1990 | 147 | 90 | 0.68 | 0.54 | 0.01 | 0.38 | 0.55 | 0.37 |
| 28 | 3 | WPi68,3 | 87.8 | 68.3 | Pinus | 97 | 1632 | 1998 | 182 | 76 | 0.84 | 0.38 | 0.08 | 0.33 | 0.43 | 0.62 |
| 29 | 3 | WLA69,5 | 97.5 | 69.5 | Larix | 26 | 1540 | 1990 | 309 | 71 | 0.81 | 0.74 | 0.10 | 0.32 | 0.72 | 0.36 |
| 30 | 3 | WLA70,5 | 89.5 | 70.5 | Larix | 38 | 1657 | 1990 | 173 | 78 | 0.73 | 0.71 | 0.08 | 0.46 | 0.69 | 0.29 |
| 31 | 3 | WLA71,3 | 93.8 | 71.3 | Larix | 42 | 1569 | 1990 | 198 | 100 | 0.74 | 0.77 | 0.08 | 0.36 | 0.73 | 0.29 |
| 32 | 3 | WLa70,4 | 92.9 | 70.4 | Larix | 84 | 1663 | 2002 | 184 | 83 | 0.80 | 0.70 | 0.02 | 0.37 | 0.66 | 0.33 |
| 33 | 4 | EPC70,3 | 103.5 | 70.3 | Picea | 47 | 1630 | 1990 | 123 | 66 | 0.73 | 0.57 | 0.08 | 0.36 | 0.51 | 0.48 |
| 34 | 4 | EPI66,5 | 122.3 | 66.5 | Pinus | 31 | 1564 | 1991 | 210 | 85 | 0.58 | 0.39 | 0.33 | 0.47 | 0.47 | 0.23 |
| 35 | 4 | ELA68,6 | 112.3 | 68.6 | Larix | 30 | 1450 | 1990 | 335 | 107 | 0.80 | 0.51 | -0.07 | 0.23 | 0.67 | -0.02 |
| 36 | 4 | ELA69,8 | 119.1 | 69.8 | Larix | 26 | 1482 | 1990 | 353 | 81 | 0.81 | 0.53 | 0.15 | 0.29 | 0.66 | 0.10 |
| 37 | 4 | ELA69,7 | 112.8 | 69.8 | Larix | 52 | 1564 | 1990 | 223 | 113 | 0.84 | 0.61 | 0.11 | 0.39 | 0.64 | 0.14 |
| 38 | 4 | ELA70,6 | 104.3 | 70.6 | Larix | 36 | 1563 | 1990 | 222 | 98 | 0.76 | 0.68 | 0.17 | 0.36 | 0.62 | 0.35 |
| 39 | 4 | ELA71,7 | 118.6 | 71.7 | Larix | 56 | 1708 | 1990 | 138 | 95 | 0.69 | 0.74 | 0.08 | 0.29 | 0.71 | 0.27 |
| 40 | 4 | ELA71,9 | 111.0 | 71.9 | Larix | 56 | 1625 | 1990 | 179 | 113 | 0.71 | 0.71 | 0.12 | 0.25 | 0.66 | 0.16 |
| 41 | 4 | ELA72,4 | 101.8 | 72.5 | Larix | 24 | 1624 | 1990 | 209 | 84 | 0.72 | 0.79 | 0.13 | 0.35 | 0.71 | 0.22 |
| 42 | 4 | ELA72,5 | 105.2 | 72.5 | Larix | 44 | 1580 | 1997 | 212 | 68 | --- | --- | --- | 0.27 | 0.56 | 0.32 |
| 43 | 5 | NLA68,8 | 163.1 | 68.8 | Larix | 34 | 1538 | 1991 | 273 | 113 | 0.74 | 0.56 | 0.03 | 0.37 | 0.62 | 0.29 |
| 44 | 5 | NLA66,2 | 165.4 | 66.2 | Larix | 34 | 1492 | 1991 | 256 | 96 | 0.79 | 0.56 | 0.12 | 0.45 | 0.57 | -0.01 |
| 45 | 5 | NLA67,5 | 167.7 | 67.5 | Larix | 25 | 1432 | 1991 | 405 | 90 | 0.78 | 0.63 | 0.20 | 0.24 | 0.69 | 0.22 |
| 46 | 5 | NLA67,3 | 153.7 | 67.3 | Larix | 34 | 1556 | 1991 | 241 | 94 | 0.85 | 0.46 | 0.11 | 0.37 | 0.48 | 0.51 |
| 47 | 5 | ELA68,4 | 143.2 | 68.4 | Larix | 32 | 1553 | 1991 | 205 | 103 | 0.87 | 0.42 | 0.28 | 0.45 | 0.53 | 0.43 |
| 48 | 5 | ELA68,5 | 147.6 | 68.5 | Larix | 40 | 1579 | 1991 | 243 | 119 | 0.78 | 0.57 | 0.24 | 0.39 | 0.56 | 0.58 |
| 49 | 5 | ELA70,2 | 148.1 | 70.3 | Larix | 37 | 1434 | 1990 | 251 | 92 | 0.74 | 0.73 | 0.21 | 0.32 | 0.67 | 0.12 |
| 50 | 5 | NLA69,3 | 154.8 | 69.3 | Larix | 32 | 1449 | 1991 | 267 | 58 | 0.68 | 0.74 | 0.22 | 0.28 | 0.67 | 0.46 |
| 51 | 5 | ELA67,8 | 130.8 | 67.8 | Larix | 29 | 1669 | 1991 | 161 | 79 | 0.74 | 0.68 | 0.10 | 0.38 | 0.64 | 0.30 |
| 52 | 5 | ELA70,3 | 138.2 | 70.3 | Larix | 29 | 1550 | 1991 | 204 | 88 | 0.74 | 0.57 | 0.29 | 0.37 | 0.51 | 0.44 |
| 53 | 5 | ELA71,0 | 133.0 | 71.0 | Larix | 28 | 1496 | 1991 | 251 | 107 | 0.70 | 0.64 | 0.17 | 0.25 | 0.61 | 0.11 |
| 54 | 5 | ELA71,2 | 127.4 | 71.2 | Larix | 34 | 1391 | 1990 | 330 | 104 | 0.75 | 0.72 | 0.23 | 0.28 | 0.69 | 0.07 |
| 55 | 5 | ELA70,7 | 125.9 | 70.7 | Larix | 90 | 1405 | 1994 | 306 | 100 | --- | --- | --- | 0.29 | 0.61 | 0.00 |
| 56 | 5 | NLA69,5 | 150.3 | 69.5 | Larix | 11 | 1500 | 1994 | 331 | 88 | --- | --- | --- | 0.34 | 0.72 | 0.19 |
| 57 | 5 | ELA70,1 | 146.5 | 70.1 | Larix | 36 | 1572 | 1994 | 175 | 76 | --- | --- | --- | 0.32 | 0.64 | 0.23 |
| 58 | 5 | ELA70,5 | 148.1 | 70.5 | Larix | 10 | 1412 | 1994 | 380 | 106 | --- | --- | --- | 0.24 | 0.67 | 0.05 |
| 59 | 5 | ELA69,5 | 147.0 | 69.5 | Larix | 34 | 1259 | 1994 | 397 | 74 | --- | --- | --- | 0.21 | 0.57 | 0.06 |
| 60 | 5 | ELA70,4 | 143.9 | 70.4 | Larix | 51 | 1493 | 1994 | 302 | 97 | --- | --- | --- | 0.23 | 0.60 | 0.12 |
| 61 | 6 | ELa63,2 | 139.2 | 63.2 | Pinus | 20 | 1588 | 2001 | 327 | 45 | 0.87 | 0.41 | 0.69 | 0.29 | 0.51 | 0.68 |
| 62 | 6 | ELA61,2 | 136.6 | 61.2 | Larix | 30 | 1647 | 1992 | 265 | 83 | 0.88 | 0.26 | 0.33 | 0.37 | 0.41 | 0.29 |
| 63 | 6 | ELA69,3 | 125.3 | 69.3 | Larix | 27 | 1694 | 1990 | 179 | 132 | 0.94 | 0.43 | 0.55 | 0.54 | 0.53 | 0.05 |
| 64 | 6 | ELA64,9 | 132.9 | 64.9 | Larix | 32 | 1564 | 1991 | 222 | 94 | 0.81 | 0.37 | 0.33 | 0.34 | 0.40 | 0.51 |
| 65 | 6 | ELA67,6 | 137.5 | 67.6 | Larix | 31 | 1565 | 1991 | 247 | 87 | 0.82 | 0.45 | 0.09 | 0.35 | 0.44 | 0.40 |
| 66 | 6 | ELA65,2 | 149.4 | 65.2 | Larix | 34 | 1555 | 1991 | 276 | 69 | 0.88 | 0.47 | 0.38 | 0.41 | 0.45 | 0.43 |
| 67 | 6 | ELA67,5 | 142.6 | 67.5 | Larix | 35 | 1591 | 1991 | 220 | 85 | 0.83 | 0.44 | 0.31 | 0.37 | 0.41 | 0.57 |
| 68 | 6 | EPC61,2 | 136.6 | 61.2 | Picea | 28 | 1664 | 1992 | 278 | 34 | 0.73 | 0.25 | 0.39 | 0.30 | 0.40 | 0.05 |
| 69 | 6 | EPC62,5 | 137.8 | 62.5 | Picea | 24 | 1729 | 1991 | 173 | 51 | 0.75 | 0.42 | 0.27 | 0.59 | 0.35 | 0.57 |
| 70 | 6 | ELA62,5 | 137.8 | 62.5 | Larix | 32 | 1568 | 1990 | 282 | 97 | 0.86 | 0.52 | 0.31 | 0.52 | 0.63 | 0.34 |
| 71 | 6 | ELA65,8 | 137.3 | 65.8 | Larix | 26 | 1580 | 1991 | 223 | 78 | 0.84 | 0.50 | 0.31 | 0.40 | 0.46 | 0.39 |
| 72 | 7 | NLA60,4 | 154.1 | 60.4 | Larix | 30 | 1690 | 1993 | 208 | 44 | 0.81 | 0.55 | 0.05 | 0.63 | 0.59 | 0.40 |
| 73 | 7 | NLA63,5 | 151.7 | 63.5 | Larix | 28 | 1362 | 1991 | 417 | 97 | 0.86 | 0.53 | 0.14 | 0.32 | 0.57 | 0.60 |
| 74 | 7 | NLA63,7 | 160.0 | 63.7 | Larix | 52 | 1560 | 1994 | 302 | 77 | 0.73 | 0.64 | 0.24 | 0.31 | 0.64 | 0.16 |
| 75 | 7 | NLA61,2 | 154.0 | 61.2 | Larix | 60 | 1547 | 1994 | 253 | 110 | 0.77 | 0.59 | 0.24 | 0.37 | 0.63 | 0.18 |
| 76 | 7 | NLA62,1 | 154.6 | 62.1 | Larix | 64 | 1497 | 1994 | 330 | 89 | 0.83 | 0.54 | 0.13 | 0.31 | 0.57 | 0.03 |
| 77 | 7 | ELA63,6 | 148.3 | 63.6 | Larix | 34 | 1688 | 1991 | 213 | 60 | 0.73 | 0.63 | 0.22 | 0.36 | 0.61 | 0.30 |
| 78 | 7 | NLA61,3 | 152.0 | 61.3 | Larix | 28 | 1338 | 1994 | 438 | 103 | 0.71 | 0.56 | 0.25 | 0.19 | 0.64 | 0.24 |

*Climate data*

Two versions of monthly station temperatures were considered: the raw and adjusted data of the Global Historical Climatology Network (GHCN; Peterson et al., 1997), also available via the Royal Netherlands Meteorological Institute (KNMI; Oldenborgh et al., 2003). Considering these data, we calculated monthly anomalies with respect to the 1951-1980 period, computed mean JJA timeseries for each of the 13 stations, averaged these records for the 6 WSIB, 5 ESIB, and 2 NESIB stations, and used the raw GHCN data for tree-ring calibration.

Table S3 provides detail on the 13 Siberian climate stations that started operating before 1910. The 1900-90 trends were obtained by fitting linear regressions lines to unadjusted JJA mean temperature timeseries. Inhabitant statistics were obtained from various Russian online resources.

**Table S3** Siberian long-term climate stations.

| | Station | Lat. | Lon. | Period | 1900–90 Trends | Population (Year) | |
|---|---|---|---|---|---|---|---|
| WSIB | 1 Berezovo | 63.9 | 65.0 | 1881–1990 | 0.27 | 1,400 (1897) | 6,700 (2002) |
| | 2 Salehard | 66.5 | 66.7 | 1882–now | -0.13 | 500 (1897) | 40,000 (2007) |
| | 3 Hanty-Mansijs | 61.0 | 69.0 | 1892–now | 0.18 | 7,500 (1939) | 63,200 (2007) |
| | 4 Surgut | 61.2 | 73.5 | 1884–1985 | 0.54 | 1,100 (1897) | 289,900 (2007) |
| | 5 Dudinka | 69.4 | 86.2 | 1906–1990 | 0.81 | 80 (1926) | 26,800 (2000) |
| | 6 Turuhansk | 65.8 | 87.9 | 1881–now | 0.65 | 212 (1897) | 4,800 (2002) |
| ESIB | 7 Olekminsk | 60.4 | 120.4 | 1882–1990 | -1.71 | 1,144 (1897) | 10,003 (2002) |
| | 8 Viljujsk | 63.8 | 121.6 | 1898–now | -0.05 | 600 (1897) | 10,000 (2002) |
| | 9 Jakutsk | 62.0 | 129.7 | 1829–now | 0.20 | 6,500 (1897) | 246,000 (2007) |
| | 10 Verhojansk | 67.5 | 133.4 | 1885–now | -0.13 | 400 (1897) | 1,300 (2007) |
| | 11 Ust'-Maja | 60.4 | 134.4 | 1893–1990 | -0.51 | — | 3,800 (1999) |
| NESIB | 12 Markovo | 64.7 | 170.4 | 1894–1990 | 0.33 | — | 600 (2000) |
| | 13 Anadyr' | 64.8 | 177.6 | 1898–now | 0.55 | 200 (1927) | 11,900 (2000) |

*Detrending and chronology building*

We applied four detrending methods, RCS, HUG, EXP, and SPL, to the single TRW and MXD measurement series by calculating ratios (residuals for HUG; Briffa et al. 1998) between the raw data and fitted growth curves. For each method, detrended series were averaged per site using a robust bi-weight mean and the variance of the mean chronologies' stabilized for changes in sample replication and interseries correlation (Frank et al., 2007). Chronologies were truncated over the 1801-1990 common period (1801-2000 for the WSIB update), and subsequently averaged to form the mean cluster chronologies (C1, C2, …, C7). RCS was applied on a site-by-site basis (Esper et al., 2007), and the mean of all age-aligned data (i.e., the Regional Curve) smoothed using a 10-year spline (details in Esper et al., 2003). HUG included growth curve functions with positive slopes; EXP excluded such functions but utilized the long-term mean instead. SPL included the application of a cubic smoothing spline with a 50% frequency-response cutoff for 300-year waveforms (details in Cook and Peters, 1981).

*Regional residual timeseries*

Figure S1 provides detail on the instrumental and proxy residuals in WSIB, ESIB, and NESIB (see main text for a description of residual calculation). Residuals were of similar size in WSIB and ESIB, including changes from about 1°C to 0°C over the past century. In NESIB, where the proxy/temperature fit was weaker and the station data adjustments smaller, proxy residuals were about an order of magnitude larger than temperature residuals. As these

differences were biased by the greater distance between proxy and temperature sites, the NESIB data were not included in the comparison as shown in Fig. 9 of the main text.

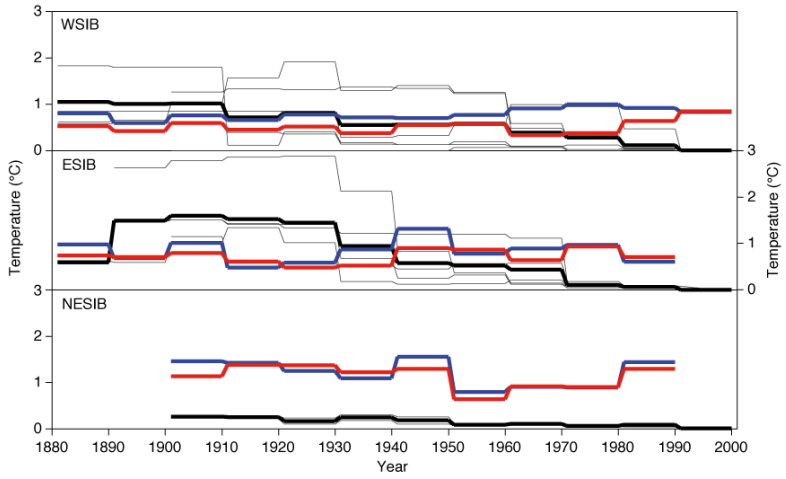


**Fig. S1** Decadally averaged residuals of the raw *versus* adjusted JJA temperature data (black), the MXD *versus* JJA temperature data (red), and the TRW *versus* JJA temperature data (blue).

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