

Additional analyses and verification sensitivity

This supplement accompanies both text replies. It presents new diagnostics and corrected figures, without reproducing the revised manuscript. The frozen R0 chronology, target, calibration and original verification splits were retained. Newly selected periods are identified as review-stage sensitivities.

Table A1. Instrumental-period response and additional annual verification. Correlations use annual RWI and the regional pNov-Apr target. Detrended correlations remove separate linear trends on the same paired years. RMSE uses the mean squared residual denominator n.

Years	n	Raw r	Detrended r	Slope	RMSE (C)
1912-2023	112	0.416	0.370	1.844	0.789
1912-1967	56	0.384	0.414	2.204	0.815
1968-2023	56	0.431	0.186	1.691	0.760
1974-1998	25	0.234	0.175	1.274	0.831
1999-2023	25	0.384	0.168	1.824	0.679

Calibration	Verification	r	RE	CEff
1974-1998	1999-2023	0.384	0.400	0.038
1999-2023	1974-1998	0.234	0.333	0.036
1934-1978	1979-2023	0.359	0.195	0.075
1979-2023	1934-1978	0.579	0.409	0.301

The late-minus-early (1968-2023 minus 1912-1967) slope difference is -0.513 C/RWI. Paired moving-block resampling independently within each half gives a 95% percentile interval of -2.242 to 0.694 (five-year blocks, 3,000 draws, seed 20260928). Three- and ten-year block intervals also include zero. This does not establish equivalence; the late-period detrended correlation is weaker.

The additional 25-year splits each leave only five complete G21 centers per segment, below the eight-observation gate. The added 45-year high-pass tests are positive and evaluable; low-pass tests remain non-evaluable. The original seven annual tests retain six positive RE/CEff outcomes.

Corrected synthetic signal-retention diagnostic

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Table A2. Primary-chronology recovery, corrected against the frozen production baseline. The earlier test covered 482-2025 (1,544 values) and omitted the F buried-wood component through legacy cluster-code handling. Its baseline differed from the production series by up to 0.390433 RWI. The corrected loader preserves all six clusters.

All four unperturbed standardization variants reproduce their frozen counterparts over 2,181 available years (-156 to 2025), with maximum absolute differences of 4.4e-16 RWI or less. Calibration, annual verification and the production chronology itself are unchanged.

Period (yr)	Old r / gain	Corrected r	Corrected gain	Median lag (yr)
11	0.988 / 0.988	0.986	0.987	0
21	0.986 / 0.977	0.985	0.977	0
31	0.983 / 0.960	0.982	0.961	0
51	0.972 / 0.909	0.974	0.919	0
75	0.956 / 0.816	0.962	0.833	0
101	0.925 / 0.671	0.936	0.693	0
150	0.786 / 0.383	0.814	0.388	-1.5
200	0.559 / 0.196	0.578	0.188	-1.5

Design. Multiply each raw width by $\exp[0.05 s(t)]$, where $s(t)$ is a unit-amplitude sinusoid on a continuous elapsed-year axis. The transition 1 BCE to 1 CE advances by one year (no year zero). Use periods 11, 21, 31, 51, 75, 101, 150 and 200 years and phase fractions 0, 0.25, 0.5 and 0.75. Re-run the original juvenile exclusion, individual standardization and aggregation. Divide the injected-minus-unperturbed chronology by 0.05. Correlation and the slope of recovered on imposed signal measure shape and gain. The lag diagnostic searches -10 to +10 annual positions for the largest absolute correlation; it is an internal phase diagnostic. Medians are across four phases for each variant (128 runs in total).

Meaning. Recovery of an imposed common growth signal describes the processing workflow. It does not establish that actual climate sensitivity was common or stationary, and does not independently validate historical temperature amplitude. The earlier numerical summaries and signal-retention figure require replacement in the revision.

Spatial tests and effective sample size

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Table A3. Spatial significance within the displayed map extent. Correlations use the existing paired-year periods and at least 50 overlapping years. Approximate two-sided t tests use the AR(1) effective sample size and $n_{\text{eff}} \geq 8$. Degrees of freedom are $n_{\text{eff}} - 2$ for raw correlations and $n_{\text{eff}} - 3$ after removing a shared linear-time covariate. Benjamini-Yekutieli (BY) adjustment is applied separately within each displayed panel. The Takayama self-correlation is excluded from testing.

Panel / comparison	Transform	Tested	$p < 0.05$	BY $p < 0.05$
a Kiso / JMA	detrended	150	116	93
a Kiso / JMA	raw	150	146	132
b Takayama / JMA	detrended	149	149	148
b Takayama / JMA	raw	149	146	146
c Kiso / CRU	detrended	1640	1101	658
c Kiso / CRU	raw	1640	1640	1613
d Takayama / CRU	detrended	1640	1596	1394
d Takayama / CRU	raw	1640	1640	1640

$n_{\text{eff}} = n(1 - r_{1_obs} r_{1_pred}) / (1 + r_{1_obs} r_{1_pred})$, bounded to $[2, n]$. For spatial tests, lag-one correlations use only calendar-adjacent pairs; gaps are not compressed. In the displayed JMA panels, 12 Kiso comparisons and 10 Takayama comparisons contain gaps; CRU overlaps are complete. Undefined spatial AR1 coefficients yield no test. The verification implementation retains its separate fallback to n , which does not determine the low-pass conclusion.

The correlation tests are approximate, particularly for trending raw series. BY adjusts for multiple comparisons but does not correct an inappropriate time-series model. We therefore show detrended maps alongside raw maps and make no claim of field-level significance, independent replicates, or independent temperature validation.

Verification threshold sensitivity. With at least eight transformed pairs required in both segments, changing the verification n_{eff} threshold to 4, 6, 8, 10 or 12 leaves the original evaluability counts unchanged: annual 7/7; G21 high-pass 4/7; G21 low-pass 0/7; G51 low-pass 0/7. In count-eligible G21 low-pass cases, n_{eff} is 2.00-2.05. Eight is a predefined pragmatic gate, not a universal significance threshold.

References: Bretherton et al. (1999), Journal of Climate, 12, 1990-2009; Benjamini and Yekutieli (2001), The Annals of Statistics, 29, 1165-1188, doi:10.1214/aos/1013699998.

Composition and climate-response methods

Component overlap (Fig. A6). Use saved primary standardized individual-series indices, with no response-based selection or re-detrending. Construct group chronologies by Tukey biweight means. Omit the 20IK bridge assigned to D from pairwise diagnostics to avoid treating shared provenance as independent evidence. Require at least five series per group per year and at least 30 paired years. Cohorts A-C are living-tree cohorts; D is archaeological core material, E historical building wood and F buried wood. Groups are not all known growth sites.

Groups	Years (available)	n	r	Detrended r
A / B	1735-2024	290	0.914	0.908
A / C	1735-2001	267	0.900	0.900
B / C	1697-2001	305	0.861	0.861
C / D	1555-1643	89	0.506	0.560
D / E	1057-1172	116	0.451	0.451
E / F	610-670	58	0.553	0.538
Hinoki / Sawara	1744-2023	280	0.643	0.625

The E-F interval has 58 available pairs within 610-670 and is not continuous. Of 171 source/location pairs, 85 qualify (median $r = 0.627$; range 0.216-0.874). Since the collection is already crossdated, these are conditional measures of shared growth variation, not independent dating tests or proof of temperature specificity. The series-count gate is pragmatic and does not establish equal chronology reliability.

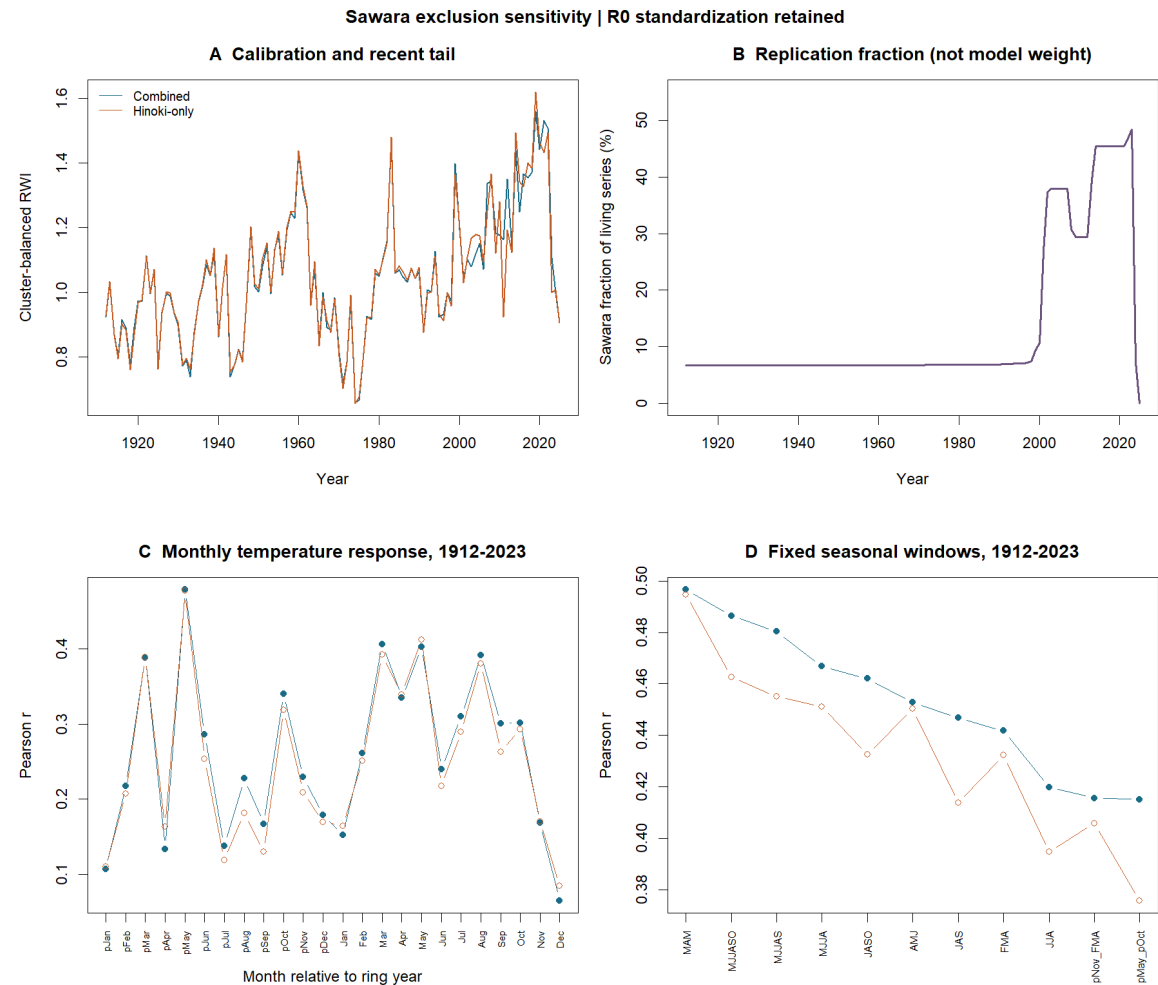
Three missing widths in two buried-wood series (437 and 512-513 CE) are omitted before the existing equally spaced spline fits. Removing both full series as a separate sensitivity gives chronology $r = 0.9987$ over 259-2025; changes occur only in 340-689 (maximum absolute difference 0.0978 RWI). The instrumental predictor is identical. This is not a bound on calendar-spacing error; no widths were imputed and the primary chronology is unchanged.

Monthly response (Figs. A5 and A7). Compare the preceding January through current December for the full 1912-2023 period and its two 56-year halves. Regional temperature uses the unchanged calibration product. Takayama monthly temperature and precipitation were downloaded from JMA on 28 September 2026. Only unflagged numeric values were retained; no interpolation or replacement of flagged values was used.

Fixed winter (pNov-Apr) and growing-season (May-Sep) covariates require every month. The partial-response sample has 107 years within 1912-2022; 2008, 2012, 2014, 2015 and 2023 fail complete-quality criteria for the actual covariates. Unused winter temperature is not required. Adjusting for Takayama winter/growing-season precipitation and growing-season temperature gives partial $r = 0.350$ (raw) or 0.366 (all variables detrended). These descriptive controls neither identify causation nor substitute for site-level soil moisture, drought, snowpack, or carbon-storage data.

Figure A1. Sawara-exclusion sensitivity

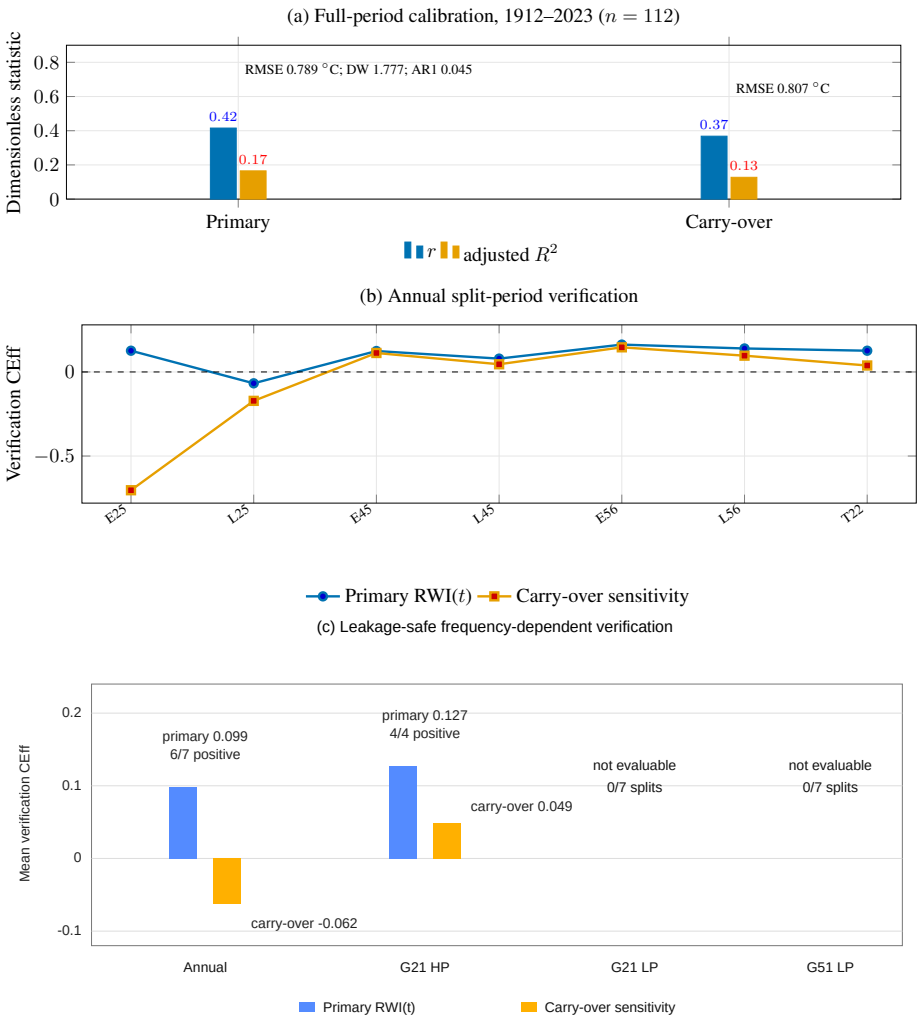
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Combined and Hinoki-only chronologies use identical standardization settings and retain all non-living components. Counts in panel B are replication fractions, not biweight or cluster weights. Calibration: 1912-2023. The modern tail is more sensitive than the earlier instrumental interval.

Figure A2. Corrected calibration/verification figure

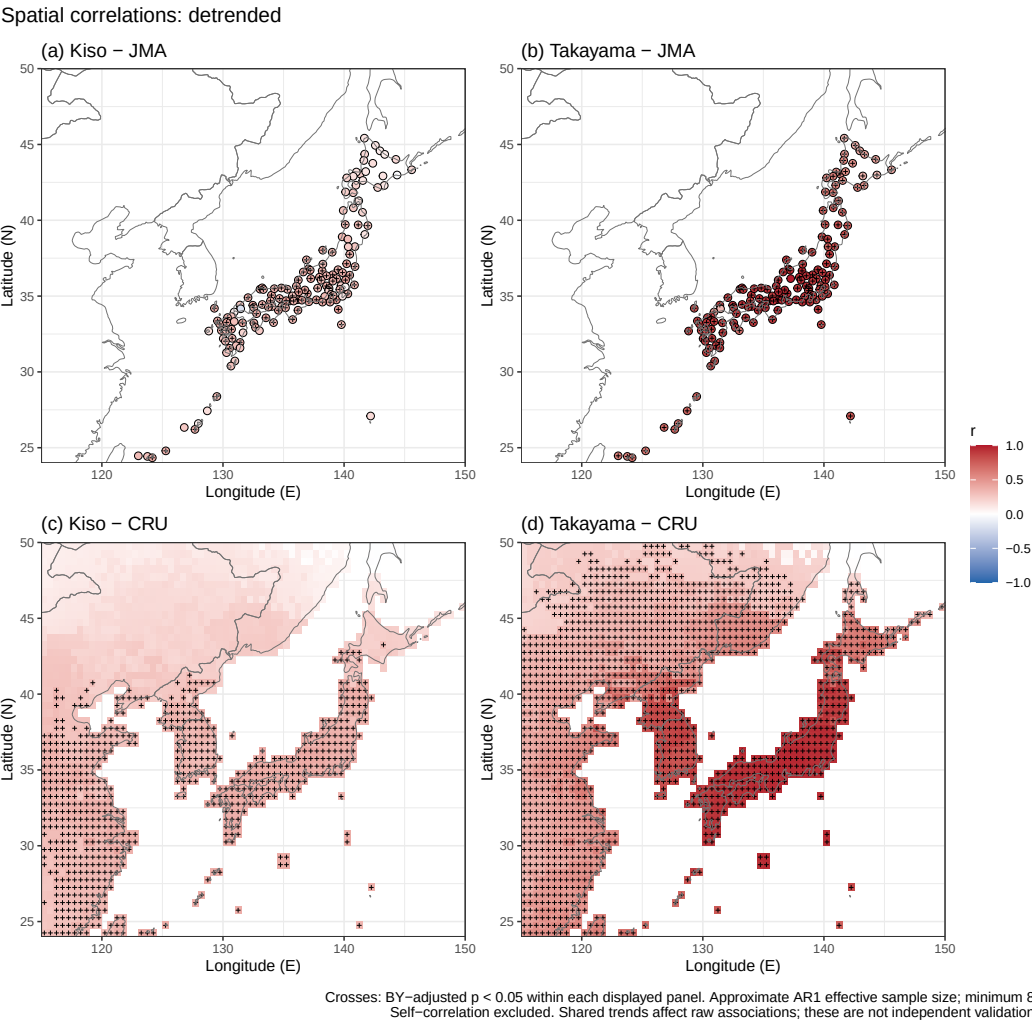
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Replacement for manuscript Fig. 3. Panel (c) was redrawn from the unchanged archived verification summary to correct clipped and overlapping annotations; panels (a) and (b) retain their original vector content. This correction does not change calibration or verification statistics.

Figure A3. Detrended spatial correlations

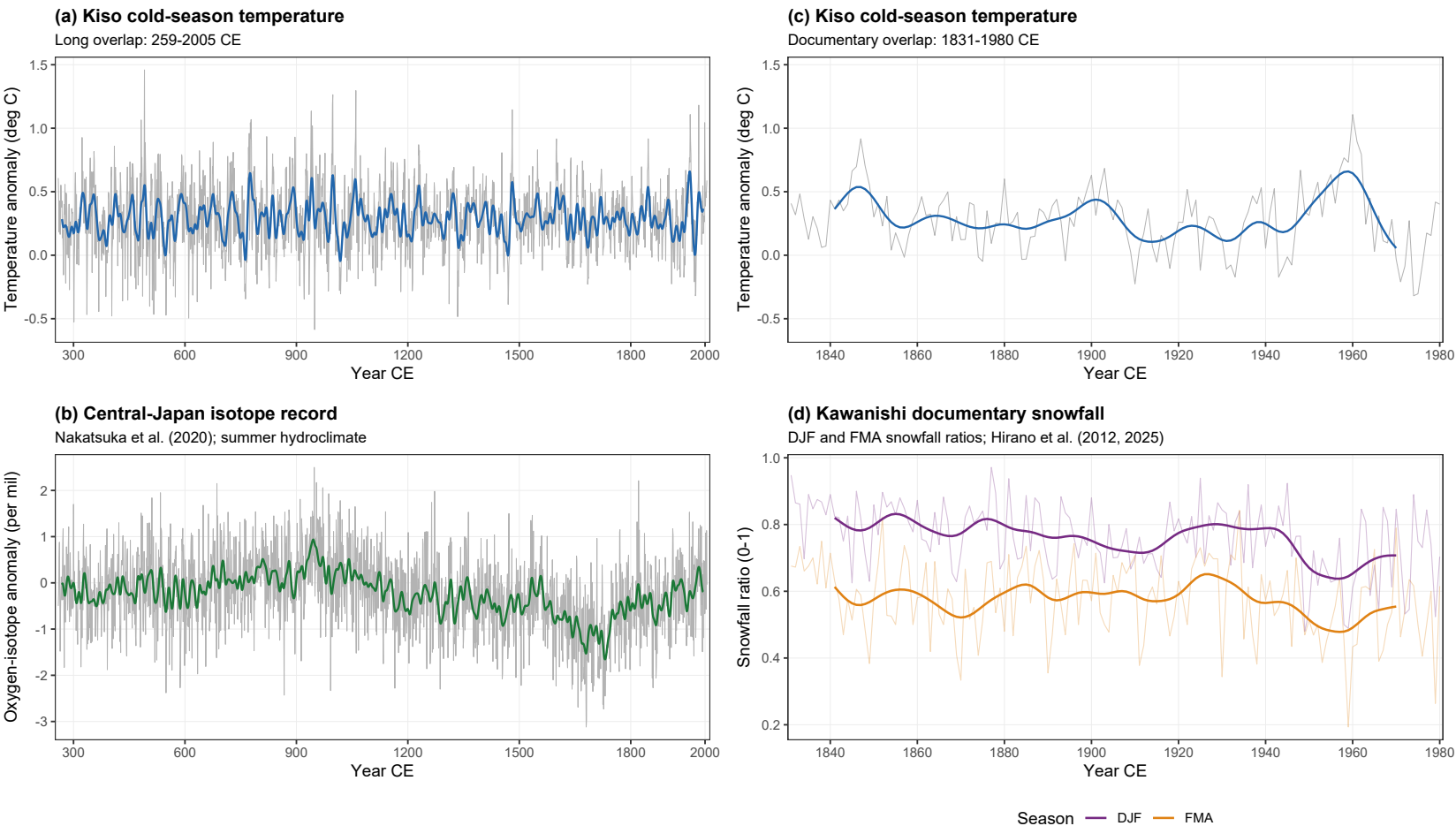
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Separate linear trends were removed on paired years before correlation. Periods and minimum 50-year overlaps match the raw analysis. JMA Kiso overlaps: 54-150 years ending 2023; Takayama: 56-126 ending 2025. CRU Kiso: 1902-2023; Takayama: 1902-2024. Crosses mark BY-adjusted $p < 0.05$; see Table A3 for assumptions and counts.

Figure A4. Isotope and documentary comparison

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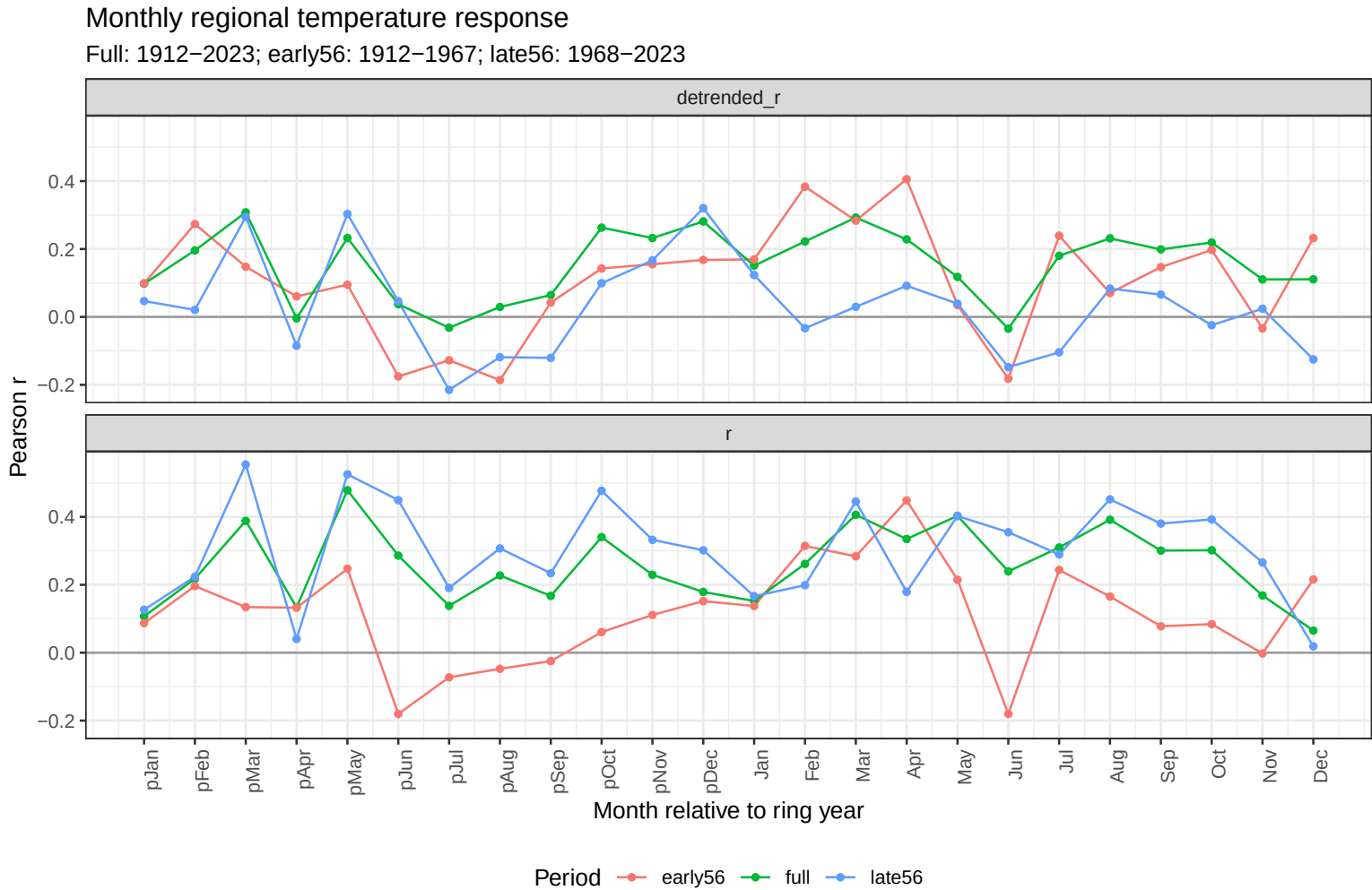


Thin lines: annual values. Thick lines: G21, complete windows within each overlap.
Separate native units and baselines; no axis inversion or temperature conversion. Descriptive context, not validation.

Kiso and archived Nakatsuka et al. (2020) oxygen-isotope anomalies: 259-2005. Kiso and Kawanishi DJF/FMA snowfall ratios: 1831-1980. Thin lines are annual; thick lines use identical centered Gaussian 21-year kernels with incomplete edges omitted. Native units and separate axes are retained. Kiso-isotope annual $r = 0.098$; Kiso-snowfall $r = -0.259 / -0.210$. Data: NOAA/NCEI doi:10.25921/crxm-hs43; Hirano et al. (2012, 2025).

Figure A5. Regional monthly temperature response

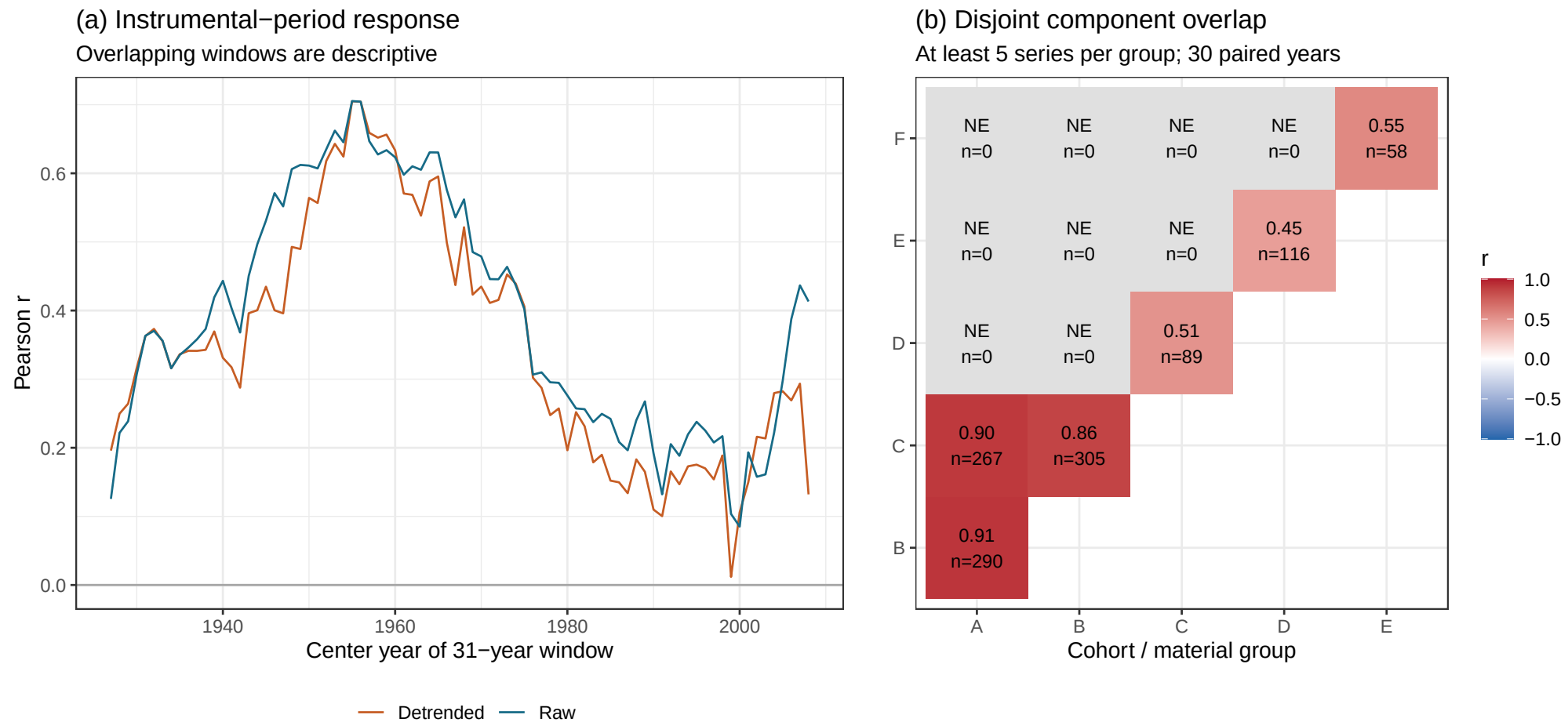
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Temperature responses for the full record and two non-overlapping halves, before and after linear detrending. Negative or zero month positions denote preceding-year months; labels pJan-pDec refer to the preceding year. These descriptive profiles do not establish uniform monthly sensitivity or a causal mechanism.

Figure A6. Temporal response and component overlap

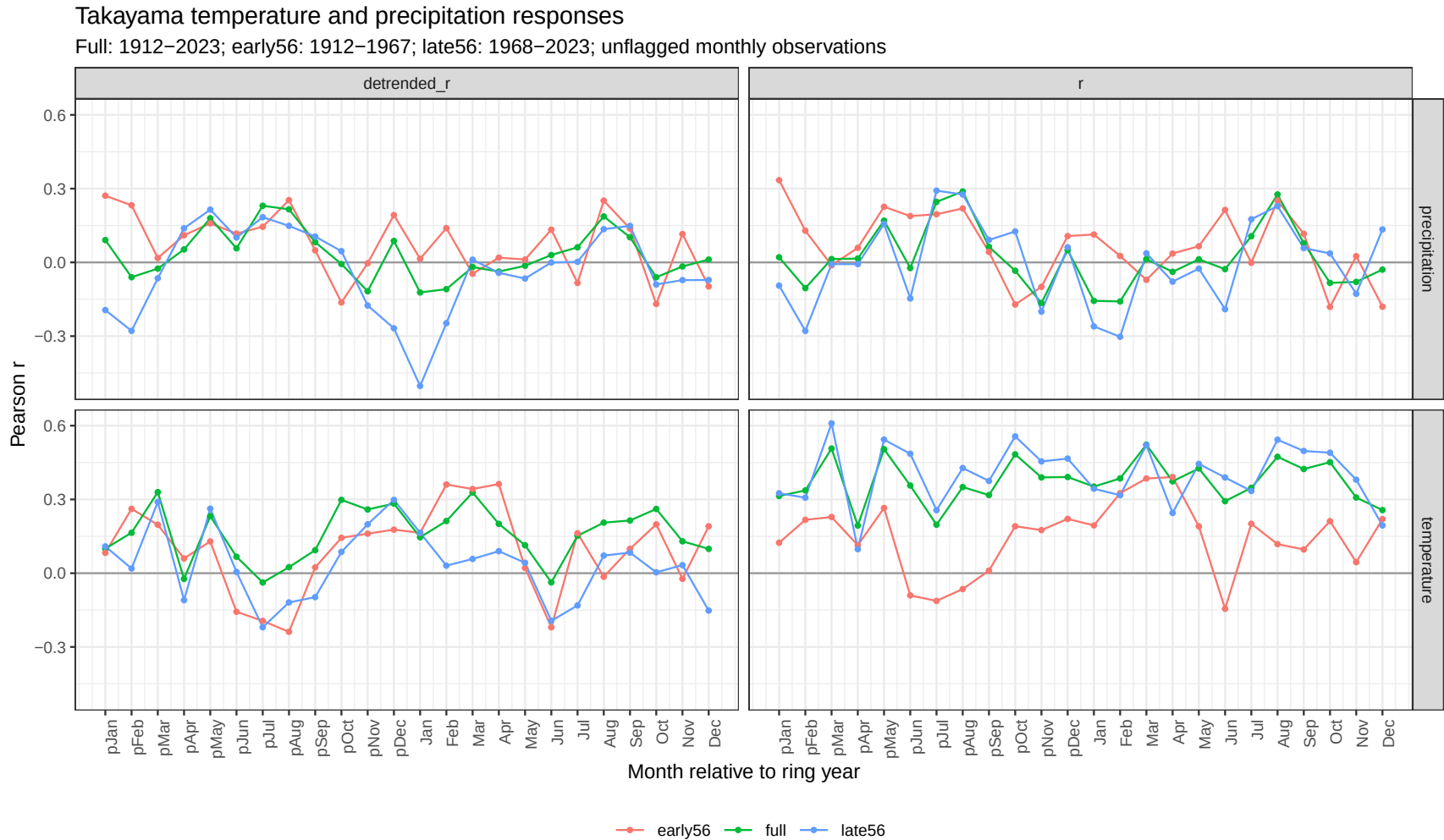
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Panel (a): correlations in 31-year moving windows; adjacent windows are not independent tests. Panel (b): disjoint cohort/material chronologies with at least five series per group per paired year and at least 30 paired years. NE denotes insufficient overlap, not zero correlation. See the composition methods on page 4. Positive overlaps do not demonstrate temperature-response stationarity.

Figure A7. Takayama temperature and precipitation

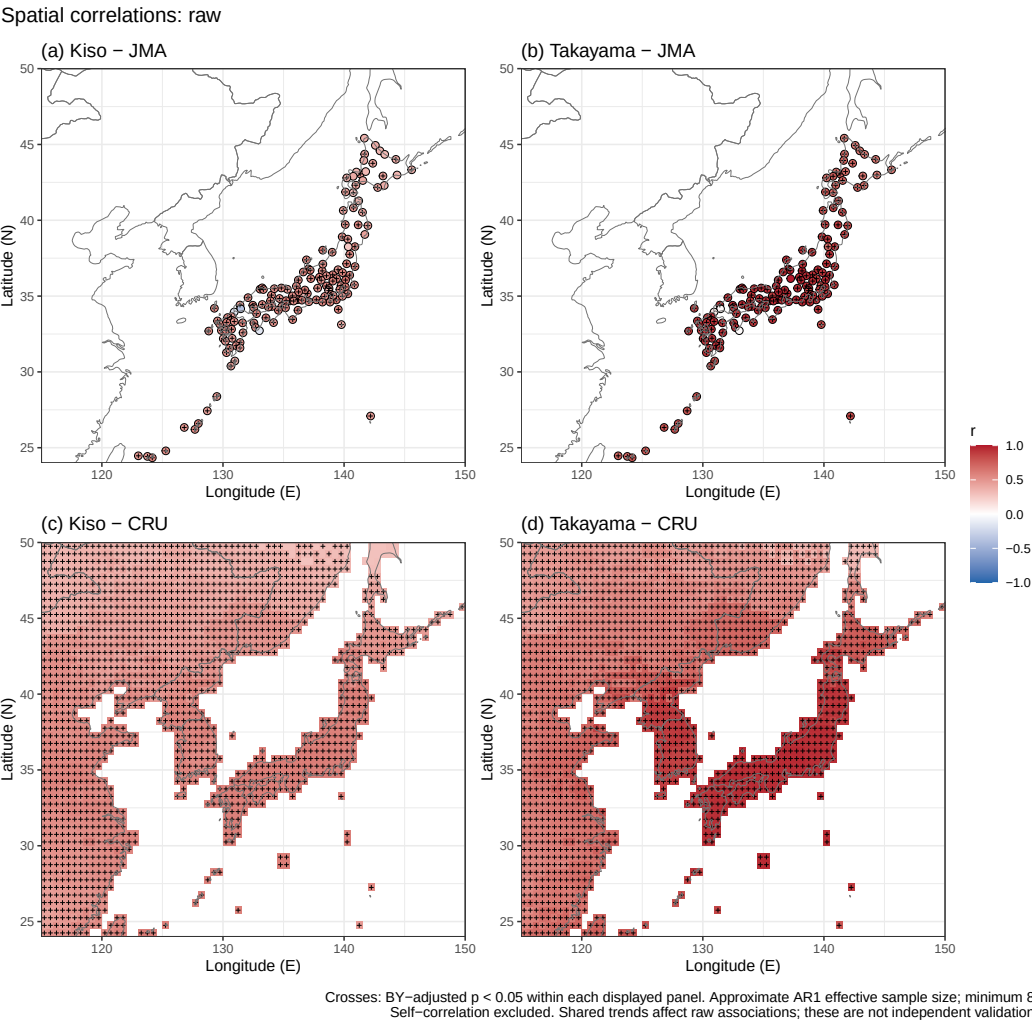
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Full, early-half and late-half monthly responses use only unflagged observations. Sample counts are retained in the analytical CSV files. Linear trends are removed separately within each paired sample for the detrended panels. Temperature and precipitation diagnostics retain the original regional calibration; no seasonal target was reselected.

Figure A8. Raw spatial correlations with test markers

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Raw correlations corresponding to the four comparisons in manuscript Fig. 5. Crosses mark BY-adjusted $p < 0.05$ within each displayed panel; Table A3 specifies the approximate AR1 tests. Raw associations include shared trends. Interpret jointly with the detrended map in Fig. A3; significance markers do not establish independent validation or field-level significance.

References and data sources

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Bretherton et al. (1999). The Effective Number of Spatial Degrees of Freedom of a Time-Varying Field. *Journal of Climate*, 12, 1990-2009. doi:10.1175/1520-0442(1999)012<1990:TENOSD>2.0.CO;2.

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Japan Meteorological Agency, Takayama monthly temperature and precipitation, accessed 28 September 2026. https://www.data.jma.go.jp/stats/etrn/view/monthly_s3.php?prec_no=52&block_no=47617&view=a1 (temperature); replace view=a1 with view=p5 for precipitation.