The CT POWER Heat Stress China Xinjiang Signal: Chinese Supply Overlay for Cotton

Why NASA POWER T2M_MAX heat-stress-day count over Xinjiang (home to 85 percent of Chinese cotton) delivers a statistically significant 26-year directional pattern on Cotton forward 60-day returns.

David Stendahl · Market Lab Analytics · November 6, 2026

The signal with the limits stated upfront

Three things the reader must know before the rest of this brief lands.

First, the full-distribution daily Spearman information coefficient against Cotton forward 60-day returns is plus 0.064 at p-value 1.4e-07 on a sample of 6,676 daily observations spanning 2000 through 2026. Statistically significant on the 26-year window.

Second, the phase pattern is cleanly monotone. Phase +1 (High Heat Stress) delivers plus 6.97 percent fwd60d across 1,699 trading days (25.4 percent of sample); Phase 0 (Normal Temperatures) delivers plus 3.54 percent on 7.8 percent share; Phase −1 (Low Heat Stress) delivers minus 10.44 percent across 4,457 days (66.8 percent). 17.41 percentage point spread between extreme buckets.

Third, the non-overlap independence test at 60-day sampling is sign-consistent but not independently significant. Across 112 independent samples the Spearman is plus 0.144 with p-value 0.13. The directional signal is robust across the full sample but requires combination with sibling China supply signals for conviction-grade positioning.

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The thesis: Xinjiang heat as the Chinese yield channel

Xinjiang produces roughly 85 percent of Chinese cotton on irrigated acreage in the Tarim Basin and northern Xinjiang growing regions. Chinese Xinjiang production has grown progressively over the 2000-2026 period as production shifted from eastern China to Xinjiang irrigated acreage; by the mid-2010s Xinjiang had become essentially synonymous with Chinese cotton supply.

The July-August peak summer window coincides with cotton flowering and early boll development. Cotton plants are most vulnerable to high-temperature damage during this window; T2M_MAX days above 35 degrees Celsius damage yield directly through flower abortion, reduced pollination, and compromised boll-set. Sustained heat stress regimes can compress regional yields by 10-25 percent.

NASA POWER (Prediction Of Worldwide Energy Resources) provides a daily reanalysis of surface temperature and other meteorological variables at point-aggregated 0.5-degree resolution with multi-decade coverage back to 1980. T2M_MAX is the daily maximum 2-meter air temperature. Direct temperature-stress measurement captures yield-damaging days that indirect precipitation or moisture proxies miss.

The signal takes a 30-day rolling count of days where T2M_MAX exceeds 35 degrees Celsius over the Xinjiang cotton region, z-scores on a rolling window, and tanh-bounds. State thresholds plus or minus 0.2 (moderate) and plus or minus 0.5 (extreme). Phase +1 at composite above +0.3, phase −1 below −0.3. Target: ICE US Cotton No. 2 first-nearby back-adjusted close.

Historical window: NASA POWER reanalysis from 1980; engine runs from 2000 onward with 504-bar warmup.

What the firings have actually done

Computed over 6,676 daily observations post-warmup from 2000 onward.

> **Daily Spearman IC (fwd 60d):** plus 0.064, p-value 1.4e-07, N equals 6,676. Statistically significant on the 26-year sample.
>
> **Non-overlap IC (60-day step):** plus 0.144, p-value 0.13, N equals 112. Sign-consistent but not independently significant.
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> **Phase-conditional forward 60-day Cotton returns:** Phase +1 (High Heat Stress, 1,699 days / 25.4 pct): plus 6.97 percent. Phase 0 (Normal Temperatures, 520 days / 7.8 pct): plus 3.54 percent. Phase −1 (Low Heat Stress, 4,457 days / 66.8 pct): minus 10.44 percent.
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> 17.41 percentage point spread between Phase +1 and Phase −1 with monotone phase pattern.

Three findings. The daily IC is statistically significant on the 26-year window. The monotone phase pattern cleanly separates High Heat Stress from Low Heat Stress with a 17.41 pp spread. The sample is heavily skewed toward Phase −1 (66.8 percent) because Xinjiang benefits from continental climate with episodic heat-stress years rather than persistent heatwave regimes.

Three cases that frame how to read the signal

The canonical anchors are the 2022 China heatwave, the 2010 Xinjiang summer heat, and the 2020 benign Xinjiang temperatures.

Case 1: The 2022 China heatwave

High Heat Stress firing through mid-2022 as a record-breaking heatwave hit China including the Xinjiang cotton belt. Composite held in Phase +1 territory through the flowering and boll-set window. Cotton rallied materially through 2022 to above 150 cents per pound consistent with the Phase +1 edge; Chinese yield stress compounded with Texas megadrought, Vidarbha monsoon stress, and Pakistan Punjab deficit producing the broader South Asian plus Chinese cotton supply-shock setup that drove the 2022 Cotton rally.

Case 2: The 2010 Xinjiang summer heat

High Heat Stress firing through mid-2010 as elevated summer temperatures hit Xinjiang cotton belt. Composite held in Phase +1 territory through the flowering window. Cotton rallied through late 2010 and into 2011 consistent with the Phase +1 edge; Xinjiang supply stress compounded with the broader 2010-11 commodity supercycle setup as emerging-market demand surged.

Case 3: The 2020 benign Xinjiang temperatures

Low Heat Stress firing through 2020 as Xinjiang experienced benign summer temperatures with T2M_MAX heat-stress day count running materially below trend. Composite held in Phase −1 territory through the benign window. Cotton underperformed through late 2020 consistent with the Phase −1 edge; Chinese supply strength loosened global balance even through the complicated COVID demand regime where downstream apparel inventory collapsed simultaneously.

How to use this signal today

Composite is currently reading minus 0.572 in the Low Heat Stress band. The Neutral phase began October 2026, 15 trading days ago. NASA POWER T2M_MAX heat-stress-day count over Xinjiang has run below the rolling mean through late 2026 consistent with benign Chinese supply regime.

Pair with the following for stacked conviction: Xinjiang CHIRPS (precipitation complement), USDA PSD US production (top-exporter supply anchor), India Vidarbha and Gujarat GRACE (India supply), Pakistan Punjab CHIRPS (adjacent producer), Baltic freight (global demand), apparel inventory demand, CFTC positioning. This Xinjiang heat signal gives the Chinese supply lens; pair with other regional supply signals for the full global read.

Reader rule: High Heat Stress firings flag bullish supply-shock setups via Chinese yield compression with the 2022 heatwave and 2010 summer heat as benchmarks. Low Heat Stress firings flag bearish regimes where benign temperatures stabilize Chinese production with 2020 as the benchmark.

Methodology

Data source: NASA POWER daily reanalysis T2M_MAX 2-meter maximum air temperature at point-aggregated 0.5-degree resolution over China Xinjiang cotton belt bounding box (Tarim Basin and northern Xinjiang growing regions). Computation: 30-day rolling count of days where T2M_MAX exceeds 35 degrees Celsius, z-scored on a rolling window, tanh-bounded. State thresholds plus or minus 0.2 (moderate) and plus or minus 0.5 (extreme). Phase +1 at composite above +0.3, phase −1 below −0.3. Target: ICE US Cotton No. 2 first-nearby back-adjusted close.

Historical window: NASA POWER reanalysis daily data from 1980; engine runs from 2000 onward with a 504-bar warmup for the rolling z-score.

Validation computed on 6,676 post-warmup daily observations. Daily Spearman IC plus 0.064 at p-value 1.4e-07 across 6,676 observations, statistically significant on 26-year sample. Phase +1 per-day forward return plus 6.97 percent. Phase 0 per-day forward return plus 3.54 percent. Phase −1 per-day forward return minus 10.44 percent. 17.41 pp Phase +1 minus Phase −1 spread. Non-overlap IC at 60-day sampling plus 0.144 at p-value 0.13 across 112 samples, sign-consistent but not independently significant.

What this signal does not cover

The signal does not cover non-Xinjiang Chinese cotton regions (Yellow River basin, Yangtze River basin), which contribute a shrinking share of Chinese production. It does not cover Xinjiang precipitation (see sibling CHIRPS Xinjiang signal). It does not capture Chinese government reserve policy effects (SRB stockpile releases). It does not capture Western sanctions regime effects on Xinjiang-origin cotton (XPCC designations and apparel supply chain restrictions). NASA POWER daily cadence is high-frequency but the 60-day forward horizon requires sustained regimes for signal firings.

Disclaimer

This brief and the signal it describes are for informational purposes only and do not constitute investment, legal, tax, or trading advice. Hypothetical or simulated performance results have certain inherent limitations. Unlike an actual performance record, simulated results do not represent actual trading. Also, since the trades have not been executed, the results may have under- or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. The phase-conditional forward-return stats reported above are a full-sample unconditional measurement. Readers should consult a licensed financial professional before taking any trading action.

References

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