The CT CHIRPS India Vidarbha Precipitation Signal: Indian Rainfed Supply Overlay for Cotton

Why CHIRPS precipitation over Vidarbha, India's largest rainfed cotton belt, delivers a strongly significant 26-year directional pattern on Cotton forward 60-day returns.

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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 0.091 at p-value 8.4e-14 on a sample of 6,676 daily observations spanning 2000 through 2026. Strongly significant on the 26-year window.

Second, the phase pattern is cleanly monotone. Phase +1 (Precip Deficit) delivers plus 6.06 percent fwd60d across 2,034 trading days (30.5 percent of sample); Phase 0 (On Trend) delivers plus 3.95 percent on 7.6 percent share; Phase –1 (Precip Above Trend) delivers minus 11.42 percent across 4,133 days (61.9 percent). 17.48 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 0.147 with p-value 0.12. The directional signal is robust across the full sample but requires combination with sibling India supply signals for conviction-grade positioning.

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The thesis: Vidarbha is India's rainfed cotton heart

India is the world's largest cotton producer. Within India, Maharashtra's Vidarbha region (eastern Maharashtra, roughly the belt from Nagpur south through Yavatmal and Amravati) carries the largest share of rainfed cotton acreage. Unlike Gujarat in the west, which benefits from Sardar Sarovar canal irrigation, and unlike Punjab (India) and Punjab (Pakistan) which carry canal networks from the Himalayan system, Vidarbha cotton depends almost entirely on the southwest monsoon.

The southwest monsoon over Maharashtra runs June through September with peak intensity in July and August. Monsoon moisture during this window determines yield directly; below-trend rainfall

compresses yields materially, and sustained drought regimes can reduce yields by 20-40 percent. Because India dominates global production share, Vidarbha stress transmits directly to global supply balance and Cotton futures at 60-day horizons.

The CHIRPS satellite-rain-gauge blended precipitation product provides daily 5-kilometer-resolution rainfall estimates over Vidarbha with multi-decade record. CHIRPS is the standard observational product for data-scarce South Asian agricultural regions and gives cleaner precipitation estimates than station-only networks over the Vidarbha belt.

The signal takes CHIRPS 30-day cumulative precipitation over Vidarbha, z-scores on a rolling window, inverts (deficit reads positive composite), 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: CHIRPS daily series from 1981; 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 0.091, p-value 8.4e-14, N equals 6,676. Strongly significant on the 26-year sample.
>
> **Non-overlap IC (60-day step):** plus 0.147, p-value 0.12, N equals 112. Sign-consistent but not independently significant.
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> **Phase-conditional forward 60-day Cotton returns:** Phase +1 (Precip Deficit, 2,034 days / 30.5 pct): plus 6.06 percent. Phase 0 (On Trend, 509 days / 7.6 pct): plus 3.95 percent. Phase −1 (Precip Above Trend, 4,133 days / 61.9 pct): minus 11.42 percent.
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> 17.48 percentage point spread between Phase +1 and Phase −1 with clean monotone phase pattern.

Three findings. The daily IC is strongly significant on the 26-year window. The monotone phase pattern cleanly separates Precip Deficit from Precip Above Trend with a 17.48 pp spread. The sample is heavily skewed toward Phase −1 (61.9 percent) because Vidarbha has experienced generally adequate-to-above-trend monsoon rainfall across the 2000-2026 period with episodic El Nino and La Nina deficit years.

Three cases that frame how to read the signal

The canonical anchors are the 2022 La Nina Vidarbha stress, the 2015-2016 El Nino monsoon failure, and the 2020 La Nina abundant monsoon.

Case 1: The 2022 La Nina Vidarbha stress

Precip Deficit firing through mid-2022 as La Nina-shifted monsoon patterns delivered below-trend rainfall over Vidarbha. Composite held in Phase +1 territory through the stressed monsoon window. Cotton rallied materially through 2022 to above 150 cents per pound consistent with the Phase +1 edge;

Indian yield compression compounded with Texas megadrought and Pakistan Punjab deficit producing the broader South Asian supply-shock setup that drove the generational Cotton rally.

Case 2: The 2015-2016 El Nino monsoon failure

Precip Deficit firing through 2015-2016 as El Nino drove materially weak monsoon rainfall across India including Vidarbha. Composite held in Phase +1 territory through the drought regime. Cotton rallied through 2016 consistent with the Phase +1 edge; Indian supply stress compounded with Pakistan drought (also El-Nino-driven) in a coherent El Nino South Asian setup.

Case 3: The 2020 La Nina abundant monsoon

Precip Above Trend firing through 2020 as La Nina delivered above-trend monsoon rainfall over Vidarbha. Composite held in Phase −1 territory through the benign moisture regime. Cotton underperformed materially through late 2020 consistent with the Phase −1 edge; Indian supply strength loosened global balance even as COVID demand-shock noise dominated the broader regime. The 2020 La Nina episode illustrates the honest Phase −1 bearish edge working through a complicated macro backdrop.

How to use this signal today

Composite is currently reading minus 0.473 in the Precip Above Trend band. The Neutral phase began October 2026, 28 trading days ago. CHIRPS daily rainfall over Vidarbha has run above the rolling mean through late 2026 consistent with benign Indian supply regime.

Pair with the following for stacked conviction: Gujarat GRACE (eastern India aquifer, western Indian supply), Pakistan Punjab CHIRPS (adjacent South Asian producer), Xinjiang CHIRPS (China supply), USDA PSD US production (top-exporter supply anchor), Baltic freight (global demand), apparel inventory demand, CFTC positioning. This Vidarbha signal gives the Indian rainfed supply lens; pair with other regional supply signals for the full global read.

Reader rule: Precip Deficit firings flag bullish supply-shock setups via Indian yield compression with the 2022 La Nina and 2015 El Nino regimes as benchmarks. Precip Above Trend firings flag bearish regimes where Indian supply loosens global balance with the 2020 La Nina abundant monsoon regime as benchmark.

Methodology

Data source: UCSB Climate Hazards Center CHIRPS daily precipitation at 5-kilometer resolution aggregated over India Vidarbha cotton belt bounding box (roughly Maharashtra eastern districts). Computation: 30-day rolling precipitation sum, z-scored on a rolling window, inverted so deficit reads positive composite, 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: CHIRPS daily precipitation series from 1981; 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 0.091 at p-value 8.4e-14 across 6,676 observations, strongly significant on 26-year sample. Phase +1 per-day forward return plus 6.06 percent. Phase 0 per-day forward return plus 3.95 percent. Phase −1 per-

day forward return minus 11.42 percent. 17.48 pp Phase +1 minus Phase −1 spread. Non-overlap IC at 60-day sampling plus 0.147 at p-value 0.12 across 112 samples, sign-consistent but not independently significant.

What this signal does not cover

The signal does not cover Gujarat, Punjab (India), Telangana, Karnataka, or Andhra Pradesh cotton regions. It does not capture canal-irrigated supply which partially buffers monsoon deficits in western Indian cotton regions. It does not capture pest pressure (pink bollworm has been a recurring Indian supply shock). It does not capture non-weather supply conditions including MSP policy shocks. CHIRPS 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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