The KC CHIRPS Brazil Cerrado Drought Signal: A Satellite Drought Lens for Second-Tier Arabica

Why CHIRPS satellite precipitation over the Brazil Cerrado coffee belt, inverted as a drought lens, delivers a monotone phase pattern on forward 60-day Arabica returns even though the directional magnitude is modest.

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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 Arabica forward 60-day returns is plus 0.028 at p-value 0.008 on a sample of 8,947 daily observations. Significant at 5 percent but economically modest. Phase +1 (Cerrado Drought) delivers plus 0.38 percentage points above baseline across 4,494 trading days; Phase −1 (Cerrado Wet) delivers minus 0.46 percentage points across 2,979 days. 0.83 pp directional spread.

Second, the non-overlapping independence test at 60-day sampling is sign-consistent but not independently significant. Across 150 independent samples the Spearman is plus 0.040 with p-value 0.63.

Third, the 0.83 pp directional spread is modest compared to ENSO (3.46 pp) or the cross-soft basket (3.97 pp). This signal should not be used standalone; it covers the second-tier Cerrado Arabica belt and is best paired with Sul-Minas-focused signals (TERRACLIMATE water deficit, ENSO) for full Arabica coverage.

The thesis: CHIRPS satellite reads Cerrado drought

Brazil produces roughly 35 percent of the world Arabica coffee crop. The growing region concentrates in two belts: Sul-Minas (south Minas plus Mogiana, higher altitude, more established) and Cerrado (Goias plus Minas tablelands, lower altitude, second tier). Cerrado is more drought-sensitive due to shallower soil water storage; when precipitation runs below trend, yield stress appears faster than in Sul-Minas.

CHIRPS (Climate Hazards Group InfraRed Precipitation with Station data) is a satellite-plus-station precipitation dataset at 0.05-degree resolution with daily cadence from 1981 onward. The signal takes

CHIRPS daily precipitation over the Brazil Cerrado region, computes a 30-day trailing average to smooth daily satellite noise, inverts so drought reads as positive composite, and tanh-bounds to plus or minus one.

State thresholds are 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 Coffee C first-nearby close.

What the firings have actually done

The phase pattern is monotone across Phase +1 (Drought), Phase 0, and Phase −1 (Wet). Computed over 9,007 daily observations post-warmup from December 1990 through November 2026.

> **Baseline Arabica forward 60-day return:** mean plus 2.32 percent / median minus 0.96 percent across the live-window sample.
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> **Daily Spearman IC (fwd 60d):** plus 0.028, p-value 0.008, N equals 8,947. Significant at 5 pct.
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> **Daily Pearson IC (fwd 60d):** plus 0.038, p-value 3.5e-04.
>
> **Non-overlap IC (60-day step):** plus 0.040, p-value 0.63, N equals 150. Sign-consistent with daily IC but not independently significant.
>
> **Phase-conditional forward 60-day Arabica returns:** Phase +1 (Cerrado Drought, 4,494 days / 49.9 pct): plus 2.70 percent, edge plus 0.38 pp. Phase 0 (Near Trend, 1,534 days / 17.0 pct): plus 2.10 percent, edge minus 0.22 pp. Phase −1 (Cerrado Wet, 2,979 days / 33.1 pct): plus 1.86 percent, edge minus 0.46 pp.
>
> 0.83 pp directional spread.

Three findings. The pattern is monotone across phases consistent with the stated mechanism. The directional magnitude is modest (0.83 pp spread vs 3.46 pp ENSO, 3.97 pp basket). The non-overlap test does not clear the 5 percent threshold, so use as part of a stacked view rather than standalone.

Three cases that frame how to read the signal

The canonical anchors are the 2014 Brazil drought-of-record (strongest Phase +1 anchor), the 2021 compound drought preceding the Minas Gerais frost, and the 2009-2010 wet-Cerrado regime.

Case 1: The 2014 Brazil drought-of-record

Cerrado Drought extreme firing began January 2014 as CHIRPS 30-day trailing precipitation collapsed across Goias and Minas tablelands. The 2014 Brazilian drought became the drought-of-record for the modern era; the composite held in Phase +1 territory through the critical flowering window, anticipating the 2014-2016 Arabica rally. Forward 60-day at the January 30, 2014 trigger was plus 65.67 percent reflecting the sharp yield-stress-driven rally. Signature anchor.

Case 2: The 2021 compound drought preceding the Minas Gerais frost

Cerrado Drought firing established the 2021 dry-regime context that intersected with the late-June 2021 Minas Gerais frost. The CHIRPS composite held in Phase +1 territory through the dry season, confirming the broader water-deficit regime. The compound shock (drought plus frost) delivered the

2021-2022 Arabica rally. This case illustrates how the CHIRPS signal flags the drought regime that raises frost vulnerability.

Case 3: The 2009-2010 wet-Cerrado regime

Cerrado Wet firing began October 2009 as abundant moisture returned to Goias and Minas tablelands after the 2008-2009 La Nina transitioned toward neutral. The composite held in Phase −1 territory through the 2009-2010 growing season, consistent with the loose-supply regime. Canonical Phase −1 anchor.

How to use this signal today

Composite is currently reading plus 0.634 in the Cerrado Drought band. The HEALTHY phase began May 2026, 129 trading days ago. CHIRPS 30-day trailing precipitation over Goias and Minas tablelands has run significantly below trend.

Pair with the following for stacked drought-regime conviction: the TERRACLIMATE water-deficit signal (PET-AET lens on the same geography), the ENSO signal (long-lead ocean forcing), the Cecafe realized-price signal (short-lead transaction confirmation), and the cross-soft basket signal (macro-cycle context). This CHIRPS signal covers second-tier Cerrado Arabica specifically; Sul-Minas-focused signals cover the first-tier belt.

Reader rule: Phase +1 firings are short-to-medium-lead drought-regime setups; Phase −1 firings are wet-regime setups. 0.83 pp spread means directional edge is real but modest; do not size on this signal alone.

Methodology

Data source: CHIRPS satellite precipitation estimates at 0.05-degree resolution over the Brazil Cerrado coffee region (Goias plus Minas tablelands grid). Computation: 30-day trailing average of daily precipitation, inverted so drought reads as positive composite, tanh-bounded to plus or minus one. 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 Coffee C first-nearby close (KC_1160BD).

Historical window: CHIRPS data from 1981-01; engine runs from December 1990.

Validation computed on 9,007 post-warmup daily observations. Daily Spearman IC plus 0.028 at p-value 0.008 across 8,947 observations; significant at 5 pct. Phase +1 (Cerrado Drought) per-day forward return plus 2.70 percent (plus 0.38 pp above plus 2.32 pct baseline). Phase −1 (Cerrado Wet) per-day forward return plus 1.86 percent (minus 0.46 pp below baseline). 0.83 pp directional spread. Non-overlap IC at 60-day sampling plus 0.040 at p-value 0.63 across 150 samples; not independently significant but sign-consistent with daily IC.

What this signal does not cover

The signal does not cover Sul-Minas (the first-tier Arabica belt has its own TERRACLIMATE and ENSO signals). It does not cover Brazilian frost directly. It does not cover ICE futures positioning. It does not resolve short-horizon moves faster than the 30-day trailing window allows. It is a second-tier Cerrado drought lens; use as part of a stacked drought-regime view.

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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