CGIAR DIGITAL INNOVATION · IWMI · SEASONAL BRIEFING

El Niño impacts in the Limpopo River Basin

A very strong El Niño is forecast. This briefing sets out the July–December 2026 seasonal outlook for the basin and what the historical record implies for the 2026/27 growing season and its maize crop.

TYPE **Briefing** AREA **Limpopo Basin** FORECAST ISSUE **July 2026**

CONFIDENCE **Moderate** C3S DATA FINAL · 8 MODELS

KEY FINDINGS

- A **very strong El Niño** is forecast. On **RONI** — NOAA's standard ENSO index since 2026, which removes the background tropical-ocean warming — the event classifies as very strong (≈ +2.0). The model's physical **Niño 3.4 SST-anomaly** forecast is **2.02 °C** for the Jun–Nov mean (80% range 1.7–2.34 °C), MOS-recalibrated from the equal-weight mean of all 8 systems (552 members total); the range is the cross-validated calibration error, not the raw member spread.
- **Markedly above-average temperatures** are predicted across the basin for July–December 2026 (+0.6 to +1.6 °C), with near-unanimous agreement between models.
- **Rainfall tilts driest toward November**, when up to 100% of the basin **area** carries a below-normal signal (spatial extent, not a probability).
- Historically, El Niño JFM seasons in the basin are **drier, hotter and more evaporative** (-11.6% rainfall, +0.7 °C, +5 hot days, +34 mm ET_0) and are associated with **lower maize yields** in South Africa, Mozambique and Zimbabwe.

NIÑO 3.4 FORECAST

2.02 °C

El Niño · Jun–Nov average · 80% range 1.7–2.34 °C

BASIN TEMPERATURE

+1.6 °C

peak lead · 100% model agreement

NOVEMBER RAINFALL (BASIN)

100%

of basin **area** below normal — spatial extent, not probability

HISTORIC JFM ET_0

+34 mm

El Niño composite anomaly

01 · THE PACIFIC

El Niño is here

A sustained warming of the central and eastern equatorial Pacific has crossed the El Niño threshold. 8 C3S seasonal forecast systems place the Niño 3.4 index firmly in El Niño territory through July–December 2026.

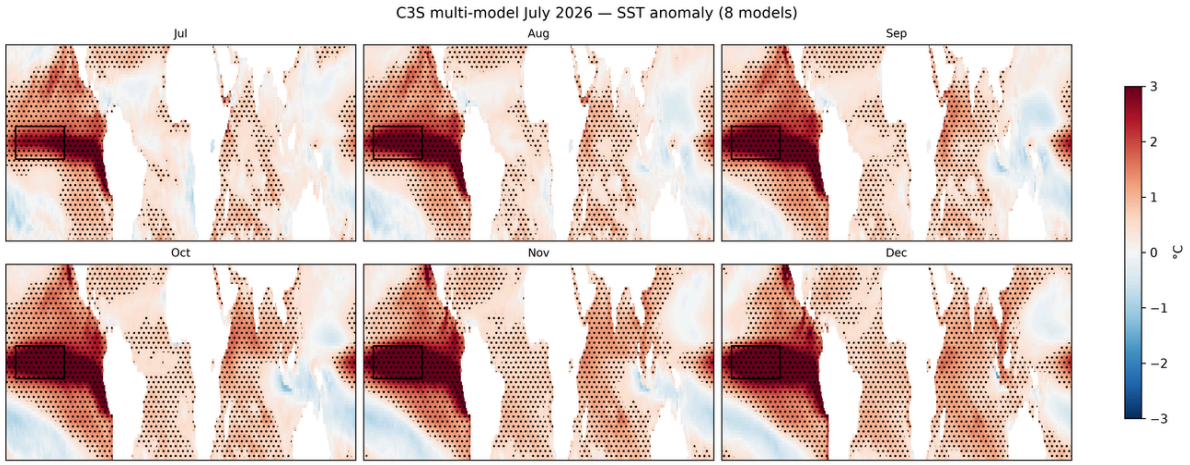


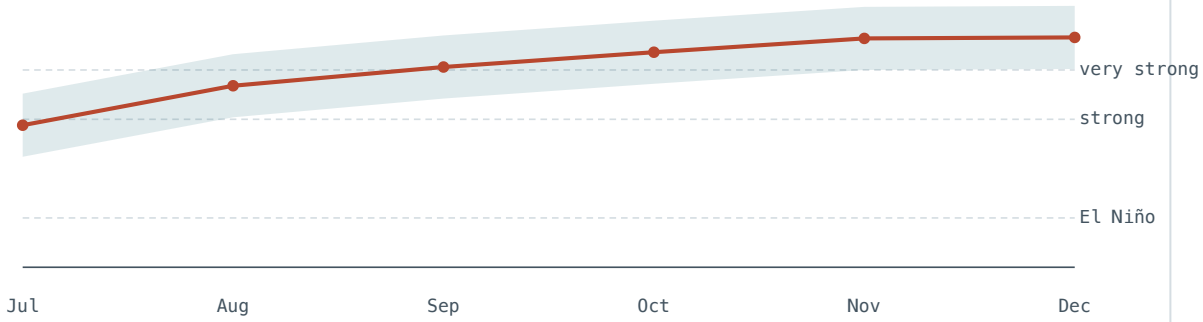
Figure 1. Multi-model sea-surface-temperature anomaly forecast (8 systems), July–December 2026. The rectangle marks the Niño 3.4 region (5°N–5°S, 170°W–120°W); stippling shows where the anomaly exceeds 0.5 °C. ↳ Methodology[2]

FORECAST NIÑO 3.4 · CALIBRATED POINT & 80% INTERVAL



Calibrated multi-model Niño 3.4 (filled marker) with its leave-one-out 80% predictive band; dashed ticks mark the El Niño (+0.5 °C), strong (+1.5) and very-strong (+2.0) thresholds. The hollow marker is the raw model mean before recalibration. ↳ Methodology[2,4]

FORECAST TRAJECTORY · JULY–DECEMBER 2026



Calibrated Niño 3.4 by target month (line) with the ±leave-one-out band — whether the event builds or eases through the season. ↳ Methodology[2,4]

PHASE & STRENGTH PROBABILITIES



Share of the 552-member calibrated ensemble in each ENSO phase (ocean = La Niña, grey = Neutral, ember = El Niño) and, for El Niño, split by strength (deeper = stronger; grey = not El Niño). Derived from MOS-calibrated ensemble members. ↳ Methodology[2,4]

02 · THE FORECAST

What to expect: July–December 2026

The basin is predicted to run hot. Temperature anomalies are near-unanimous and consistent across models; the rainfall signal is weaker — up to 100% of the basin **area** tilts below normal toward November (spatial extent, not a probability; seasonal rainfall skill here is low, so read it as a risk flag rather than a confident drought forecast).

HOW THE BASIN ENTERS THE SEASON · RECENT RAINFALL VS 1991–2020



2026-04 to 2026-06 rainfall was 181% of the 1991-2020 normal — much above normal (95th percentile, SPI-3-style +1.7). Basin-mean CHIRPS gauge rainfall over the three months before issue, standardised against the 30-year distribution of the same window (empirical percentile → normal quantile). The season therefore opens on wet ground, which buffers the drought risk implied by the forecast below. ↳ Methodology[9]

Root-zone soil moisture is at the 97th percentile (very wet, SSI-3 +1.8; 135% of the 1991-2020 normal). This is the rain-fed water-availability companion to the rainfall index above — ERA5-Land monthly reanalysis, 0–100 cm root zone over 2026-04 to 2026-06, standardised against the same 1991-2020 window. Rain-fed cropping depends on this soil water; irrigated areas depend on the storage buffer below.

↳ Methodology[14]

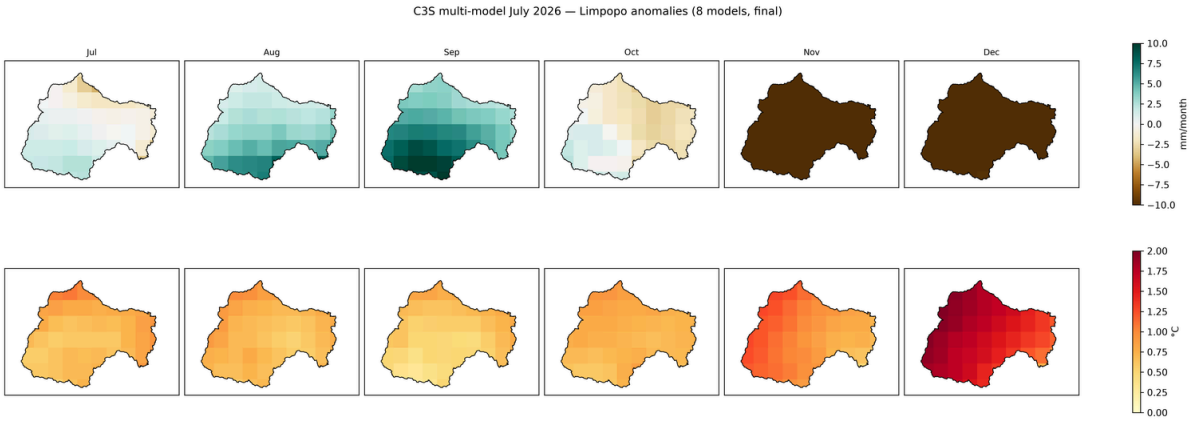
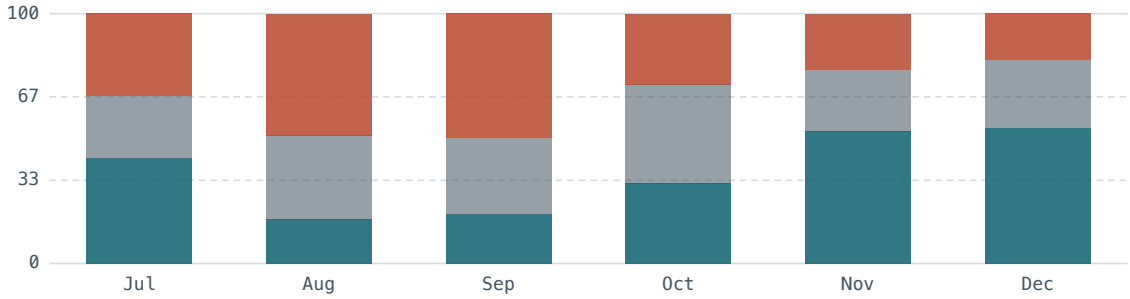


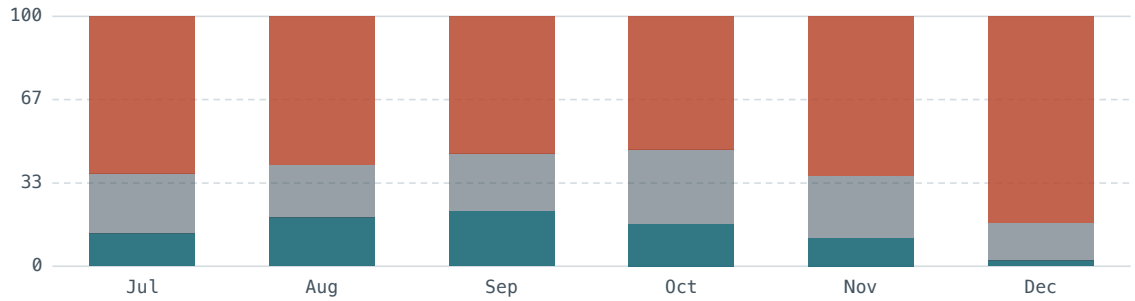
Figure 2. Multi-model rainfall (top) and mean-temperature (bottom) anomalies for the Limpopo Basin, July–December 2026, clipped to the catchment. The temperature signal is basin-wide (100% peak model agreement); the rainfall deficit concentrates toward November. ↳ Methodology[2]

RAINFALL TERCILE PROBABILITIES · BY MONTH



Probability of the below / near / above-normal tercile each month (ocean = below, grey = near, ember = above; dashed guides at 33/67% mark equal-odds climatology). Ensemble counted against each model's own 1993-2016 hindcast terciles. **Verified skill** (leave-one-out vs CHIRPS, 24 yr): RPSS +0.00, ROC 0.49 (below) / 0.56 (above). ⚠ **Hindcast skill is at/below climatology here — read these probabilities as context, not a confident signal.** ↳ Methodology[2,9]

TEMPERATURE TERCILE PROBABILITIES · BY MONTH



Probability of the below / near / above-normal tercile each month (ocean = below, grey = near, ember = above; dashed guides at 33/67% mark equal-odds climatology). Ensemble counted against each model's own 1993-2016 hindcast terciles. **Verified skill** (leave-one-out vs ERA5, 24 yr): RPSS +0.25, ROC 0.88 (below) / 0.70 (above). ↳ Methodology[1,2]

Seasonal risk timeline

MONTH-BY-MONTH HEAT & DRYNESS RISK

	Jul	Aug	Sep	Oct	Nov	Dec
Heat	63	60	55	53	64	83
Dryness	42	18	20	32	53	54

Heat risk peaks around Dec (83% chance of an above-normal month — skill-backed); dryness risk is greatest around Dec (54% below-normal, but seasonal rainfall skill is low, so read it as context). Cell shade is proportional to the probability above the 33% climatological baseline; the outlined cell is each row's peak. The season opens much above normal (95th-percentile recent rainfall), so near-term dryness is buffered until that surplus draws down. ↳ Methodology[1,2,9]

Water in the basin now — the irrigation-supply buffer

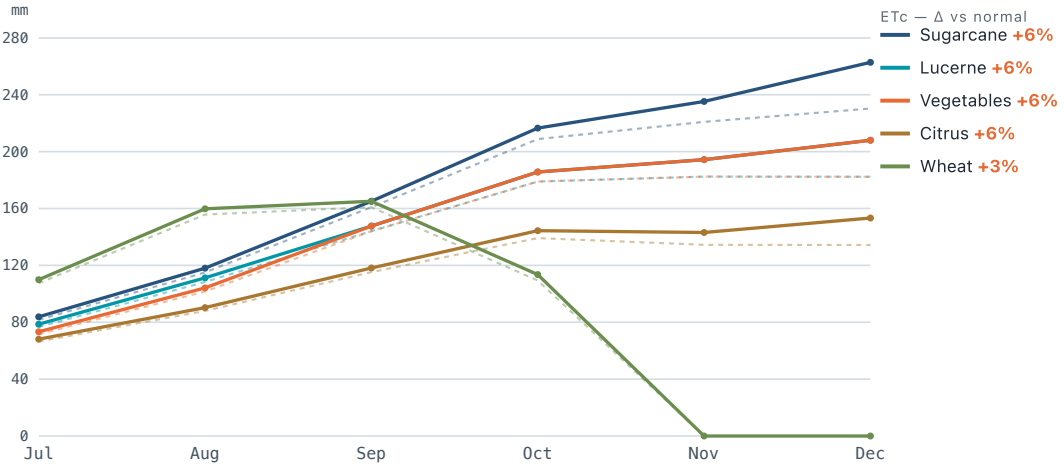
RESERVOIR STORAGE · % OF CAPACITY (AS OF 2026-08-11)



Basin reservoirs are at 87% of capacity (7,356 of 8,454 MCM across 231 monitored dams, of which 77 are Tier 1/2 validated). The SWAT median (pc50 ensemble) forecast projects storage to 2026-11-30 at **72%** (↘ -15 pts) — a falling trend, the expected dry-season drawdown. Ocean bars show current fill by country; the ember dash on the basin bar marks the forecast level. Satellite area→volume estimates + DWS gauges, with the SWAT Control forecast filling stale observations. For irrigated agriculture this stored volume is the season's supply buffer — a substantial buffer against the forecast season, and consistent with the wet antecedent state above. (Rain-fed areas depend instead on the soil-water and rainfall outlook, not on this storage.) ↳ Methodology[11]

Crop water demand — the irrigation-demand side

CROP WATER DEMAND ETC · JUL–DEC · FORECAST VS 1991–2020 NORMAL



Irrigated agriculture is the basin's largest water user — about 52% of total basin water demand (2,551 of 4,881 Mm³/yr; LIMCOM Future Water Demand Scenarios Report, 2025), so a warmer season raises how much water crops lose to the atmosphere. El Niño lifts reference ET_0 about +6% above the 1991-2020 normal over Jul–Dec, raising crop water demand (ETc = Kc×ET_0 — soil evaporation + plant transpiration) for the main irrigated crops by up to +6% (Sugarcane). Because the rainfall outlook is also drier, the **net** irrigation requirement (ETc minus effective rainfall) rises by more than ETc alone. This seasonal rise previews the longer-term trajectory: LIMCOM projects basin reference ET to climb roughly 5–10% by 2060 under climate change (LIMCOM Climate Change Analysis for the Limpopo River Basin, 2025). The ET_0 climatology is FAO-56 Penman–Monteith (AgERA5); the ET_0 rise is a **temperature-sensitivity approximation** — the observed basin dET_0/dT applied to the forecast temperature anomaly, with radiation, humidity and wind held at climatology (the seasonal forecast carries no such fields), not a full Penman–Monteith recomputation. Kc curves per crop are FAO-56 (Allen et al. 1998), Table 12 — representative, editable. ↳ Methodology[3,5]

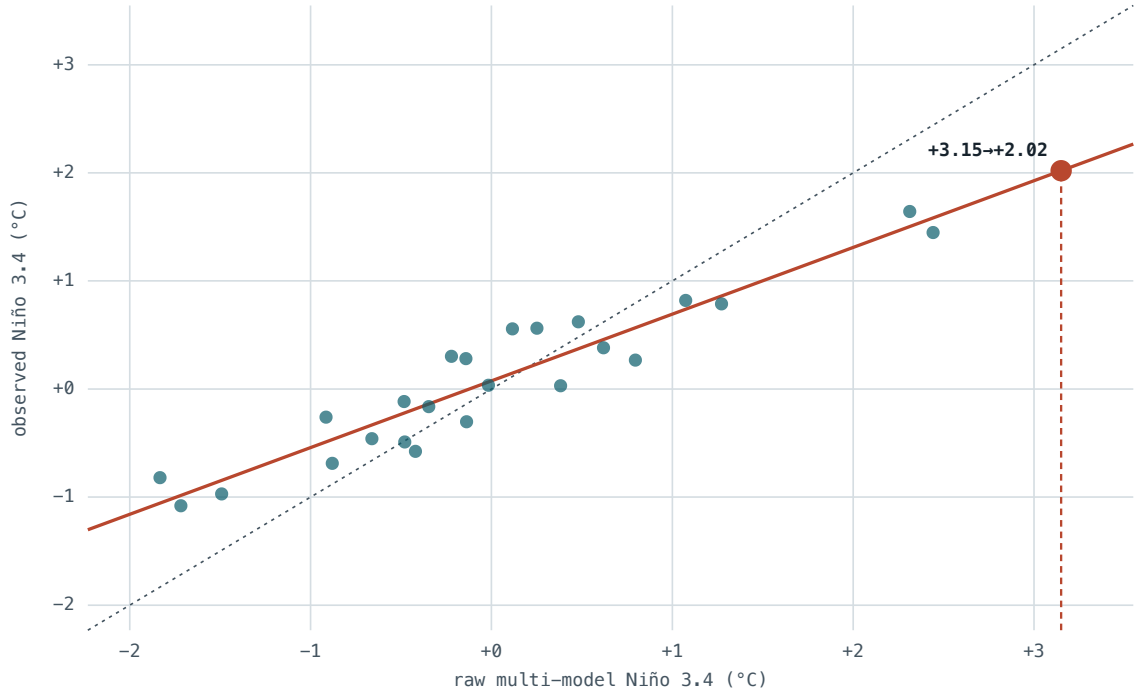
Lower-than-average rainfall at the start of the season can delay planting for rainfed maize, while the accompanying heat raises water demand on emerging seedlings — compounding stress into the 2026/27 season.

03 · CALIBRATION & TRANSPARENCY

How the forecast is bias-corrected

Raw coupled-model Niño 3.4 can mis-scale El Niño amplitude, so the headline index is recalibrated against observations. Over 1993-2016 the multi-model hindcast tracks observed Niño 3.4 with correlation r = 0.94; a least-squares fit (slope 0.62) maps the raw forecast onto observations, and the leave-one-out RMSE (0.25 °C) — not the over-dispersed ensemble spread — sets the uncertainty band.

OBSERVED VS MODEL NIÑO 3.4 · 1993–2016 HINDCAST



Calibration transparency. Each dot is one hindcast year (raw multi-model Niño 3.4 vs observed ERSSTv6); the dotted line is 1:1, the ember line the MOS fit. The forecast (large marker) is read off the fit: raw +3.15 °C → calibrated +2.02 °C. ↳ Methodology[2,4]

Correlation (phase skill)	MOS slope
r = **0.94**	b = **0.62** · over-amplifying (slope < 1)
Cross-validated error	**Training period**
LOO RMSE = **0.25** °C	1993–2016 · n = 24 yr

04 · THE RECORD

What past El Niño seasons did to the basin

Over the January–March growing season, historical El Niño years in the basin trend drier, hotter and more evaporative. The temperature, hot-day and evaporative-demand signals are the most consistent; the rainfall signal is drier on average but weaker and more variable — the strength of each link is quantified below.

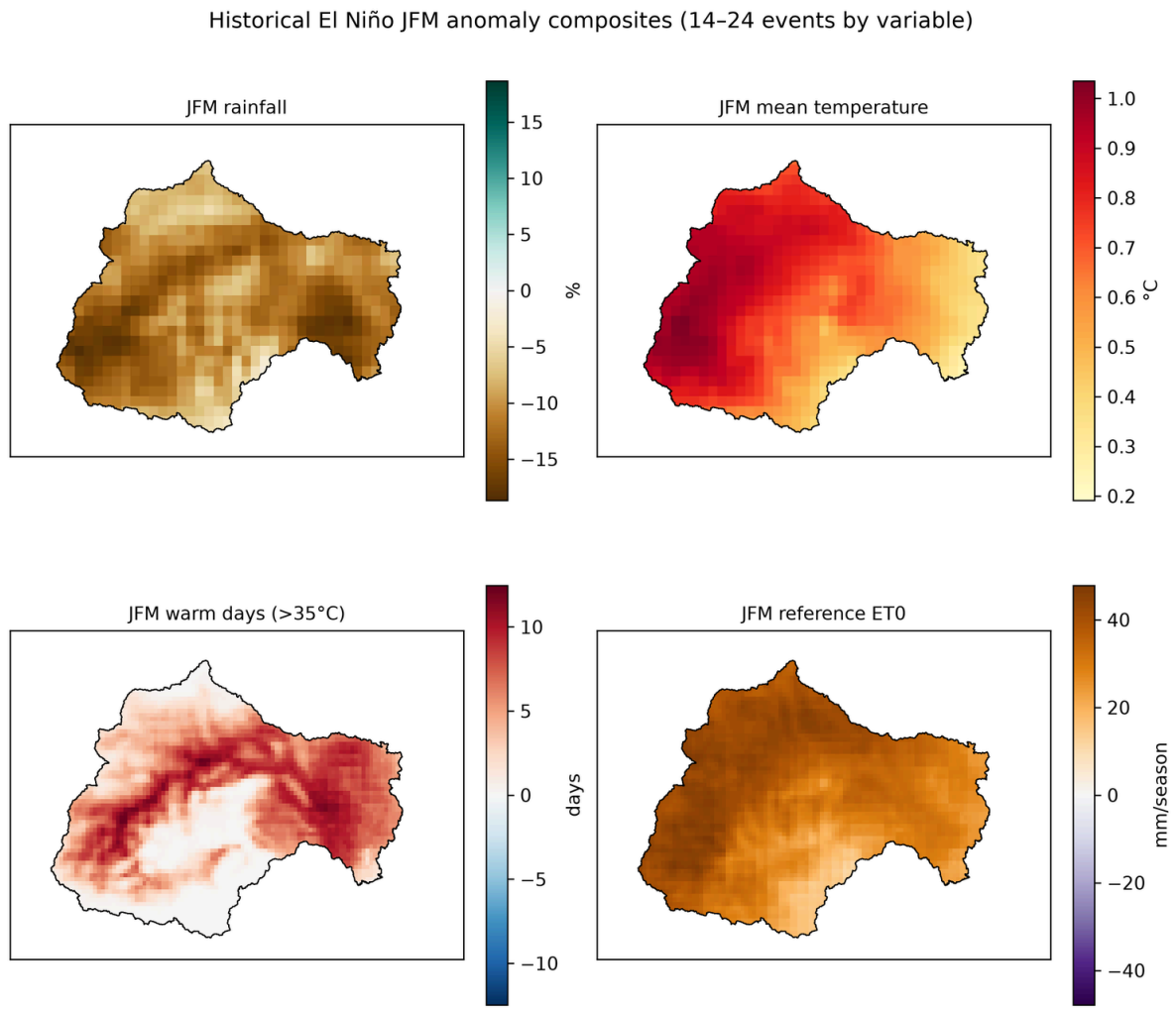
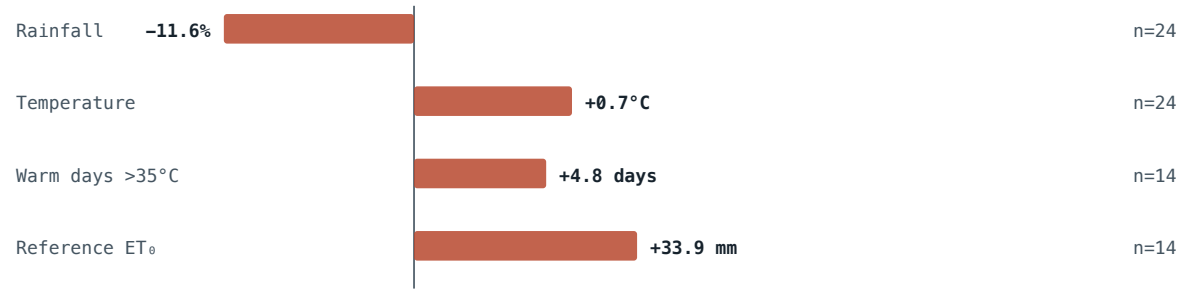


Figure 3. January–March composites over the RONI-defined El Niño years (anomalies vs the all-years normal): rainfall -11.6%, temperature +0.7 °C, warm days +5, reference ET_0 +34 mm. ERA5 (1950–2022) and AgERA5 (1979–2022). ↳ Methodology[1,3,5]

AVERAGE EL NIÑO SIGNATURE OVER THE BASIN



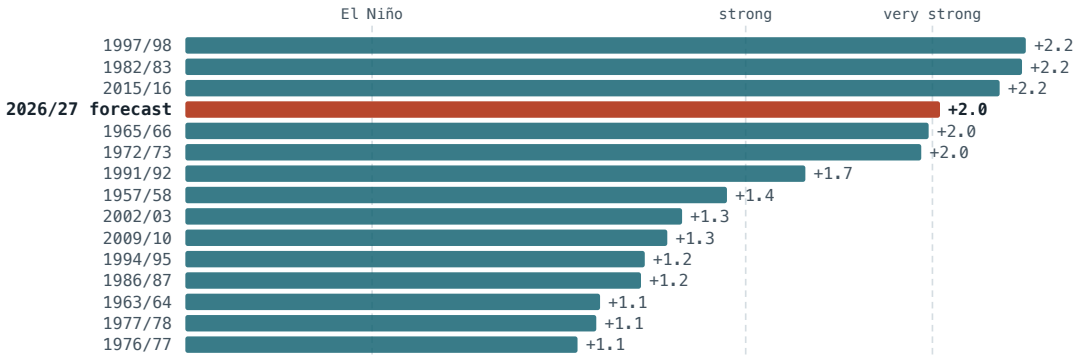
Basin-mean El Niño composite anomaly per variable (bar length normalised within each variable; ember = drier / hotter / more evaporative, ocean = wetter / cooler). n = El Niño years composited.

↳ Methodology[1,3,5]

How this compares to past El Niños

STRONGEST EL NIÑOS ON RECORD · RANKED BY NOVEMBER RONI

On **RONI** — NOAA's standard ENSO index since 2026, which strips out the background tropical-ocean warming — the forecast is a **very strong El Niño** at ≈ +2.0, ranking among the strongest — #4 of 24 El Niño seasons since 1951. Its closest RONI analogues are 2015/16, 1965/66, 1972/73 — those seasons ran -16%, +16%, -31% on basin January–March rainfall, with generally lower maize yields. (the model's raw Niño 3.4 SST-anomaly forecast is +2.3 °C at its November peak, +2.02 °C for the Jun–Nov mean) Events are compared on preceding-November RONI (the methodology's predictor month).



The 15 strongest El Niño seasons since 1951 (of 24 with November RONI ≥ 0.5), ranked; this forecast (ember) sits at #4. The closest analogues and the basin impacts they recorded (RONI primary, raw Niño 3.4 shown alongside):

ANALOGUE SEASON	NOV RONI	NOV NIÑO 3.4	BASIN JFM RAINFALL	MAIZE YIELD
2015/16	+2.2	+2.6	-16%	-53% to -16%
1965/66	+2.0	+1.5	+16%	-15% to +1%
1972/73	+2.0	+1.9	-31%	-35% to -2%

Analogues are the observed El Niño seasons closest to this forecast in preceding-November RONI; impacts are the basin January–March outcomes those seasons actually recorded (not a forecast). Maize-yield range spans South Africa, Mozambique and Zimbabwe. ↳ Methodology[1,6,16]

05 · THE CONSEQUENCE

Maize yields & basin climate track ENSO

Across the historical record, the association between the preceding-November RONI and maize-yield anomalies is negative in all three riparian countries — statistically clear for South Africa and Zimbabwe, but weaker (not significant at p<0.05) for Mozambique — alongside a hotter, more evaporative basin. None of these links is deterministic; they are statistical associations, and their strength is shown below. **Maize is used here as a proxy for rain-fed cropping only** — the relationship reflects national yields dominated by rain-fed production; irrigated maize is buffered by the stored water shown in the water-resources section, so this signal should be read as the outlook for the rain-fed crop.

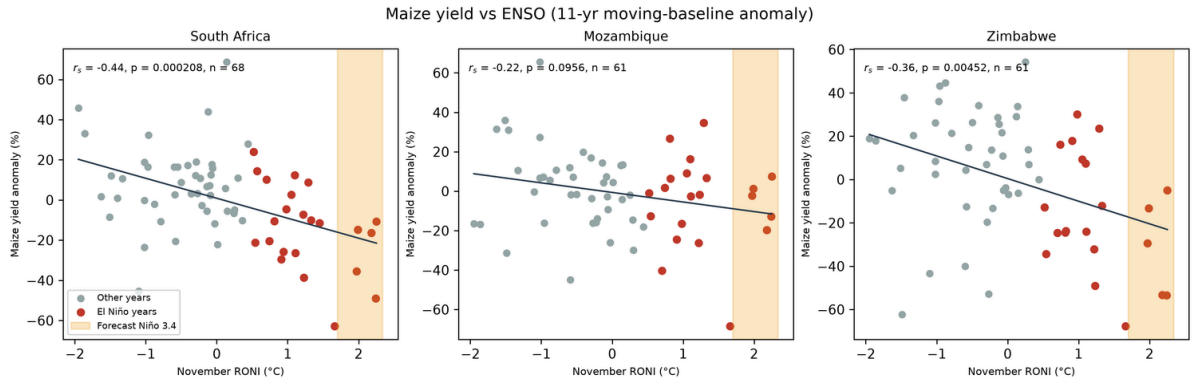


Figure 4. National maize-yield anomaly versus the preceding November **RONI** (NOAA CPC, from 1950). Red points are El Niño years; the shaded band is the 2026 forecast range. Maize yields: South Africa long series; Mozambique and Zimbabwe from FAOSTAT. ↳ Methodology[6,7,16]

South Africa

Spearman **−0.43** · p < 0.001 · n=68

Mozambique

Spearman **−0.21** · p = 0.096 · n=61

Zimbabwe

Spearman **−0.36** · p = 0.005 · n=61

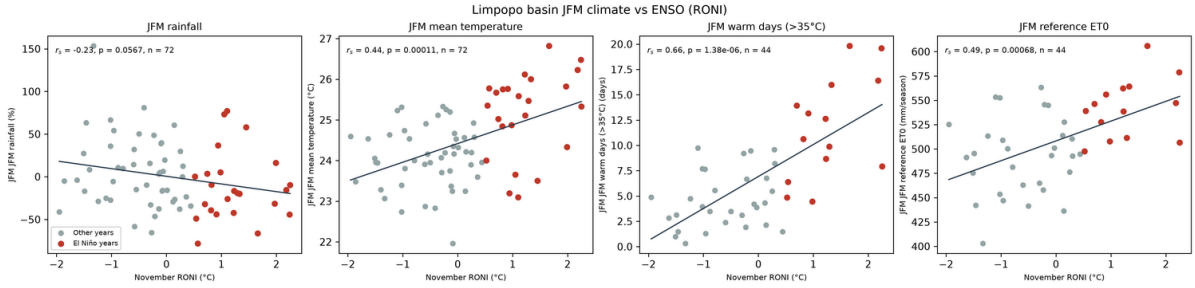


Figure 5. Limpopo Basin JFM climate versus the preceding November **RONI** — rainfall, temperature, warm days and reference ET_0. ↳ Methodology[1,3,16]

Rainfall

Spearman **−0.23** · p = 0.057 · n=72

Temperature

Spearman **+0.44** · p < 0.001 · n=72

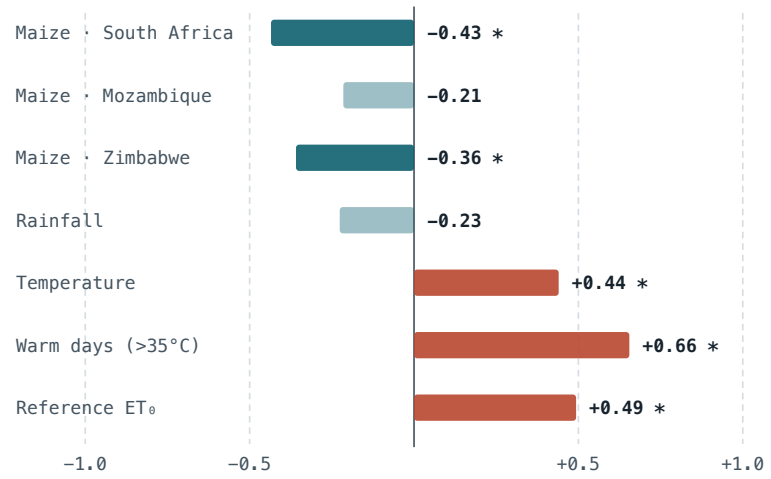
Warm days (>35°C)

Spearman **+0.66** · p < 0.001 · n=44

Reference ET_0

Spearman **+0.49** · p < 0.001 · n=44

STRENGTH OF THE ENSO LINK · SPEARMAN R

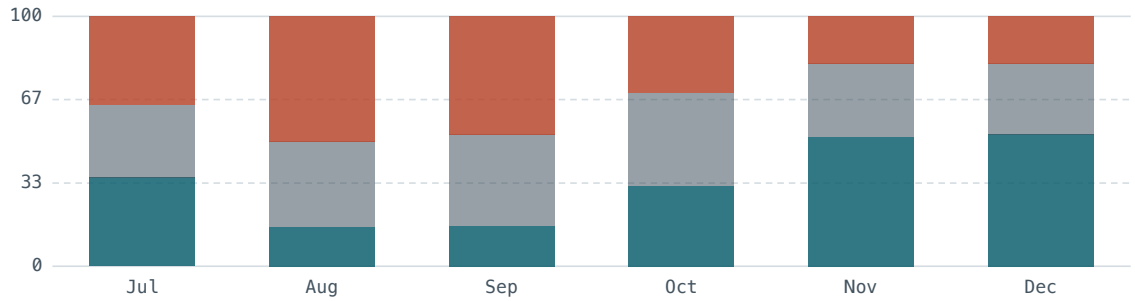


Rank correlation between the preceding November **RONI** and each outcome (maize-yield anomaly; basin JFM climate). Ember = positive, ocean = negative; solid bars are significant at p < 0.05 (marked *), faded are not. ↳ Methodology[6,7,16]

Where the maize actually grows

Maize-growing cells span about 47% of the basin footprint (2,459,815 ha harvested area, SPAM 2010), concentrated in the South African and Zimbabwean portions of the catchment. Re-aggregating the identical multi-model forecast by maize harvested area — rather than averaging the whole basin uniformly — sharpens the agriculturally relevant signal: it is driest for maize around **Dec** (53% below-normal, -2 pts vs the basin average); hottest around **Dec** (85% above-normal, +2 pts vs basin). The same skill caveats apply as for the basin forecast.

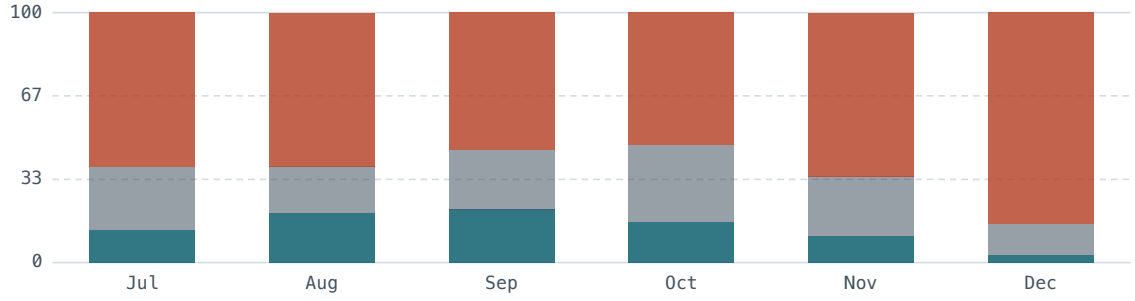
MAIZE-AREA RAINFALL TERCILE · BY MONTH



Weighted to maize-growing area. Probability of the below / near / above-normal tercile each month (ocean = below, grey = near, ember = above; dashed guides at 33/67% mark equal-odds climatology). Ensemble counted against each model's own 1993-2016 hindcast terciles. **Verified skill** (leave-one-out vs CHIRPS, 24 yr): RPSS +0.03, ROC 0.61 (below) / 0.58 (above).

↳ Methodology[2,9,10]

MAIZE-AREA TEMPERATURE TERCILE · BY MONTH



Weighted to maize-growing area. Probability of the below / near / above-normal tercile each month (ocean = below, grey = near, ember = above; dashed guides at 33/67% mark equal-odds climatology). Ensemble counted against each model's own 1993-2016 hindcast terciles. **Verified skill** (leave-one-out vs ERA5, 24 yr): RPSS +0.35, ROC 0.87 (below) / 0.85 (above).

↳ Methodology[1,2,10]

METHODOLOGY

Forecast anomalies. Each of the 8 C3S systems is converted to anomalies against its own 1993–2016 hindcast climatology, matched by initialization and lead month, so system-specific drift and bias cancel before combination; systems are regridded to a common grid and combined with equal weight per model (a run needs ≥6 systems, targets 8).[1,2]

Niño 3.4 recalibration (MOS). The raw multi-model Niño 3.4 is corrected toward observations by ordinary-least-squares, observed ≈ intercept + slope×model, fit on Jun–

Nov season-mean pairs over 1993-2016 against NOAA ERSSTv6; here slope = 0.62, r = 0.94. Skill and the 80% interval come from leave-one-out cross-validation (RMSE = 0.25 °C), not the over-dispersed ensemble spread; the pipeline falls back to the raw value if cross-validated r < 0.5.[4]

Spatial weighting & historical composites. Basin means weight each cell by cos(latitude) × its fraction inside the basin polygon. Historical impact is the January–March composite anomaly over the RONI-defined El Niño years; reference ET_0 follows FAO-56 Penman–Monteith from AgERA5, and a warm day exceeds 35 °C.[3,5,8]

ENSO index — RONI (dual-index). ENSO phase, strength and the historical comparison use the **Relative Oceanic Niño Index (RONI)** — NOAA CPC's standard ENSO index since February 2026, and the index on IWMI's ENSO platform (enso.iwmi.org). RONI is the 3-month Niño 3.4 SST anomaly minus the 20°S–20°N tropical-mean anomaly (variance-adjusted), removing the background tropical-ocean warming that inflates a raw fixed-base Niño 3.4 index over a multi-decade record. We use CPC's published RONI series. The **raw Niño 3.4 SST anomaly** is retained wherever the physical Pacific temperature is meant — in particular the forecast itself, which C3S issues as a Niño 3.4 anomaly. The forecast is placed on the RONI scale via the observed raw→RONI relationship (recent-window linear fit, r ≈ 0.99) and reported as an estimate, because CPC's variance adjustment cannot be reproduced from Niño 3.4 alone. In our own leave-one-out validation RONI predicts basin JFM rainfall, warm-days and reference ET_0 at least as well as raw (temperature a tie), so the composites use it too.[4,16]

Relationships & classification. ENSO links use the Spearman rank correlation (OLS lines and forecast bands where shown; significance at α = 0.05). Maize-yield anomalies are departures from an 11-year moving normal, pairing the preceding-November RONI with the following harvest. A season is an "El Niño" when its November-centred (OND) RONI ≥ +0.5 — NOAA's threshold — used to select analogue seasons and build the impact composites (1950–present, the RONI series span).[6,7,16]

Probabilistic forecast & verified skill. Tercile probabilities keep every ensemble member and count it against each model's own 1993-2016 hindcast terciles (equal weight per model). Skill is out-of-sample: leave-one-year-out over the hindcast, scored by the ranked probability skill score (RPSS, vs an equal-odds climatology) and ROC area, verifying temperature against ERA5 and rainfall against CHIRPS gauge data. Probabilities are flagged where cross-validated RPSS falls to climatology (≤ 0.02), so a sharp-looking signal is never presented as confident without demonstrated skill.[9]

Cropland (maize) weighting. The maize-area outlook re-aggregates the identical multi-model forecast, weighting each cell by SPAM 2010 maize harvested area rather than averaging the basin uniformly, so the agriculturally relevant signal reflects where maize is actually grown. It carries its own leave-one-out skill on the same weighting.[10]

Antecedent conditions. The soil-water state the outlook lands on is summarised by the basin-mean CHIRPS rainfall over the three completed months before issue, expressed as an SPI-3-style index — its empirical percentile in the 1991-2020 distribution of the same

three-month window, mapped to a normal quantile (distribution-free, so it is robust to rainfall's skew).[9]

Water resources (reservoirs). Basin storage aggregates 231 monitored dams (of which 77 are Tier 1/2 validated or gauged) from the Limpopo Digital Twin's reservoir monitoring — satellite surface-area→volume estimates blended with DWS gauge records, with the SWAT Control forecast substituted where a satellite observation is stale (> 30 days). The forward projection is the SWAT ensemble median (pc50) storage trend — its first-to-last modelled change, applied to the current observed storage — not the Control baseline (which runs flat and understates dry-season drawdown). It is a live snapshot dated in the panel, separate from the frozen forecast run.[11]

DATA SOURCES

Datasets & provenance

DATASET	PROVIDER	VERSION / PERIOD	ACCESS	LICENCE	ROLE IN BRIEFING
C3S seasonal forecast `seasonal-monthly-single-levels`	Copernicus C3S multi-system · CDS / ECMWF	8 operational systems (ECMWF SEAS5, UKMO, Météo-France, DWD, CMCC, NCEP, JMA, ECCC); hindcast 1993–2016; leads 0–5	cds.climate.-coperni-cus.eu	Coperni cus licence	**Primary forecast: rainfall (mm/mo), 2 m temperature (°C), SST & Niño 3.4**
ERA5 monthly reanalysis	C3S / ECMWF	1940–present · 0.25°	doi:10.24381/cds.f17050d7	Coperni cus licence	**Temperature verification obs for forecast skill (RPSS/ROC)**
ERA5-Land monthly reanalysis	C3S / ECMWF	1950–present · 0.1° · soil layers 1–3 (0–100 cm)	doi:10.24381/cds.68d2b-b30	Coperni cus licence	**Root-zone soil moisture for the SSI-3 antecedent indicator**
CHIRPS v2.0 monthly	UCSB Climate Hazards Center	1981–present · 0.05° · Africa	doi:10.15780/G2RP4Q	Public domain	**Gauge-blended rainfall — verification obs for rainfall skill**
SPAM 2010 v2.0 — maize	IFPRI / MapSPAM	H_MAIZ_A harvested area · ~10 km · 2010	doi:10.7910/DVN/PRFF8V	CC0 1.0	**Cropland weighting: aggregate the forecast to maize-growing area**
AgERA5 agro-met indicators	C3S / ECMWF	v2.0 · 1979–present · 0.1°	doi:10.24381/cds.6c68c9bb	Coperni cus licence	**Daily inputs for warm-days (>35 °C) & FAO-56 ET_0**
NOAA ERSST v6 — Niño 3.4	NOAA NCEI / PSL	ERSSTv6 · anomaly base 1991–2020	psl.noaa.gov/data/correla-tion/nina34.anom.data	U.S. public domain	**Observed raw Niño 3.4 (physical SST forecast reference) & MOS calibration target**
NOAA CPC RONI	NOAA CPC	3-mo running · ERSST.v5 · 1991–2020 base · 20°S–20°N removed · from 1950	cpc.n-cep.noaa.gov/data/indices/RONI.ascii.txt	U.S. public domain	**ENSO classification, analogue ranking & impact-composite year selection (standard index since 2026)**

DATASET	PROVIDER	VERSION / PERIOD	ACCESS	LICENCE	ROLE IN BRIEFING
FAOSTAT crops & live-stock (QCL)	FAO	Yield (kg/ha), maize · from 1961	fao.org/fao-stat #data/QCL	CC BY 4.0 IGO	**National maize-yield series (ZAF, MOZ, ZWE)**
20th-Century Crop Statistics	NASA SEDAC / CIESIN, Columbia	v1 · 1900–2017	doi:10.7927/tmsp-sg82	CC BY 4.0	**Long-record maize cross-reference (provenance only)**
IWMI reservoir monitoring	Limpopo Digital Twin · eflow_iwmi	231 dams · satel-lite area→volume + DWS gauges + SWAT forecast	digitaltwins.i-wmi.org	IWMI	**Live basin storage + forward projec-tion (water-re-sources buffer)**
Limpopo basin boundary	HydroSHED S / HydroBASIN S	boundary v2026-01	hydroshed-s.org	HydroS HEDS licence	**Basin mask for cos-lat area weighting**

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LIMITATIONS & CAVEATS

- **Forecast amplitude is uncertain.** Coupled models can mis-scale the Niño 3.4 signal; the MOS slope is diagnosed and flagged if it significantly departs from 1. Even recalibrated, amplitude carries real uncertainty — the reported 80% band (leave-one-out) is the honest error, wider than the raw spread.
- **Extrapolation beyond the record.** The calibration is trained on 1993-2016; a forecast outside that observed range is an extrapolation where the linear correction is least trustworthy.
- **Association is not causation.** ENSO–climate and ENSO–yield links are statistical associations mediated by many non-ENSO factors; composites describe typical patterns, not guaranteed outcomes.
- **Provisional data drift.** Recent ERA5 (ERA5T), ERSST/Niño 3.4 and FAOSTAT values are revised as observations arrive, and the 8 C3S system versions are re-checked ~twice a year as centres upgrade.
- **ENSO is not the only driver.** Limpopo seasonal climate is also shaped by the Indian Ocean Dipole, the subtropical Indian Ocean Dipole, the Southern Annular Mode and local land-surface feedbacks, which may reinforce or oppose the ENSO signal shown here.
- **Absolute vs relative Niño 3.4.** As the tropical oceans warm, a given absolute Niño 3.4 anomaly overstates ENSO's atmospheric influence; NOAA now emphasises the Relative Oceanic Niño Index (RONI). This briefing uses conventional Niño 3.4 (recalibrated to observations) — a relative index would place this event somewhat lower.

Methodology v1.3.0 · run limpopo_2026-07 · final issue · config n/a. C3S forecast cutoff July 2026; observed baselines dated per source (reservoir snapshot 2026-08-11). Every figure traces to the frozen, hashed config manifest.

IWMI — CGIAR Digital Transformation Accelerator · limpopo.digitaltwins.iwmi.org
Automated Limpopo climate-briefing pipeline · rasters: public S3 COGs · statistics: dt_enso (RDS).