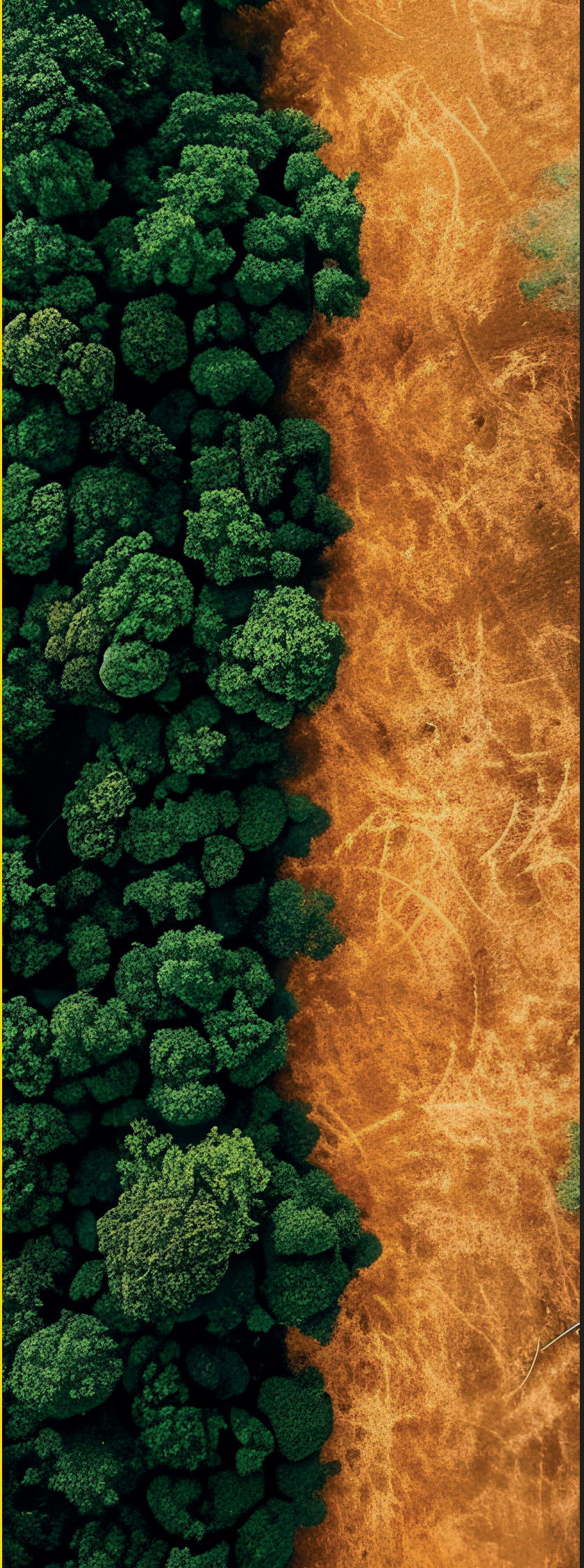


INIGO

EL NIÑO, LA NIÑA, AND GLOBAL NATURAL CATASTROPHE RISK

INIGO

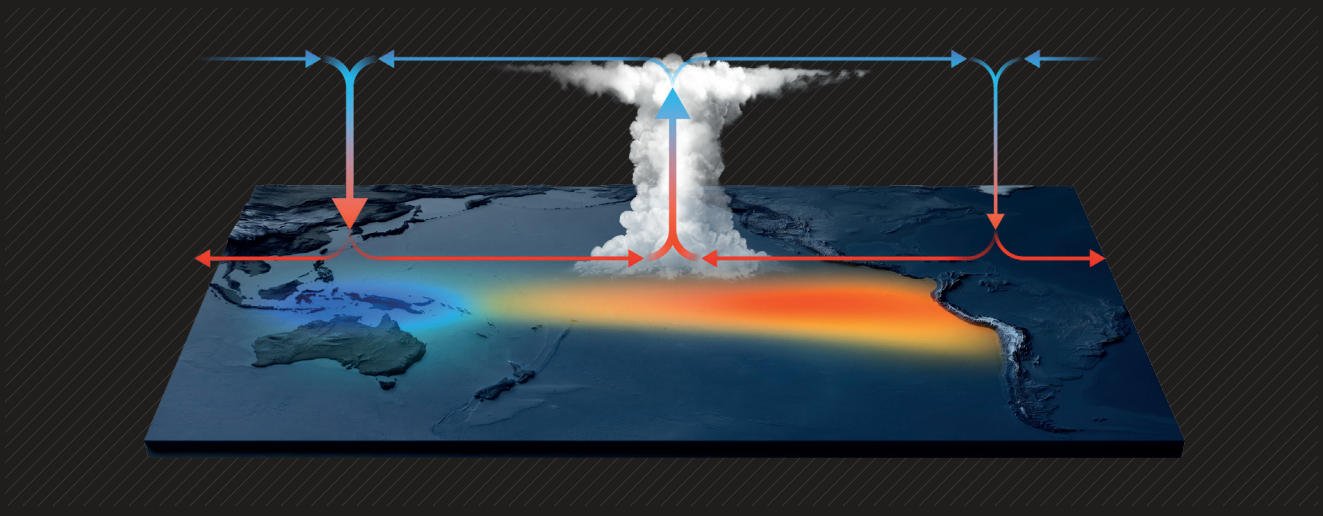
FOR THE LOVE OF DATA

JULY 2026

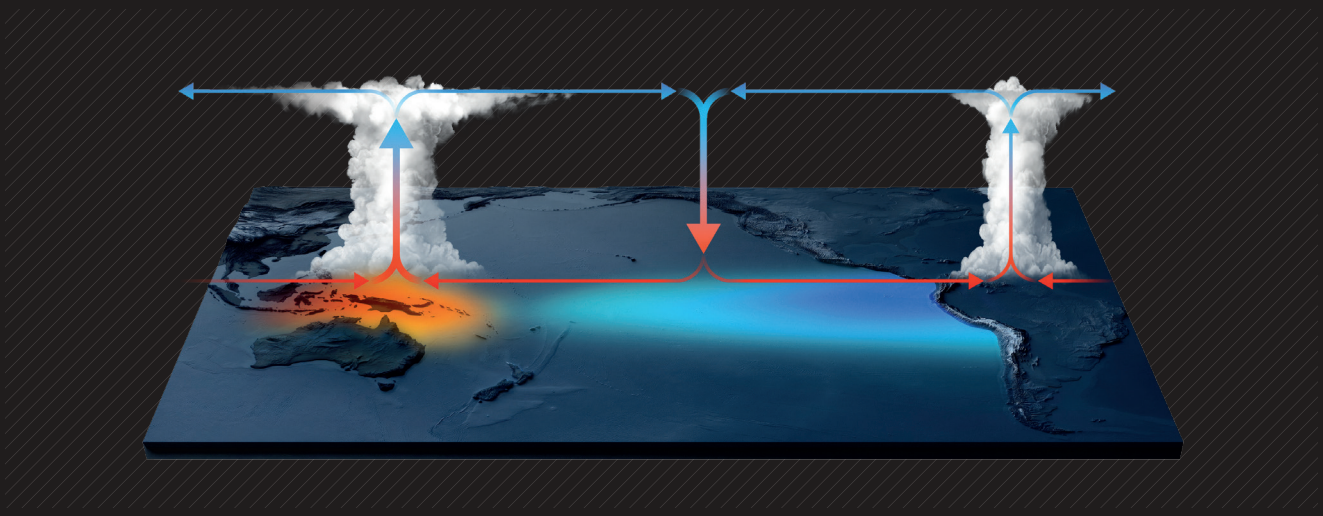
WHAT IS THE

EL NIÑO SOUTHERN OSCILLATION?

EL NIÑO



LA NIÑA



The El Niño–Southern Oscillation (ENSO) is one of the world's most influential climate patterns, affecting ocean and atmospheric conditions globally. It describes natural shifts between neutral, warm (El Niño), and cool (La Niña) sea surface temperatures in the central and eastern tropical Pacific, alongside changes in atmospheric pressure and wind patterns.

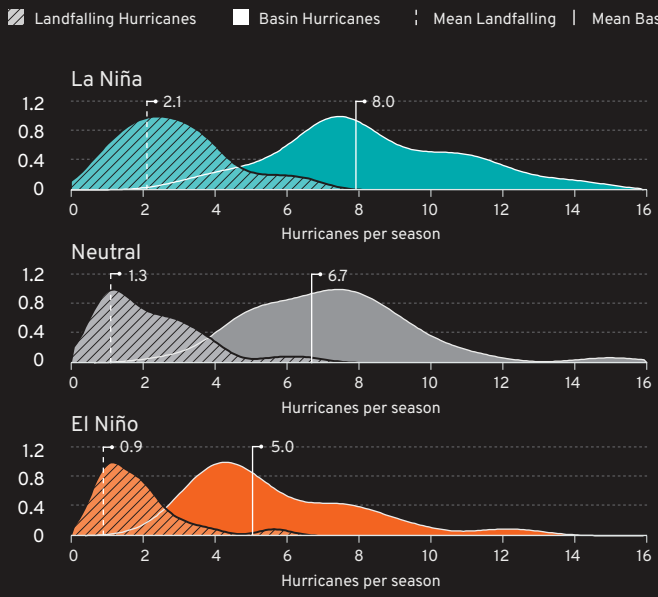
During neutral conditions, trade winds push warm surface water westward while cooler water rises in the eastern Pacific. La Niña strengthens this pattern, with stronger trade winds and increased upwelling of cold water off the Americas. El Niño reverses it: weakened trade winds allow warm water to move eastward, warming the eastern Pacific.

ENSO events typically occur every 2–7 years, lasting around 9–12 months. Their impacts extend far beyond the Pacific through atmospheric teleconnections, influencing weather patterns worldwide.

Scientists monitor ENSO state using sea surface temperature indices such as the Relative Oceanic Niño Index (RONI), which measures temperature anomalies in the tropical Pacific. Seasonal forecasts of ENSO are available for up to 6 months in the future, though forecasting skill decreases the further ahead you look, due to the climate system's complexity. Despite this, ENSO forecasts remain valuable tools for anticipating climate impacts, including Atlantic hurricane activity.

NORTH AMERICAN IMPACTS

US HURRICANE



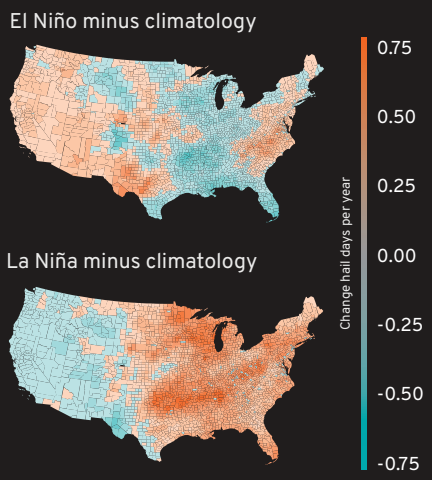
- La Niña enhances hurricane activity by weakening vertical wind shear, meaning winds vary less with height, this allows hurricanes to organise and intensify.
- El Niño suppresses hurricane activity by strengthening vertical wind shear which disrupts the hurricane development.
- The number of hurricanes making landfall is dependent on other factors, such as steering winds, so El Niño can reduce risk but not eliminate it.

DATA SOURCE:
Hurdat2 1950-2025, NOAA CPC Relative ONI (RONI) index.

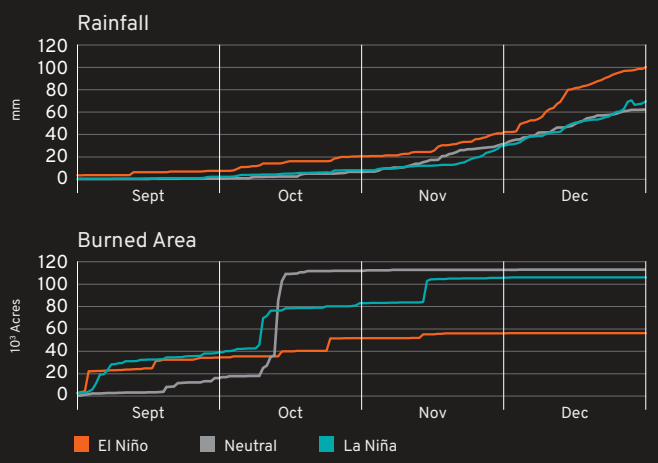
EL NIÑO AND LA NIÑA INFLUENCE THE LIKELIHOOD OF US HAIL

- The number of hail days during peak Severe Convective Storm seasons is influenced by the ENSO state during the preceding winter.
- Following La Niña conditions, parts of the central and southern US can expect between 5-20% more hail days.
- This pattern is reversed to the west of the Rocky Mountains, where hail days are instead more common during El Niño years, though with lower absolute values (<2 days/year).
- Overall, US hail risk is elevated following La Niña conditions.

DATA SOURCE:
Hail hazard data is from the Inigo Frequency Event Risk Hail (INFER-Hail) model. Hail days are defined as any day where one or more >0.75in hail stones falls within a ~25km grid cell. INFER-Hail outputs are aggregated to US county level using the US Census database.



US WILDFIRE SEASON HALTED BY EL NINO RAINS

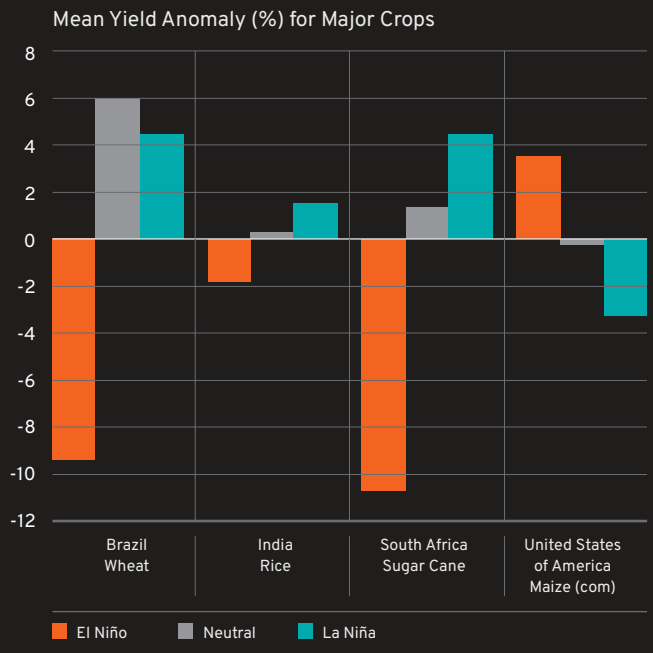


- El Niño conditions divert the jet stream southwards so that storms that otherwise impact the Pacific Northwest are more likely to hit Southern California.
- Southern California fall/winter is typically wetter during El Niño.
- Wet fall conditions suppress late-season wildfires, making events like the 2025 Los Angeles wildfires much less likely.

DATA SOURCE:
Sept-Dec burned-area for CA <36N calculated using FOD (1992-2020; Short et al., 2023) and FRAP (2021-25; CAL FIRE). Aug-Dec rainfall 1992-2025 at Stat. USW00093134 in LA (NCEI).

GLOBAL IMPACTS

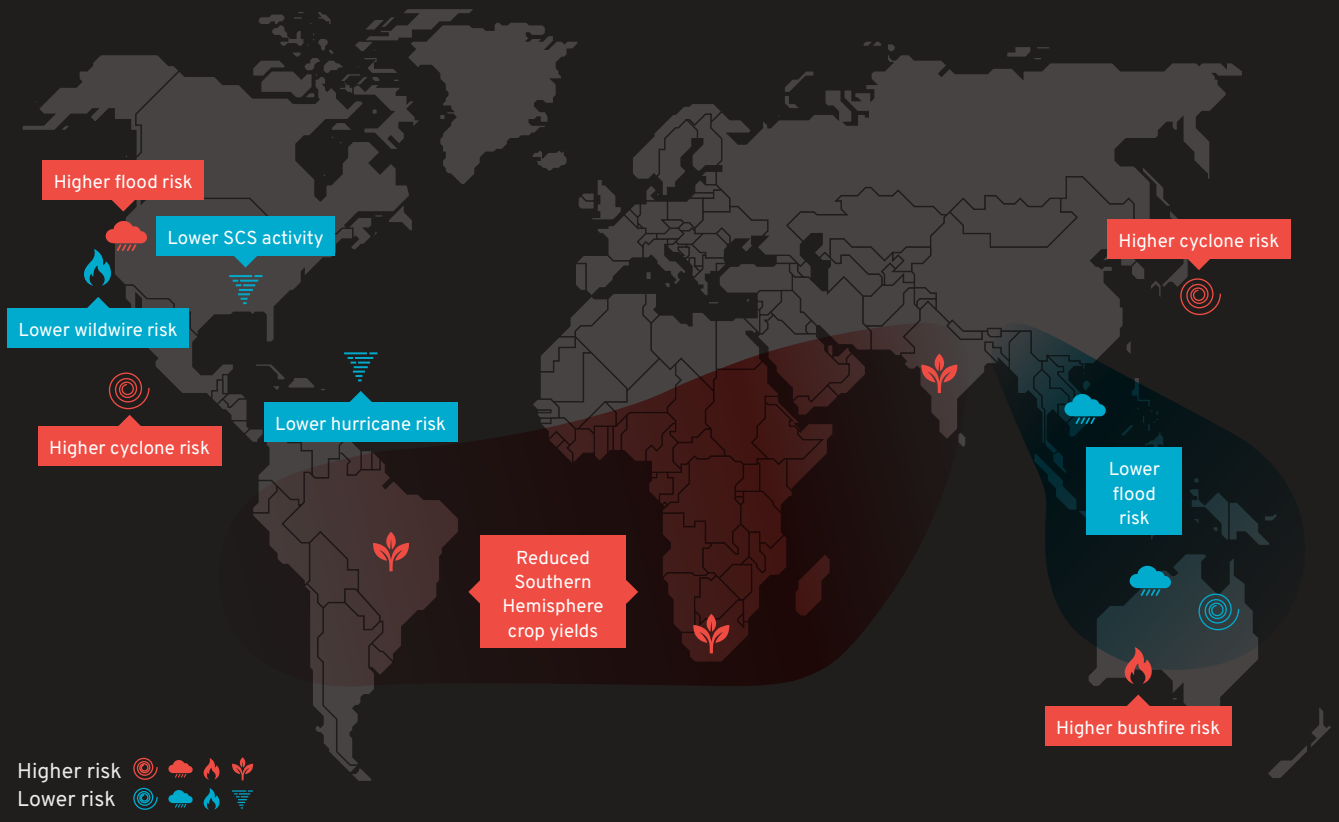
ENSO FINGERPRINTS ON GLOBAL CROP YIELDS



- ENSO drives well-documented precipitation and temperature anomalies during critical growing seasons, with material impacts on regional crop yields.
- El Niño suppresses Southern Hemisphere yields (Brazil wheat ~−9%, South Africa sugarcane ~−10%) while US maize responds positively; La Niña largely reverses the pattern.
- India rice yield shows a muted ENSO response: irrigation buffers rainfall deficits and the monsoon is co-modulated by the Indian Ocean Dipole.

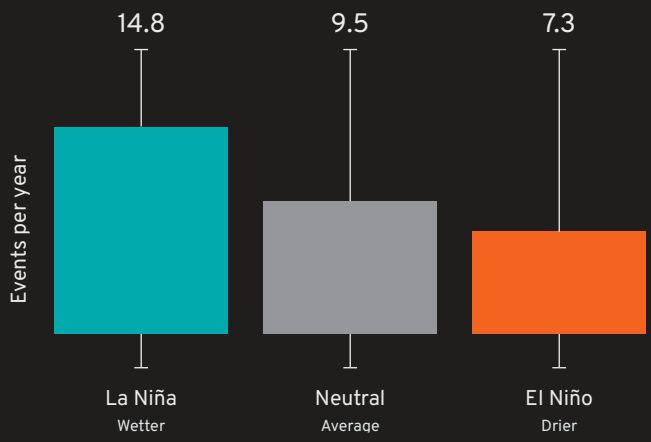
DATA SOURCE:
Crop yield data from FAOSTAT national statistics (1961–2023). Long-term technological yield trends removed by country and crop prior to anomaly calculation.

TYPICAL GLOBAL RISK PATTERNS DURING EL NIÑO PHASE



TWICE AS MANY FLOODS: THE LA NIÑA EFFECT IN SOUTH-EAST ASIA

Average number of events per year by ENSO Phase



- La Niña drives warm water westward, enhancing convection over the Maritime Continent; El Niño reverses this, suppressing regional rainfall.
- La Niña years average ~15 flood events per year versus ~7 under El Niño — a two-fold swing.
- The 2011 Thailand floods — driven by a strong La Niña — caused ~$45bn in insured losses, illustrating the tail risk embedded in La Niña years.

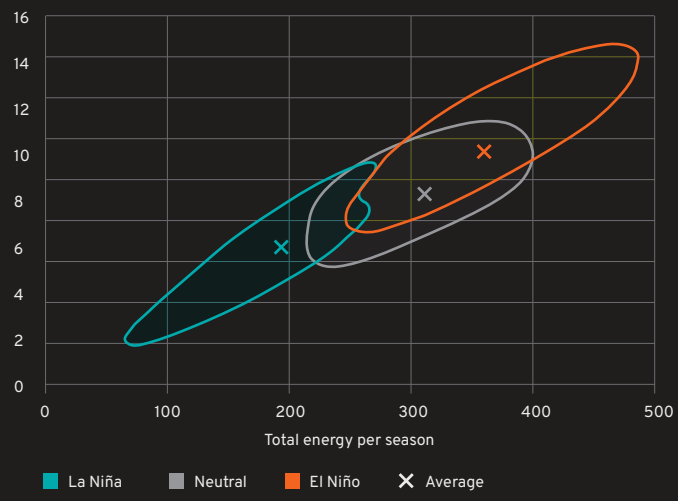
DATA SOURCE:
EM-DAT: The international disaster database.

JAPAN TYPHOON

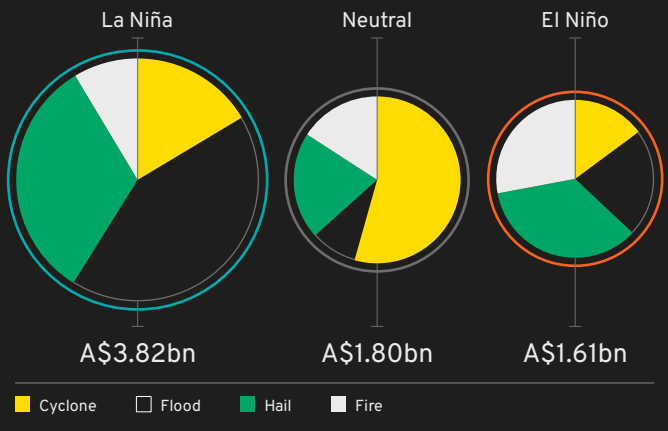
- La Niña is associated with lower energy in the West Pacific basin and fewer super-typhoons as storm formation shifts westward giving them less time over the open ocean to intensify.
- El Niño increases energy in the West Pacific and super-typhoon activity, storms tend to form further east and have longer over warm ocean water to intensify.
- Japan's risk from typhoons is highly track-dependent, hinging on whether systems are steered toward the islands or recurve into the Pacific.

DATA SOURCE:
Hurdat2 1950-2025, NOAA CPC Relative ONI (RONI) index.

Super Typhoons per season



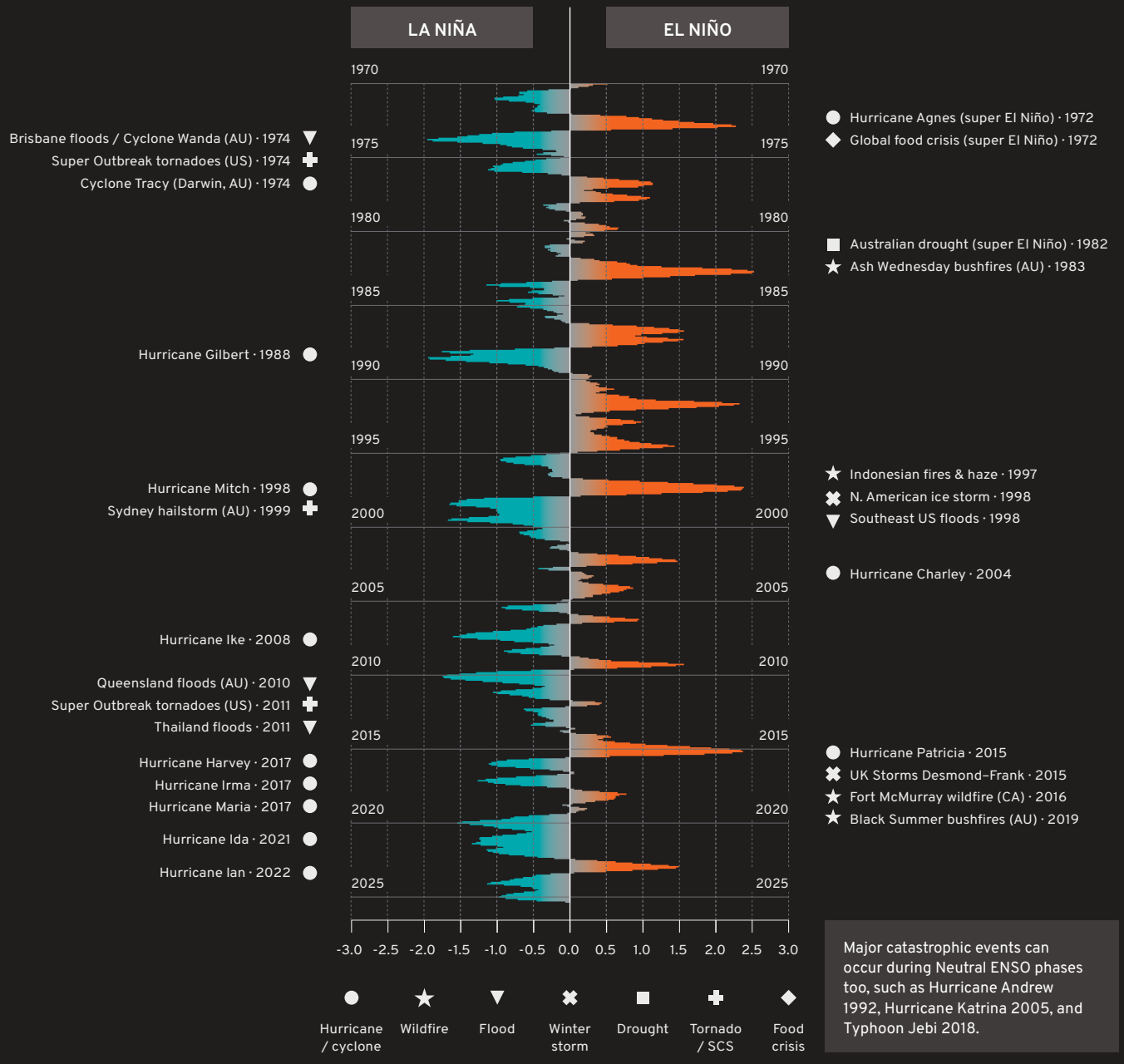
AUSTRALIA AVERAGE ANNUAL LOSS INFLUENCED BY ENSO



- Warm Pacific surface waters during El Niño weakens westerly trade winds that bring moisture to Eastern Australia.
- El Niño reduces flooding and cyclone risk but increases the chance of drought and wildfires (e.g., 2019-20 black summer wildfires).
- La Niña supercharges tradewinds, increasing the risk of cyclones and flooding (e.g., March 2021 NSW floods).

DATA SOURCE:
Insurance Council of Australia losses 1967-2025 adjusted for inflation to 2022.

ENSO STATE & ASSOCIATED CATASTROPHIC EVENTS



Major catastrophic events can occur during Neutral ENSO phases too, such as Hurricane Andrew 1992, Hurricane Katrina 2005, and Typhoon Jebi 2018.

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