U N I V E R S I D A D A U T Ó N O M A D E M A D R I D

LaSEI
School of Economic Intelligence & International Relations
Escuela de Inteligencia Económica y RRII
Universidad Autónoma de Madrid

Enero 2026

Volumen 22
ISSN 2660-7352
Editados por la Escuela de Inteligencia Económica y RRII
Editor Jefe / *Chief Editor*: Ángel Rodríguez García-Brazales

REPORTS DE INTELIGENCIA ECONÓMICA Y RELACIONES INTERNACIONALES

Brief Report. -
The economic impact of "El Niño"

Jorge Turmo and **Ángel Rodríguez**

This brief report provides a very succinct description of the oceanic and atmospheric mechanisms that provoke "El Niño", its impact on several economic sectors, and a survey of the academic literature on the economic effects on distant areas, mainly North America and the Atlantic façade of South America. The last section of this report will briefly analyse "La Niña" phenomenon.

Título: *Brief Report: The Economic impact of "El Niño"*

Autor: **Jorge Turmo Arnal y Ángel Rodríguez García Brazales**

Volumen nº: 22. **Páginas**: 1-9

Fecha: 26 de enero de 2026

ISSN 2660-7352

Reports de Inteligencia Económica y Relaciones Internacionales

Editor jefe: Ángel Rodríguez García-Brazales

Coordinador: Jesús Gil Fuensanta

Editada por la:

Escuela de Inteligencia Económica y Relaciones Internacionales

Universidad Autónoma de Madrid

Campus de Cantoblanco

C/. Francisco Tomás y Valiente, nº 5, Módulo 10, despacho 303

28049 MADRID (SPAIN

Contents

1. Introduction 1
2. The oceanic and atmospheric mechanisms 1
3. Economic impact 5
4. El Niño and La Niña 7
5. Annex 8
6. References 9

1. Introduction

In Summer 2023, meteorologists warned about a strong "El Niño" episode in the Eastern Pacific, which consists in an above-average-warming of the oceanic surface waters in the equatorial area. This phenomenon usually changes weather conditions in the American Pacific Coast, but also elsewhere. It has its reverse in "La Niña", a cooling of the ocean waters in the same area. The World Meteorological Organization (WMO) has recently issued a warning about the likelihood of "La Niña" episode for the 2024 autumn -2025 winter.

Historical research has extensively documented that changes in weather and climate patterns alter habitats and ecosystems and, consequently, humans' natural, social and economic environments. In his book *Collapse,* Jared Diamond [1] provides an excellent account on several cases in which climatological changes caused the collapse of whole civilizations. The most famous is the extinction of Norwegian settlements in Greenland in the 15th century because of the beginning of the *Little Ice Age*, which also wreaked havoc in Europe through the Modern Age.

El Niño, La Niña and other similar phenomena (as the North Atlantic Oscillation), change local and regional weather conditions, affecting crops, fishing, industries, trade (Panama Channel) and human habitats (extreme floods and droughts). But these oscillations do not appear in a regular and predictable manner, so only very recently meteorologists have been able to develop reliable early warning systems. Research on the effects beyond the Pacific coasts is in a very early stage, as the changes induced by those oscillations on the atmospheric and oceanic circulation are not well understood yet.

This report provides a very succinct description of the oceanic and atmospheric mechanisms that provoke "El Niño", its impact on several economic sectors, and a survey of the academic literature on the economic effects on distant areas, mainly North America and the Atlantic façade of South America. The last section of this report will briefly analyse "La Niña" phenomenon.

2. The oceanic and atmospheric mechanisms

The Pacific Ocean accounts for three-fifths of all water bodies in the globe. At its widest extent (from the Gulf of Panama to the Sulawesi Sea), the Pacific spans 18422 km, about 45% percent of the earth's circumference. By contrast, the widest part of the Atlantic is approximately 6674 km. So, the impact of the Pacific Ocean on the climate and the weather of the surrounding continental masses

(North America, Asia, Australia and South America) is huge. But also on more distant regions, such as the Caribbean basin, the Indian subcontinent or Western Europe.

The widest part of the Pacific Ocean coincides approximately with the equator, which has the largest area on earth to collect solar energy at equatorial latitudes. As a result, it passes more moisture and heat into the atmosphere than the Atlantic and the Indian oceans. So, when the Pacific experiences interannual variations in sea temperature, there are higher (or lower) exports of humidity and temperature both to contiguous and distant lands. One of these variants, and perhaps the most important on the whole earth, is El Niño (and its counterpart La Niña).

El Niño has been a well-known phenomenon to north Peruvian fishermen well before the arrival of the Spaniards. They observed a regular pattern that happens every year around Christmas. At the beginning of the southern summer, warmer-than-usual waters began to move from the North into the area from the Gulf of Guayaquil to Pariñas Point. They realized that this caused changes in the local fish populations, as cold-water species are temporally substituted by tropical ones. Coinciding with these episodes, there is also a surge in southern summer showers, something quite unusual in this arid region.

However, sometimes this annual pattern changes and the flow of equatorial warm waters reach southern latitudes well beyond Pariñas Point. Erwin Schweigger [2], a German marine biologist who spent most of his professional life in Peru, identified these "major" El Niño episodes and noticed that they were accompanied by considerable variations in the weather patterns, mainly high air humidity, frequent thunderstorms, and heavy rains. Further research showed that there are two aspects to this recurring event: the **oceanic aspect**, which related to anomalies of sea temperatures across the tropical Pacific, and the **meteorological aspect**, which had to do with variations in the atmosphere above.

Figure 1. Normal circulation

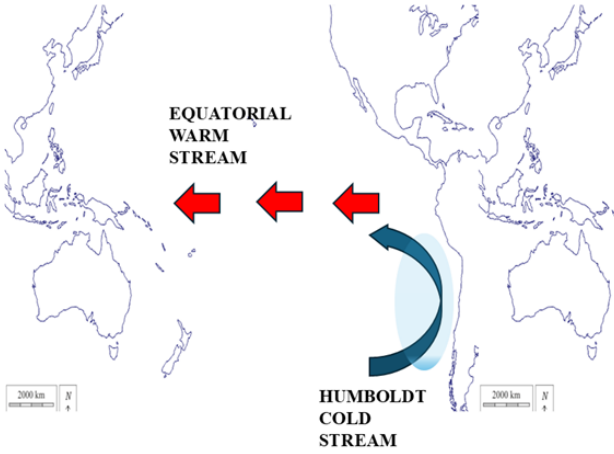
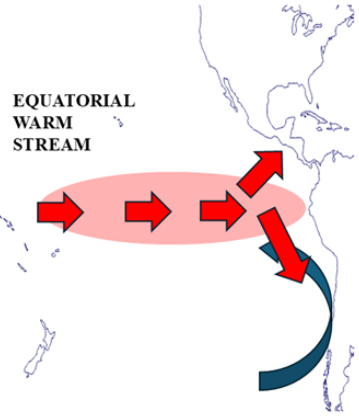


Figure 2. El Niño circulation

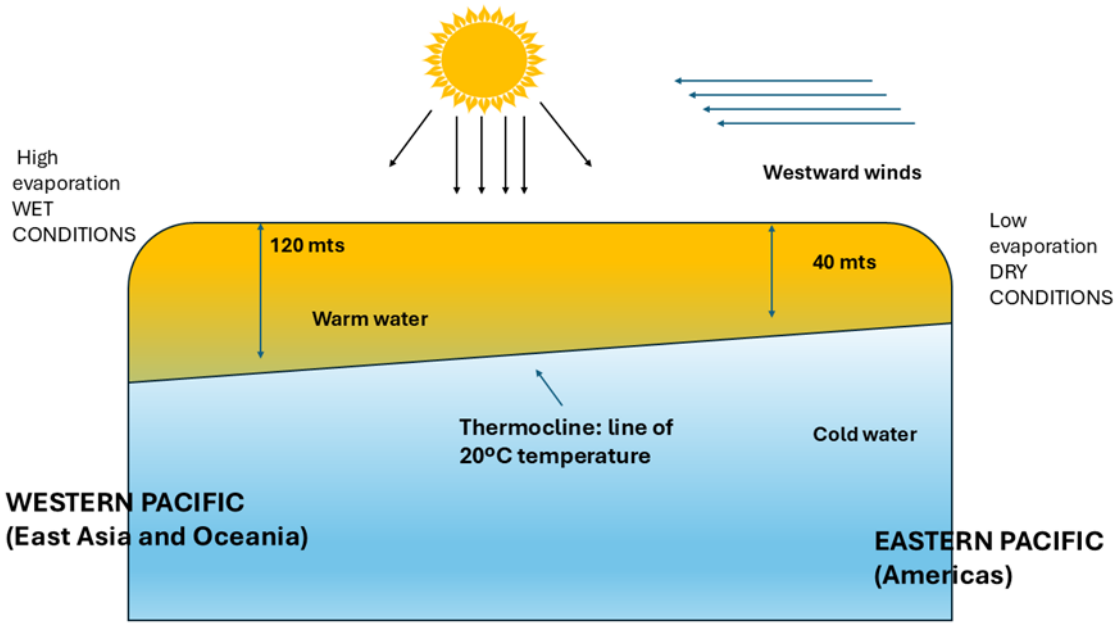


Under normal conditions (Figure 1), the area of the tropical Pacific from the coast of Ecuador/Peru to longitude 120°W is dominated by westward flowing cold waters that are the prolongation of Peru, or Humboldt Current. Off the north Peruvian coast, the current turns away from the continent and forms a flow that is abnormally cold for equatorial latitudes, with explains the colonies of penguins and seals on the Galapagos Islands. Near longitude 120°W and under the hot equatorial sun, sea temperatures start to rise, reaching near-normal equatorial values to the west of the International Date Line. It should be noted, however, that due to the stable air conditions caused by

the cool sea surface, there is little evaporation in normal years. And that explains the arid conditions prevalent in North Peru the Pacific Islands such as the Galapagos.

Driven by the constant easterly winds, the superficial waters eventually reach the western Pacific in New Guinea and south of the Philippines. This water flow explains why the ocean layer directly heated by the sun is thinner on the eastern side of the equatorial Pacific and thicker on the western side, where the warm waters tend to pile up. The "thickness" of the superficial layer is determined by the *thermocline*, or lower boundary of the sun-heated upper layer that around 20°C marks the beginning of cooler water temperatures underneath. Under normal oceanic conditions, the thermocline between Peru and the Galapagos Islands runs at a depth of some 40 meters, while on the Asian side of the Pacific, it dips as low as 120 meters, revealing a marked asymmetry in the thickness of the sun-heated layer across the Pacific (Figure 3).

Figure 3. The Thermocline. Normal years.



During El Niño years (figure 2 above) many of the regular conditions are drastically altered:

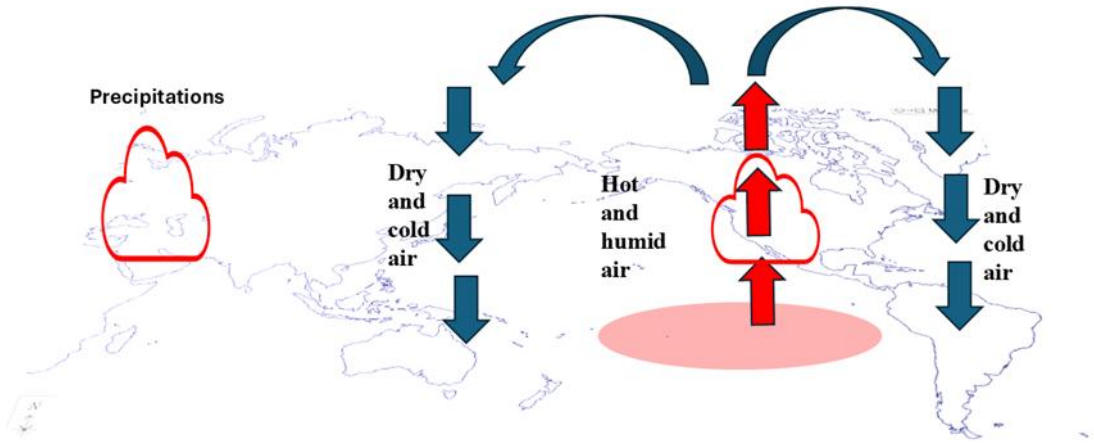
1. First, the westward flow of cooler waters weakens or ceases to exist blocked by warm equatorial southward stream.
2. Second, there are less or no westerly winds from eastern Pacific.
3. Third, the thermocline in the eastern half of the equatorial Pacific may reach depths of up to 80 meters.
4. There is horizontal transport (advection) of warm waters from the Asian side of western Pacific to the American east.

During strong El Niño episodes, the invasion of warm waters from the western Pacific could be depicted as a huge oil spill directing towards the coasts of central Peru as well as the central American Pacific coast.

The atmospheric mechanism strongly interacts with the inflow of warm waters. For reasons still not well understood, during El Niño episodes, the South Pacific anticyclone loses intensity and the whole westward wind system that works under normal conditions, collapses. The thermocline

thickens in the Eastern Pacific, and the advection of warm waters induces much more evaporation of superficial waters than usual. This process forms huge hot and humid air masses which move towards the American coast and cause torrential rains on the arid coasts of South Ecuador and northern Peru.

Figure 4. The Convection effects.



The result of the interaction of oceanic and atmospheric mechanism is a vast redistribution of heat and moisture, affecting relative distant areas of the planet (Figure 4). Large parts of the western hemisphere, that include the Pacific basin, western South America, Central America, and the western half of North America, where abnormally low air pressures, warm coastal waters, and unusually heavy rains occur. In the eastern hemisphere, centered on Indonesia, where air pressures are high, ocean waters are cooler than normal, and certain regiones in Asia suffer severe droughts. Usual phenomena linked to El Niño are heavy rains in California and Perú, but less usual are wildfires in Indonesia, severe droughts in Australia, South Africa and Brazil. Currently, the Amazon basin is suffering a historical drought that has dried rivers used by local populations as their only communication lines with the rest of the world. Also, the Gulf of Alaska and western Canada have experienced warmer temperatures during El Niño events. Some researchers suggest that El Niño patterns can even alter shorelines in Northeastern Pacific. In annex 1 there is a map elaborated by The Economist with a detailed description of El Niño effects by areas.

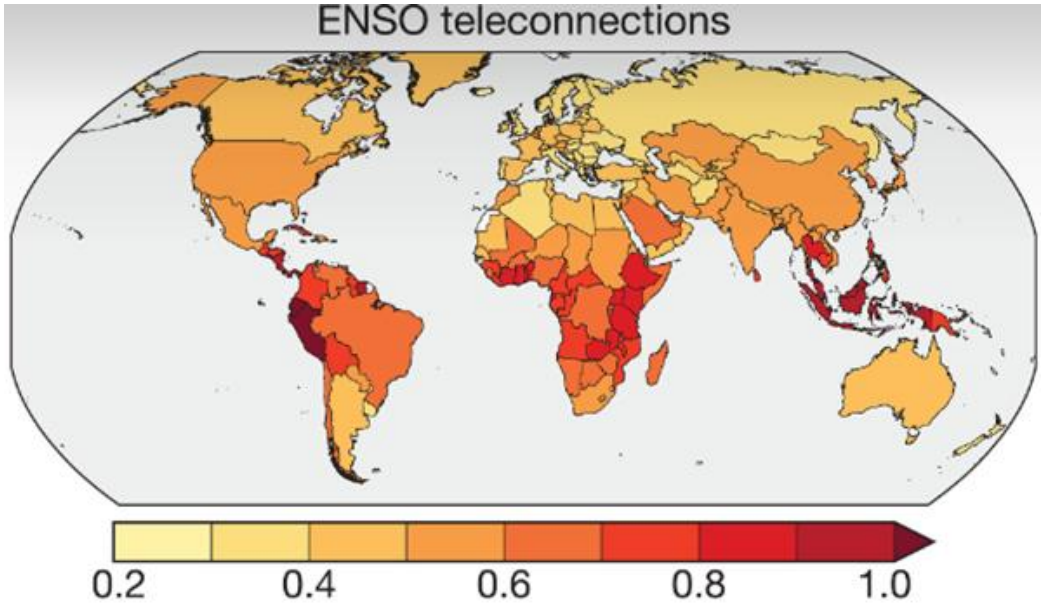
Early observations seemed to indicate that El Niño events occurred at intervals of about eleven years. This led initially to speculate that they were linked to "sunspots," that tend to peak at eleven-year intervals. However, the surge in frequency of El Niño events after 1970 and their occurrence also in years of low sunspot activity have forced researchers to look for other explanations. Nowadays, several studies show that they occur at intervals of about three and a half years, and that the major events tend to repeat themselves every six years. What processes are responsible for these frequencies is a question that it is still unknown.

3. Economic Impact

In 2023, a paper published in *Science*, probably the world's most respected scientific journal, provides an estimate of the global economic losses associated with El Niño [4]. **According to the study, the total income loss over the 1982-83 El Niño event was of $4.1 trillion, and of $5.7 trillion over 1997–98 El Niño**. Those were two of the strongest El Niño episodes ever recorded. Depending on specific assumptions on the future evolution of El Niño, those researchers anticipated an income loss of $84 trillion over the 21st-century, which is roughly equivalent to 85% of one year world's current GDP. The paper only refers to the impact on one specific country, Peru: according to their estimates,

one standard deviation of El Niño event causes a 1.3 percentual point decrease in its GDP growth. They do not provide more country-level information, but they do identify the economies most affected by El Niño: all of them belongs to Global South (see Figure 5):

Figure 5. The Economic impact of El Niño.



Source:[4] Callaghan, C., and Mankin, J., (2023)

Figure 5 represents the meteorologically impact of El Niño across countries with Perú, Central America and Southeast Asia being the most affected. However, an earlier work [5] show that there are considerable heterogeneities in the responses of different economies to El Niño events. Australia, Chile, Indonesia India, Japan, New Zealand and South Africa would face a short-lived fall in economic activity in response to an El Niño shock, although Indonesia in the "risk" areas. In other countries as the United States and the European Union, an El Niño occurrence has a growth-enhancing effect. Although there is not a well-established empirical connection, El Niño events coincide with wetter and warmer weather in North America and Western Europe. These conditions could offset seasonal and meteorological impact on GDP. El Niño could dampen the winter seasonal slowdown in Ohio and North Mississippi basins, and the periodic droughts in northern mediterranean countries. Authors warn that most countries experience short-run inflationary pressures as both energy and non-fuel commodity prices increase, mostly linked to the change in weather patterns in South America.

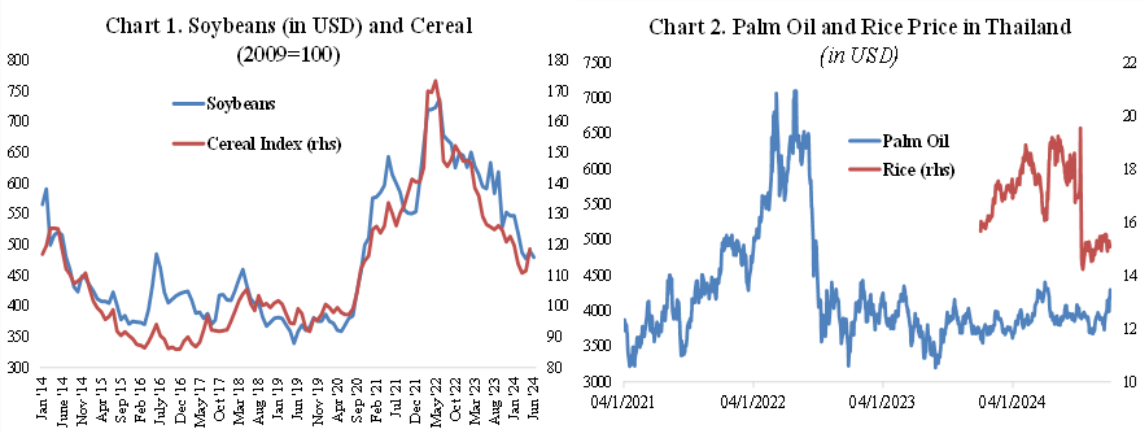
The coast of Peru is the most affected by El Niño, which has a significant impact in its buoyant fishing industry. The Humboldt stream is the habitat of cold-water fish species, being Peru world's largest capturer of anchovies, for instance. When warm waters block the cold stream, equatorial species substitute the most demanding cold-water species. In El Niño years, the Peruvian Production Ministry has to stop the activity of the fishing industry as otherwise the populations of some species could disappear, as almost happened with the anchovies in the 1981-82 El nIño event. In 2023, Peruvian authorities closed the country's first anchovy season of 2023 due to El Niño. In January 2024, the catch for the second season were cut by 75% of the quota. The decision to cancel that season cost the fishery an estimated USD 1.4 billion (EUR 1.3 billion) in lost revenue.

Another example of the economic impact of El Niño was the 2023 traffic restrictions through the Panama Canal due to the Gatun Lake's low water level and the in the dams needed to operate the locks. In 2023, Panama experienced one of the driest years on record, with a several months of the wet season recording precipitations below average. The small basin surrounding the Panama Canal provides the water used for its operations. An exceptional drought could slow down the traffic and impede the transit of large vessels, as happened in the Summer of 2023. Trade between China and the US Eastern coast, but also the trade between the US Western and Eastern coasts were affected by

those restrictions. In May 2024, a study released by the Imperial College of London [6] provided evidence that this drought was caused by El Niño and not by climate change. However, climate change will likely exacerbate El Niño events, so stricter traffic restrictions through the Canal could be expected in the coming years.

Another interesting and hotly debated issue is the El Niño impact on food commodity prices. Cashin *et al* [5] provided evidence that suggest a 5% increase in non-energy commodity prices in between 6 and 16 after El Niño event. In June 2023, the ECB warned that the increase could be up by 9%, once other factors are controlled. The ECB suggested that upside risks to food commodity prices were "particularly pronounced for soybeans, corn and rice, while the expected price effects are upwards but insignificant for wheat and around zero for coffee and cocoa".

Exhibit 1. Food Commodity prices



Source: Soybeans and Cereal Index from Statista. Palm Oil and Thai Rice from Refinitive.

Exhibit 1 shows the evolution of some key food commodity prices. The last El Niño event was identified in summer 2023 and its duration was initially estimated to span until April 2024. The evolution of cereal and soybean prices do not seem to reflect the change in meteorological conditions. Soybean growing areas in Argentina and Brazil did not suffer the expected impact of El Niño: the Atlantic coast of Argentina received more rain than in a normal year. The drought in Brazil is currently affecting the Amazonas basin, where there is very limited agricultural activity. Local meteorological conditions interact with the El Niño atmospheric changes, and sometimes offset each other. This seems not be the case in Southeast Asia: both palm oil and rice price increased over the fourth quarter of 2023 and the first quarter of 2024. There was a drought in Indonesia over that period, which has been related with El Niño by Indonesian authorities.[1] They also warned about food insecurity in some areas due to the impact on the rice crops.

In the case of food prices, the evidence of El Niño effects on worldwide crops seems to be not conclusive. Very recently, a working paper from the Bank of Spain [7], has challenged the mainstreams view that El Niño usually causes increases in food prices. Using a sample period that starts at the time of the creation of the euro area, authors show that El Niño actually decreases euro area inflation by about 0.3 percentage points (pp) after 12 months, while La Niña increases it by 0.6 pp over the same horizon. This is not surprising. Although the empirical evidence is very weak, strong El Niño episodes are related with wetter winters in Western Europe. That implies better crops in the Mediterranean basin *and* cheaper power, as hydroelectric plants can increase production. Other analysis suggest that inflation responds more strongly to an El Niño event in countries which have a higher weight of food in the inflation index, which clearly is not the case of Western Europe, but it is the case of Southeast Asia and Central America.

[1] https://reliefweb.int/disaster/dr-2023-000154-idn

4. "El Niño" and "La Niña"

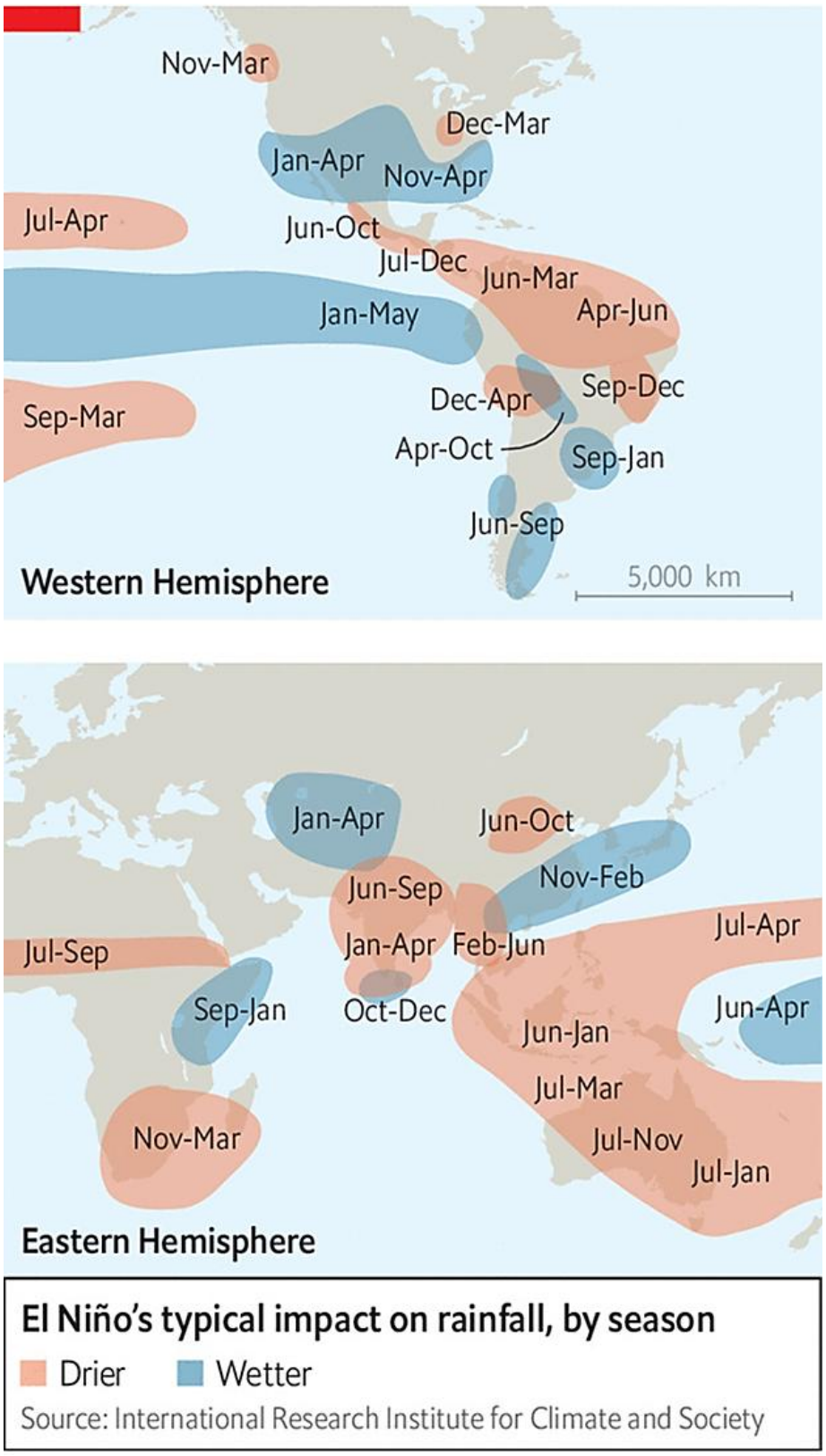
La Niña comprises generalized cold waters in the tropical Pacific, just the opposite as El Niño. A strong Humboldt oceanic stream off the coast of western South America causes a shallower thermocline in the equatorial Pacific, and consequently a large pooling of warm waters in the western Pacific. Cooler-than usual waters in Eastern Pacific allows less evaporation and little transfer of caloric energy from ocean to atmosphere. These drier atmospheric conditions cause droughts in areas near to the South American Pacific Ocean, just the opposite as El Niño. Scientific literature has linked this lack of stimuli from the Pacific with severely cold winters in continental North America and frequent mid-winter and early-spring snowstorms, as the polar jet stream is enhanced by the cold input from the Pacific Ocean.

The opposite to El Niño effect is also seen in Southeast Asia. During La Niña years, the excess of warm water in the western Pacific increased evaporation and convection produces more rain in Australia, New Guinea, the Philippines, and Indonesia. The low pressure deepens in that area and strong floods could be expected with catastrophic effects both in urban and rural areas. In Western Europe La Niña is associated with colder and drier winters, which explains the increase in prices indexes identified by the Bank of Spain.

As a final word, latest forecasts of the World Meteorological Organization indicate a 55% likelihood of a transition to La Niña conditions during September-November 2024. This likelihood increases to 60% from October 2024 to February 2025, with the chance of El Niño redeveloping during this time being negligible [8].

5. Annex

Annex 1. *Expected impact of El Niño, according to The Economist*



6. References

[1] Diamond, J., (2005) *Collapse. How Societies Choose to Fail or Succeed*, Viking Press.

[2] Schweigger, E., (1947) *El litoral Peruano*, Ed. Compañía Administradora del Guano

[3] https://www.theguardian.com/environment/2024/jan/24/devastating-drought-in-amazon-result-of-climate-crisis-study-shows

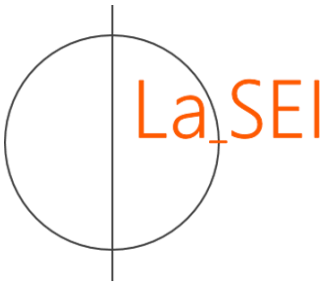
[4] Callaghan, C., and Mankin, J., (2023) "Persistent effect of El Niño on global economic growth" *Science*, https://www.science.org/doi/10.1126/science.adf2983

[5] Cashin, P., Mohaddes, K., and Raissi, M., (2017) "Fair weather or foul? The macroeconomic effects of El Niño" *Journal of International Economics*, vol. 106, May pp: 37-54.

[6] Barnes, C., *et alia* (2024) "Low water levels in Panama Canal due to increasing demand exacerbated by El Niño event" *Imperial College, London.*

[7] Borrallo, F., *et al* (2024) "El Niño" and "La Niña": Revisiting the impact on food commodity prices and euro area consumer prices", *Series: Working Papers. 2432, Bank of Spain.*

[8] https://wmo.int/news/media-centre/wmo-update-predicts-60-chance-of-la-nina



Bief Reports de Inteligencia Económica y Relaciones internacionales [Interno]

PUBLICACIONES DE LA ESCUELA DE INTELIGENCIA ECONÓMICA DE LA UAM


La_SEI
School of Economic Intelligence & International Relations
Escuela de Inteligencia Económica y RRII
Universidad Autónoma de Madrid