Box 2
Characterization of *EL Niño* Phenomenon in Colombia

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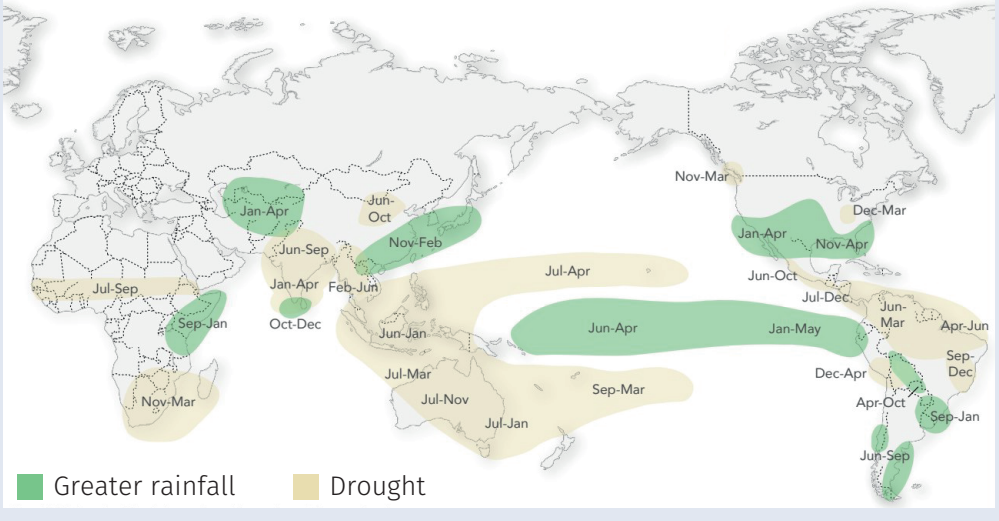
This Box characterizes *El Niño* and *La Niña* climate phenomena, specifically relating to their classification, monitoring, and intensity. Furthermore, simple calculations were performed to identify the recurrence and average duration of these weather events. Finally, the direct conduits through which an *El Niño* phenomenon can affect annual inflation in Colombia are described.

1. What are *El Niño* and *La Niña* phenomena, how are they measured, and how is their intensity determined?

The *El Niño*-Southern Oscillation (ENSO) phenomenon is an oceanic and atmospheric anomaly whose primary characteristic is a change in the temperature of the surface waters of the central and eastern tropical Pacific Ocean, especially off the coasts of Peru and Ecuador. Consequently, the ENSO pattern can appear in one of three states: warm (*El Niño*), cool (*La Niña*), and neutral. These climatic and atmospheric disturbances have persisted for millions of years, but reliable measurements have only been available since the middle of the last century.[1] The presence of an *El Niño* event has a global effect (drought or increased rainfall),

Map B2.1
Impact of *El Niño* on Global Precipitation Levels



Source: Columbia Climate School, International Research Institute for Climate and Society (IRI); accessed at: https://iri.columbia.edu/wp-content/uploads/2023/05/ELNINO-RAINFALL-2023.pdf.

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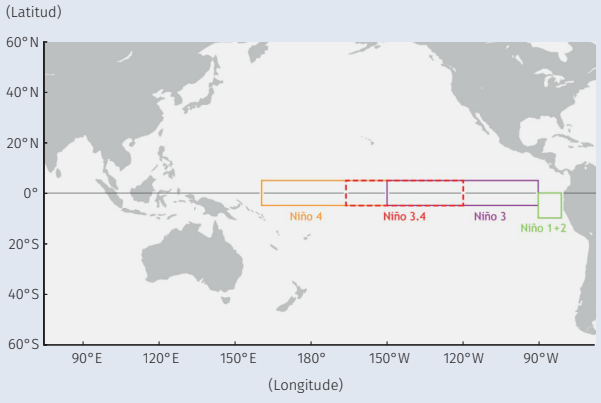
1 The term *El Niño* ("the Boy" in Spanish) dates back more than a hundred years, originally called "*El Niño* de Navidad" (The Christmas Boy) because it usually peaks close to Christmas. For more information, see https://www.cpc.ncep.noaa.gov/products/analysis_monitoring/ensostuff/ensofaq.shtml#NINA.

Map B2.2
El Niño Regions in the Equatorial Pacific Ocean[a/]



a/The NOAA divides the tropical Pacific Ocean into four regions and monitors ENSO by measuring the surface water temperature of region 3.4
Source: NOAclimate.gov, accessed at https://www.climate.gov/media/5541

disturbing different economic sectors and prices in a large part of the world (Map B2.1).[2] In Colombia, the most affected regions by the *El Niño* phenomenon, typified by lower rainfall and higher temperatures, are the Caribbean and Andean regions.

For ENSO monitoring, the U.S. National Oceanic and Atmospheric Administration (NOAA) divides the tropical Pacific Ocean into four regions: Niño 1+2, Niño 3, Niño 3-4, and Niño 4 (Map B2.2). NOAA monitors the equatorial Pacific Ocean (especially in region 3-4, between longitudes 120° W-170° W and latitudes 5°N-5°S) and, with this information, constructs the Oceanic Niño Index (ONI), which measures the temperature anomalies in a three-month running mean of the surface water temperature of the east-central tropical Pacific versus the average observed in the last thirty years. An *El Niño* event is considered to occur when ONI values are equal to or higher than 0.5°C for at least five consecutive months (three-month rolling averages). Opposite values (five observations equal to or below -0.5°C) denote a *La Niña* episode. Normal or neutral conditions persist as long as temperature anomalies do not deviate beyond 0.499°C and -0.499°C from their historical mean.

The intensity of the *El Niño* phenomenon is defined according to set ONI ranges. When water temperature anomalies in the *El Niño* 3-4 region of the equatorial Pacific Ocean range between 0.5°C and 1.0°C above their historical average for three consecutive periods (in three-month running means), it is considered a weak *El Niño* event. When these anomalies are between 1.0°C to 1.5°C, it is qualified as a moderate *El Niño* event; between 1.5°C to 2.0°C it is considered a strong event, and values above 2.0°C suggest a very strong or extreme *El Niño* is present.

2. Characterization of *El Niño*

Table R2.1 shows historic climatic disturbances according to NOAA public information. It shows that in the second half of the last century, there were more *El Niño* events (17) than *La Niña* events (10). The opposite has been the case in the present century, where the number of *La Niña* (10) episodes exceeds those of *El Niño* (seven, including the current one). Since the middle of the last century, of the 26 *El Niño* episodes recorded (not counting the present), eight were classified as weak, seven as moderate, and eight between strong and extreme (including three as very strong).

It should be noted that the *El Niño* phenomenon, like *La Niña*, does not follow regular onset, occurrence, duration, or intensity patterns. For example, there were four consecutive *El Niño* episodes (between September 1976 and June 1983), while *La Niña* occurred successively only twice (e.g., between August 2020 and January 2023). The statistical range of duration of *El Niño* and *La Niña* is between 5 and 19 months and 5 and 32 months, respectively. The maximum period with consecutive neutral conditions present was fifty months, and the minimum was one month. Alternatively, the average duration of an *El Niño* phenomenon is ten months, with an average course of six months for a weak *El Niño*, ten months for a moderate *El Niño*, twelve months for a strong *El Niño*, and almost sixteen months for an

2 There are lesser known *El Niño*-like phenomena. "*El Niño* Costero" is seen in the *El Niño* 1+2 region off the coasts of Peru and Ecuador and has a localized impact, particularly affecting Peru. It is characterized by enhanced effects of the global *El Niño* (3-4) in Peru and, to a lesser extent in Ecuador, without adverse impact on the rest of the continent. The Dipole, or Indian Ocean *El Niño* (IOD), is an anomaly that occurs in the equatorial Indian Ocean and creates climate disturbances in East Africa (rains), Indonesia, and Australia (droughts).

Cuadro R2.1
Caracterización del ENSO

Dates	Episode	Duration in months	Neutral conditions	Intensity	Observations
Jan 50 to Jul 50	Niña	7	10		
Jul 51 to Jan 52	Niño	8	12	Moderate	
Feb 53 to Feb 54	Niño	13	2	Weak	2 consecutive *El Niño*
May 54 to Sep 56	Niña	29	6		
Apr 57 to Jul 58	Niño	16	3	Strong	
Nov 58 to Mar 59	Niño	5	50	Weak	
Jun 63 to Feb 64	Niño	9	2	Moderate	3 consecutive *El Niño*
May 64 to Jan 65	Niña	9	3		
May 65 to Apr 66	Niño	12	29	Strong	
Oct 68 to May 69	Niño	8	2	Moderate	
Aug 69 to Jan 70	Niño	6	5	Weak	3 consecutive *El Niño*
Jul 70 to Jan 72	Niña	19	3		
May 72 to Mar 73	Niño	11	1	Strong	
May 73 to Jul 74	Niña	15	2		
Oct 74 to Apr 76	Niña	19	4		2 consecutive *La Niña*
Sep 76 to Feb 77	Niño	6	6	Weak	
Sep 77 to Jan 78	Niño	5	20	Weak	
Oct 79 to Feb 80	Niño	5	25	Weak	
Apr 82 to Jun 83	Niño	15	2	Super Strong	4 consecutive *El Niño*
Sep 83 to Jan 84	Niña	5	8		
Oct 84 to Aug 85	Niña	11	12		2 consecutive *La Niña*
Sep 86 to Feb 88	Niño	18	2	Moderate	
May 88 to May 89	Niña	13	23		
May 91 to Jun 92	Niño	14	26	Strong	
Sep 94 to Mar 95	Niño	7	4	Moderate	2 consecutive *El Niño*
Aug 95 to Mar 96	Niña	8	13		
May 97 to May 98	Niño	13	1	Super Strong	
Jul 98 to Feb 01	Niña	32	15		
Jun 02 to Feb 03	Niño	9	16	Moderate	
Jul 04 to Feb 05	Niño	8	8	Weak	2 consecutive *El Niño*
Nov 05 to Mar 06	Niña	5	5		
Sep 06 to Jan 07	Niño	5	4	Weak	
Jun 07 to Jun 08	Niña	13	4		
Nov 08 to Mar 09	Niña	5	3		2 consecutive *La Niña*
Jul 09 to Mar 10	Niño	9	2	Strong	
Jun 10 to May 11	Niña	12	1		
Jul 11 to Apr 12	Niña	10	29		2 consecutive *La Niña*
Oct 14 to Apr 16	Niño	19	3	Super Strong	
Aug 16 to Dec 16	Niña	5	9		
Oct 17 to Apr 18	Niña	6	4		2 consecutive *La Niña*
Sep 18 to Jun 19	Niño	10	13	Moderate	
Aug 20 to May 21	Niña	10	2		
Aug 21 to Jan 23	Niña	18	2		2 consecutive *La Niña*

Event	Average duration in months	Maximum duration in months	Intensity with higher	Most consecutive events
El Niño	10.0	19	Weak	4
La Niña	12.6	32	-	2
Neutral conditions	9.2	50	-	-

Source: Created by the authors using NOAA data.

extreme *El Niño*. The average number of months without adverse climatic anomalies is close to nine months. The latter suggests an increasing relationship between the intensity and duration of *El Niño*; namely, the more intense the *El Niño*, the longer its term tends to be.

3. In Colombia, what sectors may be affected by *El Niño*, and what has been the impact of previous episodes on consumer inflation?

The *El Niño* phenomenon, contingent upon its intensity, primarily affects agriculture, public utilities (electricity and, to a lesser extent, water supply), and food away from home sectors, placing upward pressure on consumer prices.[3] According to information from the Ministry of Agriculture, the *El Niño* phenomenon mainly reduces livestock production (especially cattle) and crop yields (by approximately 5.0%). It affects more severely the Caribbean and Andean regions, reducing the food supply and placing upward pressure on food prices (Ministry of Agriculture, 2012). Historically, the most affected crops are fique, cassava, African oil palm, barley, rice, potato, corn, cotton, sugarcane, bananas, cocoa, and beans. Ministry data also indicated that milk production decreases on average by 4.9% during *El Niño* episodes. In addition, previous *El Niño* events have resulted in substantial reductions in the volume of fish caught, especially in the Pacific Ocean, affecting the harvest of several fish species.[4] Lower river flows also affect river transport, water supply, and electric power supply.

One of the most notable traits of *El Niño*, regardless of its intensity, is that it leads to a decrease in relative food prices in Colombia (relative to total CPI), particularly those of perishables. Furthermore, when the *El Niño* climate event occurs without the presence of other macroeconomic shocks,[5] the seasonal pattern of relative food prices assumes a bell shape, with rising food prices in the first half of the year and falling prices during the second half. In the case of the concurrent occurrence of exogenous non-climate-related shocks, the intra-annual behavior of relative prices will depend on the nature of the additional shocks taking place and their duration.

In general, the *El Niño* phenomena may occur with differing intensities and varying effects on prices. This is because it is challenging to isolate from the inflationary behavior what responds to the deteriorating weather conditions effects versus other shocks that may occur simultaneously. Consequently, possible *El Niño* events of modest intensity could heavily impact prices, while strong intensity events may have more moderate consequences on inflation. Some studies suggest the effects could range from between 18 to 62 basis points,[6] a scope that depends not only on the intensity of the climatic incident but also on the macroeconomic conditions taking place at the time.[7]

Finally, it is essential to highlight that, as supported by historical data, the impact of an *El Niño* phenomenon would presently pass on with less traction and strength to consumer prices because food, including food away from home, has been steadily decreasing its share in the consumer basket. The current CPI for food (December 2018 base = 100) weighs less than half (23.8%) of what it did in 1988 (about 49%), and the most volatile and weather-affected items (perishables) fell from 13.6% in 1988 to 3.2%, as of today. Likewise, processed foods, whose price dynamics depend less on the weather and correlate more with demand or exchange rate behavior, also decreased their share in the CPI from 35.4 % in 1988 to 11.9 % today. In contrast, items highly indexed to wages or past inflation, such as meals away from home, have increased their weight in the CPI from 1.4% in 1998 to 8.8% today.

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3 Food away from home is a CPI subclass considered a service, not food, in the most recent CPI methodological revision (December 2018).

4 The most affected species include ronco, margarita, corvina, snapper, tuna, and carduma. Alternatively, lobster harvests increases with the warmer waters.

5 These include shocks such as high demand, a sharp exchange rate depreciation, increases in international food or oil prices, etc.

6 In general, the literature has found that a weak *El Niño* weather shock does not impact consumer food prices and, consequently, total inflation.

7 For more information on estimates regarding the impact of previous *El Niño* episodes on inflation in Colombia, see Abril- Salcedo et al. (2016), Abril-Salcedo et al. (2020), and Bejarano-Salcedo et al. (2020).

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